EVALUATION OF THE NUTRITIONAL QUALITY OF FEED SUPPLEMENTS UTILISED BY COMMUNAL CATTLE FARMERS DURING THE DRY SEASON AT GA-MATLALA, LIMPOPO PROVINCE, SOUTH AFRICA

BY

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A RESEARCH MINI-DISSERTATION

Submitted in fulfilment of the requirements for the degree of

MASTER OF SCIENCE IN AGRICULTURE

in

ANIMAL PRODUCTION

in the

FACULTY OF SCIENCE AND AGRICULTURE

(School of Agricultural and Environmental Sciences)

at the

UNIVERSITY OF LIMPOPO, SOUTH AFRICA

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2022

DECLARATION

I declare that this research report hereby submitted to the University of Limpopo, for the degree of Master of Science in Agriculture (Animal Production) has not previously been submitted by me for a degree at this or any other University, this is my own work in design and execution, and that all materials contained herein has been duly acknowledged.

Signature… Date: 07 September 2022

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ACKNOWLEDGEMENTS

I'd like to say Ebenezer to Jehovah since He's been with me thus far.

The National Research Foundation provided support for this work.

Tlou Christopher Kujoana, my research mentor, and research assistants Mashoto Hlakudi and Matabo Mamabolo deserve special recognition. Your support has been quite beneficial.

My thanks go to my supervisor, Dr Busisiwe Gunya, for your patience, understanding, and advice throughout.

I would also want to thank my Co-Supervisor, Mr. Masibonge Gxasheka, for his assistance during the research.

Finally, I want to express my heartfelt gratitude to my loving Monkwe family for always being there for me; I adore you all.

DEDICATION

This dissertation is dedicated to communal livestock farmers with the aim to encourage them to provide their livestock with good quality feedstuffs.

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LIST OF SYMBOLS

%	Percentage
^oC	Degree Celsius
g	Grams
ppm	Parts per million

LIST OF ABBREVIATIONS

Ca	Calcium
K	Potassium
N	Sodium
P	Phosphorus
Cu	Copper
Fe	Iron
Mn	Manganese
Zn	Zinc
ADF	Acid Detergent Fibre
NDF	Neutral Detergent Fibre

CHAPTER ONE

INTRODUCTION

1.1 Problem statement

Beef production is critical to the South African economy and the food security of many community farmers, particularly in rural areas (Malatje *et al*., 2008). Nguni cattle are commonly owned by communal farmers in communal regions (Lebbie and Ramsay, 1999). Cattle are often grown on grass, which is naturally low in nutritious content, digestibility, and availability during the dry season (Babayemi *et al*., 2009). Nutrition is an important aspect of cattle production. The greatest impediment to enhancing beef output and reproductive performance in rural regions is a lack of fodder (Mayberry *et al*., 2017). Due to variable rainfall patterns, this problem is exacerbated throughout the dry season. During this time, the animal's performance on natural pasture suffers significantly because the quality of the pasture is lignified and high in fibre, which affects intake, digestibility, and utilization (Lamidi and Ologbose, 2014).

According to Mogogovhali (2011), community farmers typically augment animal meals during dry winter seasons with commercial feeds, shrubs, and tree materials, and crop residues were accessible. Without appropriate supplementation, pasture with low feeding value results in weak immunological function, body condition and weight losses, dystocia, calf health problems, lower conception rates, low milk output, and increased mortality in beef cattle (Dixon and Stockdale, 1999). The study, however, is focused on evaluating the nutritional content of feed supplements used by communal beef farmers in the Ga-Matlala, Limpopo Province.

1.2 Rationale

Beef cattle are kept by communal farmers for a variety of reasons. Rural households rely on cattle for milk, meat, hides, horns, bride price, draught power for agricultural production, and communal income (Musemwa *et al*., 2008). The dry winter season, on the other hand, could pose a severe threat to cattle production because the quality and quantity of available pasture generally fall during this season, and community farmers are known to be the most affected (Muthelo, 2019). The emerging sector owns around 40% of the beef cattle in South Africa (Oduniyi *et al*., 2020). The nature and character of community cattle farming have very little to do with income generation and much more to do with food security (Mmbengwa, 2015). This allows South African communal beef farmers to increase beef production by adjusting to the climate. An increase in beef production can reduce poverty and improve efforts to alter this system for income generation in accordance with the South African government's National Development Plan 2030. (National Planning Commission, 2013).

According to Nyathi (2013), supplementary feeding maintains bovine body condition and supports cow production in terms of quicker growth rate and higher milk yield. Males *et al*. (2003) stated that, while cattle can use low-quality grasses to some extent, feed supplementation will be required to meet nutrient requirements during the dry seasons to promote diet balance and maintain maximum production of the livestock herd.

Previous research concentrated on the nutritional quality of feed supplements (Herd *et al*., 2000; Lamidi and Ologbose, 2014; Ali *et al*., 2019). This research, however, did not provide information on selecting the optimal feed supplement that can deliver more nutrients and result in uniform supplement consumption of cattle under the influence of dry seasons. As a result, during the dry seasons, cattle production continues to face nutritional issues. As a result, it is vital that the study be carried out to conduct a proper analysis of the nutritional quality of feed supplements so that the best feed supplement having high levels of the main nutrients may be employed for optimum production under the influence of the dry seasons.

1.3 Aim

The study's goal was to look at cattle farmers' understanding of feed supplements and to assess the nutritional quality of feed supplements used by community beef producers in Ga- Matlala, Limpopo Province, South Africa, during the dry season.

1.4 Objectives

The objectives of the study were to:

i. Assess the knowledge of communal beef farmers on the nutritional quality determination of the feed supplements utilised during the dry season at Ga- Matlala, Limpopo Province.
ii. Identify the feed supplements commonly utilised by communal cattle farmers during the dry season at Ga- Matlala, Limpopo Province.

iii. Determine the nutritional quality of feed supplements utilised by communal cattle farmers during the dry season at Ga- Matlala, Limpopo Province.

1.5 Hypotheses

i. Farmers have no knowledge on the nutritional quality of feed supplements utilised during the dry season at Ga- Matlala, Limpopo Province.

ii. Farmers do not use feed supplements during the dry season at Ga- Matlala, Limpopo Province.

iii. The nutritional qualities are the same in feed supplements utilised by communal cattle farmers during the dry season at Ga- Matlala, Limpopo Province.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Forage is the primary food source for beef cattle (Rodriguez, 2018). Grass from herding areas, dry fields, bunds, and roadside grasses are common feed sources for beef farm cattle (Mtengeti *et al*., 2008). According to Abdullah *et al*. (2014), the availability of forage is seasonal, with forage production being high during the rainy season and low during the dry season.

The main factor affecting beef output and overall reproductive performance, especially in communal areas, is a lack of sufficient pasture, which is especially problematic during the dry season due to irregular rainfall patterns (Katikati, 2017). Throughout this phase, the animal's total performance which is dependent on natural pasture significantly drops since high-quality pastures are lignified and high in fibre, resulting in decreased consumption, digestibility, and utilization (Lamidi and Ologbose, 2014). The dry season feed and feeding have been identified as a limiting factor to successful cattle production due to poor nourishment of the cattle at some point throughout the dry season, resulting in lower animal overall performance in terms of growth, work, maintenance, production, and reproduction (Oladotun *et al*., 2003).

Feed supplements are given to beef cattle to help with poor nutrition, forage conservation, forage utilization, animal overall performance, income, and cattle behaviour management (Marshall *et al*., 2006). As a result, supplementary feeding tries to offer nutrients that are lacking in the pasture, allowing cattle to be kept at a low cost (Kawas *et al*., 2010). Knowledge of feed supplement composition is essential for providing feed supplements with the right quantities of various nutrients to suit the nutritional requirements of cattle (Gizzi and Givens, 2004).

2.2 Overview of beef cattle production in South Africa

Beef cattle production in Southern Africa is largely an enormous system based mostly on the use of natural pastures. Beef production is a significant and necessary component of South African agriculture (Nyamushamba *et al*., 2017). According to Scholtz *et al*. (2013), more than 75 percent of the cattle slaughtered are fed maize and maize by-products because beef cattle raising is prevalent in South Africa's official sector.

According to a profile of the South African beef market value chain (2020), production and consumption of beef decreased by 8% and 7% from 2015/16 to 2018/19 respectively. The decline in production comes from farmers not having enough beef cattle to slaughter due to herd recovery. The rebuilding of herd led to high beef prices that in turn affected the demand of beef and beef products. The gross value of beef production increased from R15 billion in 2009/10 to R37 billion in 2017/18. This is an increase of 173% during the said period. In 2018/19, beef gross value experienced a slight decline of 7%. The increase in the past decade was due to the increased consumption of beef during the past years. The average gross value of beef produced during this period amounted to R25.6 billion per annum.

South African beef farming generates approximately 85 percent of the country's meat requirements, with the remaining 15 percent imported from Namibia, Botswana, Swaziland, Australia, New Zealand, and the European Union (Tyasi *et al*., 2015). Cattle production in the subtropics is exposed to climatic stress, nutritional stress, managerial constraints, and disease hurdles; thus, susceptibility to these stressors has a substantial impact on fertility, growth rate, and mortalities within and among breeds. Breeds that can adapt to these barriers can thus be expected to be more profitable (Nardone *et al*., 2010). Crop residues, marginal farmland, land unsuitable for tillage, or land incapable of producing crops other than grass all feed resources that beef cattle efficiently use.

2.3 Background to communal farming

Communal farming has a significant prominence in the promotion of livelihoods within the poorest regions of developing countries around the world (Mmbengwa *et al*., 2015), with cattle grazing being a common form of land use in Sub-Saharan Africa (Yayneshet *et al*., 2009). South Africa's National Department of Agriculture, Forestry, and Fisheries (2013) indicated that 80 percent of cattle are utilized for beef production and 20 percent for dairy production and that 80 percent of agricultural land in South Africa is suitable for extended grazing.

According to Van Wyk and Mayhew (2013), in the early twentieth century, the inheritance of land dispossession in South Africa resulted in the land being unevenly allocated between races, resulting in a small group of people owning 87 percent of the land and a large group of people owning only 13 percent. He also claimed that the most recent cohort is largely in a communal sort of land tenure. However, Lahiff (2007) contends that the process of equitable land re-allocation in post-apartheid South Africa is gradual. According to Salomon (2011), Apartheid and segregation policies exacerbated conflicts over cattle and rangeland.

Livestock is used for a variety of purposes in South Africa, including the price of Lobola, funeral slaughtering, and personal use (Chaminuka *et al*., 2014). Lobola is an indigenous cultural ritual in South Africa in which a groom's family requests the bride's family's hand in marriage in return for many cattle desired by the bride's family. During funerals, red meat is slaughtered for the consumption of all those attending the funeral.

When there is enough grass and water to sustain the cattle, they graze near the homestead but far away from crop areas (Verlinden *et al*., 2007). As communities' populations and herd sizes grew, so did their need for space, water, and feed. As a result, there was competition for land use patterns, including cattle eating field crops grown for human use (Rufino *et al*., 2011).

Cattle are grazing near the homestead, but far away from crop fields when there are enough grass and water available to feed the cattle (Verlinden *et al*., 2007). Due to an increase in population and herd size in communities, the need for space, water, and forage increased. Therefore, this resulted in competition in land use practices which included cattle feeding on field crops that are produced for human consumption (Rufino *et al*., 2011).

For nutrition, cattle production relies heavily on communally maintained natural rangelands (Gwelo, 2013). However, these communal areas face numerous issues, including poor management, overgrazing, overstocking, uncontrolled animal movement, bush encroachment, loss of palatable plant species, and land degradation (Mokgotsi, 2018). Low conception rates and high herd death rates in communal cattle farming areas have been attributed to a lack of fencing, a significant number of unproductive beef cattle, inadequate management tactics, and a lack of marketing (Katikati, 2017).

Communal farmers often produce beef utilizing free range (unrestricted movement of cattle to graze rangeland) production practices and, in general, without the use of fodder, licks, or other agricultural inputs (Morokong, 2016).

The communal systems are more susceptible to environmental, climatic, and seasonal changes which are a result of poorer nutritional quality and/or deficient grazing reserve and supplemental fodder resulting in decreased resilience of beef cattle to climatic stress (Mapiye *et al.*, 2009).

2.4 Management of beef cattle in communal areas in South Africa

2.4.1 Decision to farm with beef cattle for household livelihood

Commercial cattle produce 49 percent of South Africa's agricultural Gross Domestic Product (GDP) of beef production, whereas communal beef farmers appear to contribute little, owing in part to poor management systems and a lack of documentation (Montshwe, 2006).

The contribution of beef cattle products and services varies based on agro-ecological conditions, markets, and income from other sources. The employment of beef cattle for draught and transportation in rural regions with enough rainfall may also contribute significantly to total value, although this may no longer be the case in places where crops are less apparent and meat is a key value provider (Shackleton *et al*., 2005).

According to Shackleton *et al*. (2005), beef cattle are employed for a wider range of goods and services than other livestock. Beef cattle, albeit underappreciated in other areas, contribute to communal livelihood as a store of wealth. While most farmers have few animals, livestock as a safety net is an important contribution to the household. According to Dovie *et al*. (2006), the use of cattle for transportation and ceremonies is similarly undervalued as a contributor to rural livelihoods.

Beef cattle farming benefits communal livelihoods in both cash and non-cash terms by contributing to livelihood diversity and resilience (Adams *et al*., 2016) According to Shackleton *et al*. (2001), most impoverished households rely on a considerably broader range of benefits from their cattle than wealthy household owners. They make little money from beef cattle sales (Mapiye *et al*., 2009), with the direct-use value of products like meat outweighing cash revenues (Shackleton *et al*. 2005). Furthermore, Molefi and Mbajiorgu (2017) argue that annual sales have a large and favorable effect on the number of beef cattle. However, for smallholder communal farmers, selling cattle is the most practical way to get access to the cash economy.

Farmers may be able to offset the costs of obtaining more breeding stock, feed and supplements, and other expenses linked to boosting the productivity and general performance of the cattle they keep by selling cattle. Most rural households raise beef cattle for a variety of economic and non-economic reasons. They do not successfully use cattle and cannot be considered by commercial farmers (Macdonald and Mcbride, 2009).

Beef cattle byproducts, such as hides, are used to make traditional clothing. Herders are generally hired by young and aged people. Beef produced in cooperative farming systems provides the most affordable source of protein and calcium minerals. Cattle are used in traditional rites and rituals such as the Lobola price, meat distribution during funerals, and other cultural festivities. Money earned from cattle sales is utilized to pay for children's school fees and other family matters that necessitate financial assistance (Nkhori, 2006). According to Ndoro and Hitayezu (2014), cattle are preserved as a store of wealth, and their quantity and worth rise over time. Furthermore, community beef cow production systems supplement agricultural production systems by producing manure that can be utilized as fertilizer.

2.4.2 Herd size

Herd size is an important component in influencing herd productivity (Molefi, 2015). Furthermore, Nthakheni (2006) showed that a smaller herd reduces the chances of making a living from livestock husbandry. The characteristics and productivity of the cattle are not a primary emphasis in South African communal areas; farmers are more concerned with the number of the herd they own as a symbol of their social status and wealth as Africans (Molefi, 2015).

When compared to communal regions, larger herd sizes in farming business enterprises can be related to lower mortality rates, a higher proportion of breeding females, and a reduced frequency of theft (Montshwe, 2006).

High animal death rates are caused by failing to screen bulls before breeding and culling diseased bulls, as well as inconsistent herd vaccination (Tada *et al*., 2013).

Cattle production in community areas does not contribute significantly to formal agricultural output (Musemwa *et al*., 2008). However, collective herd sizes vary between places. Animal ownership is lopsided since a few people own huge herds while the majority possess few cattle (Shackleton *et al*., 2001).

One of the reasons for the scarcity of cattle in some rural areas is a scarcity of acceptable high-quality rangelands (Molefi, 2015). Furthermore, this is owing to a scarcity of appealing and nutritious grazing pastures as a result of erratic rainfall patterns that have a negative impact on vegetation growth (Mapiye *et al*., 2009).

2.4.3 Daily management

In general, beef cow farming in communal regions is limited by insufficient infrastructure and common land ownership, resulting in cattle farming issues (Mendelsohn *et al*., 2006). Cattle are historically herded in communal areas, especially during the crop-growing season, then kraaled at night after harvest. Cattle graze on the stubble and stalks of maize or millet. Cattle are kraaled at night and only go out for grazing and drinking water during the day (Nthakheni, 2006). Farmers bring their animals to cattle posts during pasture shortages and, in some cases, crop-growing seasons. Access to water is critical in community areas, but access to pasture has proven to be the most difficult. Grazing is more numerous in locations far from constructed water sources, but the scarcity of water and abundance of poisonous plants make these areas extremely difficult to use, save during the rainy season (Bilotta *et al*., 2007).

2.5 Challenges faced by cattle farmers that reduce the efficiency of production in communal areas during the dry season in South Africa

There are many factors that influence beef cattle productivity and the success of communal cattle farming. Farmers must understand these aspects and be able to control them for cattle improvement and productivity.

2.5.1 Management

The best approach to increasing production levels in communal farming is through good management. Farmers in community settings use very few management measures regularly (Ndlovu *et al*., 2007). Government aid encourages specific procedures such as immunization, tick management, deworming, and other critical practices that are typically lacking (Molefi, 2015). Animals are often subjected to natural selection, with only those that fit surviving (Mirkena *et al*., 2010).

Because beef cattle rely on natural grazing, communally managed rangelands are essential for nutrition (Morokong, 2016).

Farmers must be aware of the nutritional quality of forages as part of a strategy to allow their natural rangelands to continue giving necessary nutrients to livestock for development and reproduction, as well as to manage feed scarcity during winter so that beef cattle are not impacted (Solomon *et al*., 2007).

A few managerial variables, such as poor diseases and parasite control, a shortage of feed resources, and poor rangeland management, have an impact on beef cattle productivity in communal regions (Musemwa *et al*., 2007). There may also be a need to implement income-maximizing programs that can inspire a shift in viewpoint about the culture of beef cattle farming and management practices such as feeding, breeding, and disease control in community areas. Establishing disease control methods, as well as more agricultural grazing land and water, will greatly boost beef cattle productivity (Pretty *et al*., 2003). The mix of indigenous knowledge and contemporary animal husbandry is thought to boost beef cattle output in South Africa's communal regions.

2.5.2 Diseases

Cattle provided with a diet containing poor nutrients are more susceptible to diseases as compared to cattle provided with adequate diets. This is because malnourished cattle are by a reduction in the immunity and therefore the cattle become more prone to diseases during the dry season when forage is of low nutritive value (Ricks, 2018). Overall performance depends on the well-being and health of the cattle. Therefore, any metabolic disturbance can interfere with the overall performance (Johnson, 2018).

Diseases and parasites are severe restraints for communal beef cattle farmers due to the high cost and scarcity of treatment, as well as the scarcity of veterinary services (Tavirimirwa *et al*., 2013). Diseases and parasitism are prevalent and pose a significant danger to beef cow productivity in communal settings (Marufu, 2008). Blackleg, heartwater, babesiosis, anthrax, and anaplasmosis are the most frequent diseases (Molefi, 2015).

Inadequate management also adds to the prevalence of common ailments such as heart diseases, gallstones, black leg, Tuberculosis, lumpy skin diseases, and infectious abortion (Hashe, 2011). Because of increased morbidity and mortality in community beef cattle, these illnesses cause productivity decreases (Chawatama *et al*., 2005). Horn flies, face flies, stable flies, ticks, and lice are examples of external parasites. The most serious health issue stems from the increased stress that these insects produce in cattle. When cattle are contaminated, they spend more time in the shadow and do not graze, resulting in poor performance. Ticks cause a decrease in productivity, fertility, and death, and are a significant economic ecto-parasite in cow production (Sharma *et al*., 2015).

Inadequate access to veterinary services during dipping influences beef cow output, especially when weekly dipping is recommended in tropical locations during the rainy season (De Garine-Wichatitsky *et al*., 2013). However, communal farmers rarely utilize medications on their livestock and only cure minor ailments with ethno-veterinary drugs (Mutua *et al*., 2020).

2.5.3 Mortality

Commercial agriculture has a death rate of roughly 3%, but communal farmers have a mortality rate of more than 17%. Death rates reflect a financial cost to communal farmers. As a result, initiatives aiming at lowering mortality (with a seasonal component), such as the National Red Meat Development Programme (NRMDP) managed by the National Agricultural Marketing Council, should be supported (Mmbengwa *et al*., 2015).

2.5.4 Stock theft

Stock theft may be on the rise as a result of industry players failing to ensure that livestock is correctly identified. Farmers, speculators, stock auctions, feedlots, and abattoirs can be, or inadvertently are, beneficiaries of stolen cattle, and are thus breaking the law and liable for a fine or punishment (Sibanyoni, 2021).

According to Maluleke and Mofokeng (2018), "the Animal Identification Act (Act 6 of 2002) makes provision for the compulsory marking of livestock, while the Stock Theft Act (Act 57 of 1959) governs the transportation of animals." Both of these Acts were enacted to assist the industry and SAPS in combating stock theft and making it simpler to retrieve stolen cattle. According to research, a major portion of the livestock trade violates the rules of these Acts and fails to meet the minimum standards for preventing stock theft. The Red Meat Industry Forum encourages its members to follow these Acts.

2.5.5 Poisonous plants

Invasive alien species (IAS) are another difficulty for cattle, according to Mngomezulu-Dube *et al*. (2018), because they diminish pasture availability. Bugweed and Spanish reed (ubhici/ubukhwebezane in isiZulu) were the most frequent invasive plants detected. It was noted that having information on how to control these plants was essential.

2.5.6 Growth rate of the animal

Animal growth rate reduction has a significant impact on growing calves (Russell and Rychlik, 2001). Because forages are less nutritious during the dry season, they lack many of the critical nutrients that are important for growth (Tolera and Sundstol, 2000). As a result of being malnourished, the animal's growth rate is reduced. During the dry season, mature cattle may lose weight owing to hunger (Oladotun *et al*., 2003).

2.5.7 Production rate of the animal

This challenge has an impact, particularly on the mature cattle producing meat (Rodriguez, 2018). At some point in the dry season, animal production decreases because of the poor nutrients available in the forage (Mtengeti *et al.*, 2008). Lack of protein and energy can reduce overall meat production and malnutrition leads to cattle failing to show their overall genetic potential (Garg *et al*., 2013).

2.5.8 Reproduction rate of the animal

Reproduction is an issue since communal areas have low levels of calving and weaning, which has been a problem for a long time. During the dry season, forage lacks vital nutrients such as vitamins and minerals that are important in animal reproduction, resulting in a decrease in animal reproduction capabilities (Warner *et al*., 2011). Some macroelement deficiencies, like calcium, phosphorus, and sodium, may result in a lower conception rate or calving percentage (Balamurugan *et al*., 2017).

2.5.9 Overcrowding and overgrazing

Because herdsmen and their flocks are migrating, there is a tremendous demand for and competition for available grazing pasture (Githu, 2022). Farmers from different areas may migrate to the same grazing area in search of greener pasture, which may result in overcrowding and overgrazing of the available pasture, increasing disease spread due to more interactions between cattle from different farms and areas, and the incidence of theft normally increases (Lamidi and Ologbose, 2014).

2.6 Feed resources commonly utilised as dry season supplements in the communal areas

2.6.1. Crop residues

The most common crop wastes utilized to feed cattle during the dry season are sorghum and maize, both of which are lacking in critical nutrients, particularly protein. In addition, grain wastes constitute a low-quality feed item that is employed as a dry-season supplement (Devendra and Sevilla, 2002). The rising use of cereals like maize may reduce their availability as dietary supplements for animal production. As a result, it is critical to place a greater emphasis on alternative forages for animal production. Crop leftovers such as cereal straws and stovers, as well as tree leaves, may be useful in supplying nutrients to forage-based animal production, especially when grass and other forages are scarce (Chaudhry, 2008).

2.6.2. Forage crops

Sorghum (both forage and grain), Bana grass, Napier fodder, Rhodes grass, and Star grass are examples of semi-arid feed crops (Kunkle *et al*., 2000). Cattle feed can also be cultivated from forage tree legumes like Leucaena leucocephala and succulents like a cactus pear. When several fodder crops are blended, they yield a forage mix that may be able to sustain cattle (Sebata, 2018). Forages are critical to the efficient running of cattle production systems. This is especially important for cattle, that rely extensively on forages for health and production in a cost-effective and sustainable manner. Forages are an inexpensive source of nutrients for animal production, but they also help to preserve soil integrity, water availability, and air quality. Although the relevance of various forages in cattle production may vary depending on regional preferences for cattle and forage species, climate, and resources, their importance in cattle production success is recognized. Grassland and fodder crops are recognized for their contributions to the environment, recreation, and meat and milk production efficiency (Chaudhry, 2008). To ensure long-term viability, such farming methods must stay lucrative and environmentally friendly while producing nutritious crops with great economic value. As a result, it is critical to improve the nutritional value of grasses and other forage plants to boost animal production and acquire high-quality food. It is also critical to create new forages that are more efficiently utilized and waste less by integrating efficient cattle. A combination of forage legumes, fresh or stored grasses, crop leftovers, and other feeds could aid in the development of an economically efficient, useful, and viable animal production system (Chaudhry, 2008). When compared to grasses or cereals, forage legumes have the following advantages: low dependency on fertilizer nitrogen (N) inputs, high voluntary intake and animal output when feed supply is not limited, and high protein content (Phelan *et al*., 2015).

2.6.3. Fodder crops

Tripsacum laxum, *Pennisetum purpureum*, and *Panicum maximum* are examples of common fodder grasses that may be utilised during the dry season (Maleko *et al.,* 2019). Fodder legumes have a variety of advantages over other feed resources that may be utilized on livestock farms, including the fact that they are easily available on the farm and can be used for other reasons. Because fodder trees are perennial plants, they are not affected by unexpected climate changes and continue to produce high-quality fodder even during drought years when grasses and other annual forages are dried and gone. Their rapid growth allows them to generate enormous amounts of biomass, which can be used not just for animal feed but also as mulch in agricultural systems. They are also used to keep soil from eroding. When intercropped with food crops, fodder legumes do not compete for resources because their deep root system allows them to extract nutrients from deeper soil layers that shallow rooted food crops do not have access to. They also boost soil fertility by fixing atmospheric nitrogen and have other symbiotic connections that help plants absorb minerals like phosphorus. During the dry season, fodder trees provide shade for cattle and shelter them from the hot, dry weather that is usual during this time of year. They also serve as a source of firewood, as well as lumber for construction and fencing, and as a hedge surrounding the fields (Alphonce, 2017).

2.7 The nutritional quality of feed supplements

Protein, energy, water, fat, minerals, and vitamins are all required by cattle. Supplements are utilized to improve the balance of specific nutrient deficiencies, growth rates, fertility, productivity, and death rates (Gilbreath, 2018). With six to eight percent CP, maximum ingestion of poor-quality roughage is likely. Low-quality forage is defined as forage that contains less than 7% crude protein (CP) and is heavy in fiber (Lazzarini *et al*., 2009). In general, 7 percent CP is the bare minimum in cattle diets to maintain rumen microbial function and forage fiber digestibility (Waterman *et al*., 2017). According to Lazzarini *et al*. (2009), this level of CP is required to sustain microbial function and allow fiber to be efficiently utilized in low-quality forages.

True protein, such as fishmeal or cottonseed meal, has low solubility and provides more response than those with high solubility, such as NPN. Legume residues, pods, green fodder, chicken manure, and oilseed residues (e.g., from sunflower oil production for domestic use) are additional important protein sources (Wu and Ma, 2015). Green fodder is frequently unavailable in semi-arid places during the dry season, although multi-purpose tree fodder can be ensiled. The molasses/urea multi-nutrient block can be an inexpensive and effective supplement, tailored to fulfill a variety of needs (Kumssa, 2017).

Protein and carbohydrate levels in high-quality legume hay, such as Lucerne and clover, promote growth and upkeep. Poor-quality diets, such as cereal straw, grass straws, or rain-damaged hay, necessitate protein and energy supplements (Katoch, 2022).

Protein supplementation should be administered with low quality forages since protein is the first limiting nutrient that is insufficient for both rumen bacteria and cattle (Mathis, 2000). Even though energy is present in forage fiber, it will not be sufficient without protein to encourage microbial development to ferment and digest the fiber (Kunkle *et al*., 2000).

Supplying a protein supplement with low quality forage will provide nitrogen so that the rumen microbe population can grow and digest the protein supplement and use the nitrogen, along with energy from other feedstuffs, to synthesize microbial protein, which will then be used to grow more rumen microbes (Hackmann and Firkins, 2015). As a result of the enormous population of new rumen microorganisms, the capacity to ferment fiber improves, boosting the rate and volume of digestion and transit, and driving a higher intake of low-quality fodder (Dewhurst *et al*., 2000). As a result, the animal not only receives more energy and nutrients from each feed swallowed, but they can also increase the amount eaten (Wang and McAllister, 2002).

Alternatively, several types of grain are readily available and less expensive than protein supplements (Lardy and Anderson, 2009). Feeding a high-starch energy meal that is deficient in protein does not encourage microbial protein synthesis and does not stimulate rumen microbial population expansion (Hackmann and Firkins, 2015). As a result, not only is the rumen-microbial population not stimulated, but it also shifts from fiber-fermenting bacteria to starch-fermenting bacteria, exacerbating the decline in fiber-digesting microbes (Olson, 2015).

Furthermore, starch in grain-based supplements ferments very quickly in the rumen, swiftly producing organic acids and lowering rumen pH since lower pH is deadly to fiber-fermenting bacteria, restricting their ability to operate (González *et al*., 2012). To make matters worse, fiber-digesting microorganisms will begin by digesting starch first and fiber later, resulting in decreased fiber digestion (Owens and Basalan, 2016). As a result, the amount and rate of fiber digestion and passage decrease, resulting in lower fodder consumption. Even though more energy is available from the starch, it will eventually replace the lost energy from poorly digested fiber, resulting in no increase in net energy intake by the cattle, as well as a persistent protein shortage (Ceconi, 2014).

There is no need to supplement beef cattle with vitamins A, B, or E because these vitamins are present in normal-quality feedstuffs. However, vitamin A deficiency in cattle can be caused by eating dry, bleached-out hay, and indications of vitamin A deficiency include watery eyes, rough hair coat, night blindness, and low gains (Pirelli *et al*., 2000).

Minerals are inorganic chemicals that contribute to the body's bone, tooth, protein, and lipid activities. Minerals are provided via natural diets and supplementation, with supplements available as licks or mixed into feed. The composition of necessary salt or mineral supplements varies according to region and feedstuffs. Water is crucial and should be available at all times (Kubkomawa, 2019).

2.8 Conclusions and recommendations

The general management and agricultural procedures used by South African beef cattle ranchers in communal areas are still traditional and usually ineffective. This leads to low performance in beef cattle production. Proper nutrition is a critical component of animal productivity. However, when nutrients are insufficient in the animal's diet, it can provide a significant obstacle to animal output. The problem gets more difficult at some point during the dry season when cattle are unable to achieve their nutritional needs, which include protein and energy, from available low-quality forages.

This results in poorer overall animal performance, higher disease susceptibility, decreased palatability and acceptability of available fodder, overcrowding, and overgrazing of available graze areas, and cattle sold at a loss. Supplemental feeding, however, is required during this hard situation to improve the intake and digestibility of poor-quality forage by stimulating the activity of rumen microorganisms. Supplements are also required to improve the balance of specific nutrient deficiencies, growth rates, fertility, production, and death rates

To combat these challenges, cattle farmers should implement strategic practices such as forage conservation, crop residue utilization, agro-industrial by-product utilization, cultivated fodder crop use, concentrate feed, supplementing poor-quality forages with nutrient supplements, and selling cattle. Cattle farmers in communal areas should be informed about the need of using one or more of these techniques to combat the impact of the dry season on cattle output. More research should be conducted on diets and feedings for cattle productivity during the dry seasons.

CHAPTER THREE

CHALLENGES AND PERCEPTION OF COMMUNAL FARMERS ON CATTLE PRODUCTION IN GA- MATLALA, LIMPOPO PROVINCE, SOUTH AFRICA

ABSTRACT

A survey was conducted in Ga-Matlala to analyze the obstacles and communal farmers' perspectives on cattle production. A total of 59 community cattle ranchers were questioned from three rural villages (Phofu, Phetole, and Madietane). Madietane had the most respondents (49.2 %, with Phetole and Phofu having an identical amount (25.4 % (25.4 %. Males outnumbered females in all three villages investigated, with the majority of respondents aged 55 and older. The majority of respondents in all surveyed villages were cattle owners with 16 years or more of farming experience. Secondary school was the most commonly reported educational background in Phetole and Phiofu, while primary school was the most commonly recorded educational background in Phofu. The most prevalent cattle breed kept in Phetole and Phofu was Nguni, whereas Afrikaner was the most common in Madietane, and the most common motivation for keeping cattle in the study regions was revenue. Sickness, stock theft, and diseases are the most often stated concerns in the districts, with Madietane having the greatest fatality rate, followed by Phetole and Phofu. Government aid and the purchase of livestock medications were the most generally cited perceived remedies. The majority of farmers in the designated communities can purchase medicines for their cattle, and those who cannot receive immunizations are assisted by the government. As a result, it is concluded that there is a need for more knowledge and information on the subject.

Keywords: Communal farmers, Cattle, Management practices

3.1 Introduction

From its current level, global livestock production is expected to more than double by 2050. (Berners-Lee *et al*., 2018; Froehlich *et al*., 2018). As a component of agriculture, livestock production plays an important role in the natural economy of South Africa and beyond, providing food for both urban and rural residents (Hurley *et al*., 2015). Approximately 80% of South Africa's agricultural land is suitable for extensive grazing (Hendriks *et al*., 2016). Extensive grazing is distinguished by each animal grazing over a large area with little labor and expense (Pulido *et al*., 2018). For productivity, cattle ranchers in many rural communities frequently adopt this sort of grazing, in which cattle solely graze on natural rangeland (Nyamushamba *et al*., 2017; Mapiye *et al*., 2020).

Communal cow ranching is one of the world's oldest farming methods, practiced primarily by rural households in poor nations, mainly Africa, and looks to be exceptionally resilient to any global economic crises that have occurred so far (Mmbengwa *et al*., 2015). Cattle are particularly significant in communities because they generate meat for a multitude of uses, including ceremonies, selling, and domestic eating. Despite sharing land for livestock grazing, emergent and communal farmers supply 40% of cattle output in South Africa, according to the National Department of Agriculture, Forestry, and Fisheries (2016). Cattle are commonly kept in rural regions to supplement revenue from specialized occupations. Purchasing building materials for a new home, for example, or paying for school tuition or a funeral (Marandure *et al*., 2016). Furthermore, cattle supply meat for a variety of purposes, including ceremonial, selling, and domestic consumption. However, community farmers confront a number of challenges that prohibit them from getting a good return on their cattle.

Climate stress, nutritional stress, and diseases, as well as limited access to land and water, a lack of market channels, poor rangeland management, and a lack of feed resources, all impede cattle production in the subtropics (Niyas *et al*., 2015). As a result, sensitivity to these stresses has a major impact on fertility, growth rate, and mortalities, all of which reduce cow output (Jat *et al*., 2016). Another major issue for community farmers is the effectiveness of support services, particularly those connected to animal health, nutrition, and cattle and small stock marketing (Gido *et al*.,2015). Government aid is currently limited to animal health rather than comprehensive livestock producing systems. As a result, government health support is less effective since veterinarians and animal health specialists that aid communal farmers lack communication skills (Bahta *et al*., 2016). As a result, the purpose of this study was to look into the issues and perceptions of farmers in Ga- Matlala, Limpopo Province, South Africa.

3.2 Methods and materials

3.2.1 Study site

The study was conducted in three communal areas in South Africa's Limpopo province's Capricorn District Municipality. The three community regions were Phofu, Phetole, and Madietane (Figure 3.2.1.) These community areas were selected based on their willingness to participate in the study. The vegetation type found 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.*Vachellia hebeclada, Vachellia karoo, Vachellia tortillis*, and *Dichrostachys cinerea* are the most common woody plant species, whereas *Arista congesta, Brachiaria nigropedata, Cynodon dactylon, Digiteria eriantha,* and *Eragrostis rigidior* are the most common grass species. 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 average temperature is 28.1°C, and the maximum temperature is 36.8°C. 4.4°C is the average minimum temperature during the dry winter season. Shallow, skeletal soils, such as the Mispah and Glenrosa soil types, characterize the geology (Soil Classification Working Group,1991). The soils are frequently of poor quality, making agricultural cultivation impossible but good for cattle pasture (Environmental Management Plan, 2009). In these communal areas, cattle grazed on common rangelands around 10 kilometers from homesteads. Cattle grazed on community rangelands all year at a stocking rate of 7 hectares per livestock unit (Department of Agriculture, Forestry and Fisheries, 2018). The principal means of subsistence in these community lands is cattle animal production. Cattle production is an important asset since it offers food, revenue, credit insurance, and a safety net in the event of a calamity (Mapiye *et al*., 2020).

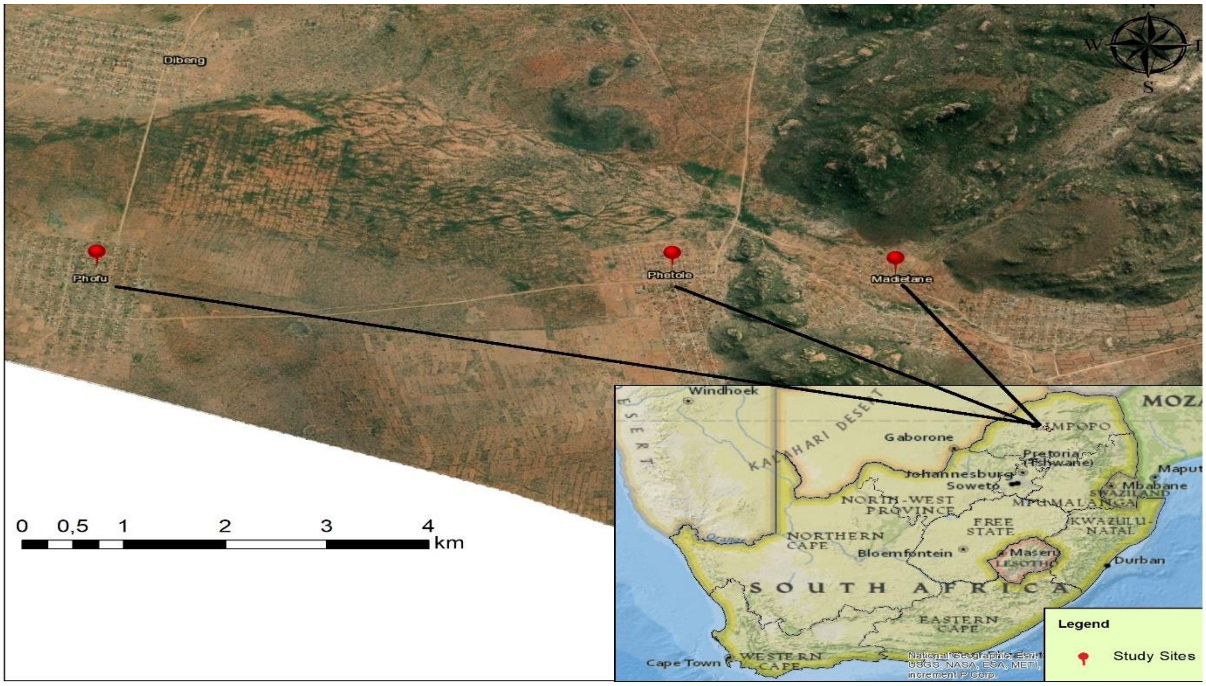

Figure 3.2.1: Map of the study area

3.2.2 Population and sampling size

The study was performed with 59 respondents from the three designated rural locations (Phofu, Phetole and Madietane). There were 15 responders from Phetole, 15 from Phofu, and 29 from Madietane. The small size and imbalance of farmers in the areas were caused by Madietane having more cattle farmers than Phetole and Phofu, as well as the refusal to continue with interviews. Prior to the data collection day, each local Induna of the three villages (Phofu, Phetole, and Madietane) was visited to request permission to collect data, and letters of the request were supplied.

3.2.3 Sampling procedure and data collection

The snowball sampling approach, also known as referral sampling, was employed to pick 59 households in each of the three villages for interviews. Starting from the department's administrative center (Extension Officers), one farmer or cow herder was interviewed, and the person questioned nominated the next individual to be included in the study.

Before being used in the survey, the questionnaire was pre-tested to ensure its applicability. This was done to discover questions that were vague. The respondents were questioned at their residences using a standardized questionnaire that had been pre-tested. Trained enumerators conducted the interviews in the Sepedi vernacular. The questionnaire was divided into four sections labeled A, B, and C. Section A collected data on household demographics, Section B on herd size and cow management, and Section C on farmers' perspectives on the issues of cattle farming in the area.

3.2.4 Statistical analysis

Data were analysed using Statistical Package for the Social Sciences version 27 (SPSS, 2020). Chi-square ($\chi 2$) statistics were used to compare categorical variables between three villages. P- value was considered significant different at 95% interval ($P < 0.05$).

3.3. Results

3.3.1 Demographic information of the farmers

All demographic characteristics of the respondents (Table 3.3.1) did not differ significantly (P > 0.05) between the three villages. Males made up more than 60% of respondents in all three villages with the bulk of them being 55 years old. The vast majority of respondents were cattle owners with more than 16 years of farming experience. The majority of respondents in Photole and Mediatane had secondary school education, whereas the majority of respondents in Phofu (33.3%) had primary school education.

Table 3.3.1: Demographic information of the farmers

Demographic information	Frequency (N)	Phetole Percentage (%)	Frequency (N)	Phofu Percentage (%)	Frequency (N)	Madietane Percentage (%)	Chi-square	*P*-value
Gender								
Male	13	86.67	10	66.67	20	68.97	1.96	0.38
Female	2	13.33	5	33.33	9	31.03		
Age distribution								
<25	0	0	0	0	0	0	8.72	0.19
25-34	1	6.67	1	6.67	7	24.14		
35-44	2	13.33	1	6.67	3	10.34		
45-54	0	0	1	6.67	5	17.24		
≥55	12	80.0	11	73.33		48.28		
Position								

Cattle owner	12	80.0	11	73.33	20	68.97	7.62	0.11
Herder		0	2	13.33	8	27.59		
Other (wife, sibling, children, neighbour etc.)	3	20.0	2	13.33	1	3.45		
Farming experience (Years)								
<2	1	6.67	2	13.33	1	3.45	6.99	0.54
3-5	3	20.0	2	13.33	7	24.14		
6-10	0	0	2	13.33	7	24.14		
11-15	2	13.33	2	13.33	3	10.34		
≥16	9	60	7	46.67	11	37.93		
Educational background								
Never attended	4	26.67	4	26.67	4	13.79	11.85	0.30
Primary school	4	26.67	5	33.33	5	17.24		
High school	6	40.0	4	26.67	15	51.72		
College diploma	0	0	2	13.33	2	6.90		
University degree	0	0	0	0	3	10.34		
Postgraduate qualification	1	6.67	0	0	0	0		

3.3.2 Cattle distribution and breeds in the herds

Figure 3.3.2 depicts information on cattle distribution in the three studied communal areas. Although, there was no statistical significance (P>0.05), Madietane had the most cattle kept, followed by Phetole and Phofu. Nguni was the most commonly owned breed in Phofu and Phetole, but the third most popular breed in Madietane (P > 0.05). The most popular breeds in Madietane were Afrikaner, Nguni, and Afrikaner (P > 0.05) (Table 3.3.2).

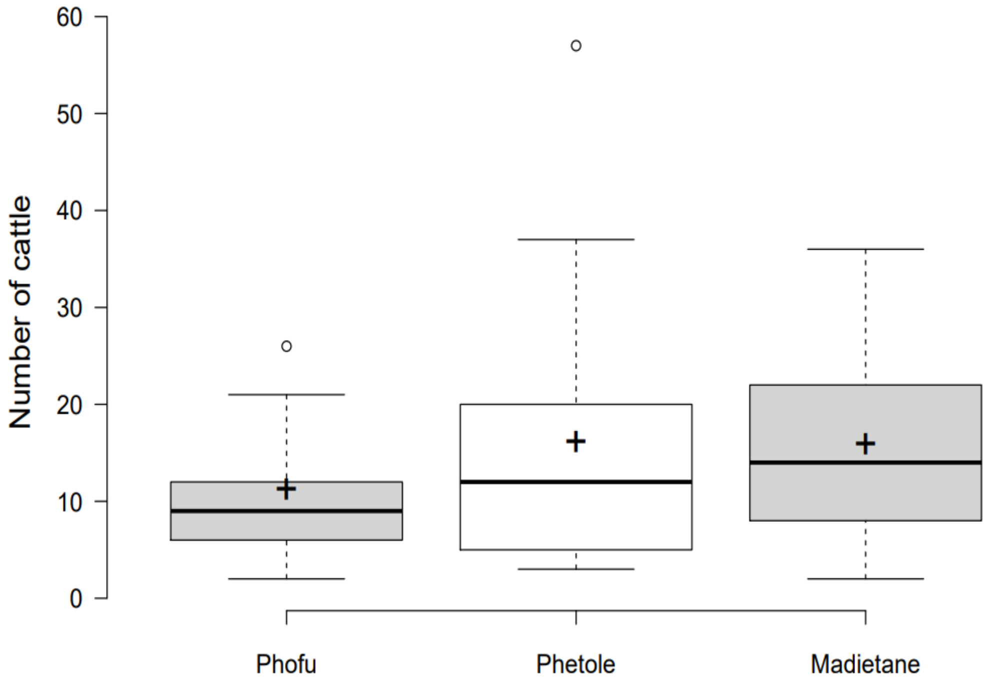

Figure 3.3.2: Distribution of cattle in the three studied communal areas. Note: The horizontal thick line is the median value, the plus sign (+) is the mean, the middle box indicates the inter-quantile range, whiskers represent values within 1.5 IQR of the lower and upper quartiles, and individual points show outlier values

Table 3.3.2. Summary of cattle breeds in the herds

Breeds	**Phofu**		**Phetole**		**Madietane**		**Chi-square**	**P-value**
	Frequency (N)	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**		
Afrikaner	3	10.3	4	26.7	8	27.6	23.66	0.10
Nguni	8	27.6	5	33.3	3	10.3		
Brahman	0	0	0	17	5	17.2		
Nguni and Afrikaner	3	20	4	26.7	8	27.6		
Nguni and brahman	0	0	2	13.3	2	6.9		
Other	1	3.4	0	0	4	13.6		

Note: Other = (Such as Nguni, Brahman and Afrikaner; Cross (Brahman x Afrikaner); Cross (Nguni x Afrikaner); Cross (Nguni x Brahman x Afrikaner)

3.3.3 Daily cattle management

The daily cattle management differed significantly between the three villages ($P < 0.05$). The majority of respondents in Phofu reported that they release their cattle in the morning and return them late at night, with no provision for food or water, and that they rely on the community for water supply (Table 3.3.3). More than 50% of respondents in Phetole and Madietane reported releasing cattle in the morning and returning late to provide them with feed, water, and medication.

Table 3.3.3. Daily cattle management

Cattle management	Phofu		Phetole		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
1	11	73.3	7	46.7	8	27.6	9.08	0.04
2	3	20	8	53.3	19	65.5		
3	1	6.7	0	0	2	6.9		

Note: 1= Released in the morning and returned late and depend on community water, 2= Released in the morning and returned late and provide water/or medication/ or food, 3= Cattle stay at the mountains and returned home sometimes

3.3.4 Reasons for keeping beef cattle

Table 3.3.4 shows the respondents' perceptions of the reasons for keeping cattle. The reasons for keeping cattle did not differ significantly among the three villages ($P > 0.05$). In Phetole and Madietane, the main perceived reason for keeping cattle was income, followed by income and household consumption. While the most perceived reason for keeping cattle in Phofu were income and inheritance, followed by a love of farming.

Table 3.3.4. Reasons for keeping cattle in the three communal areas.

Reasons for keeping cattle	Phofu		Phetole		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Income	4	26.67	7	46.67	11	37.93	31.93	0.08
Inheritance	4	26.67	1	6.67	3	10.34		
Easy to handle	1	6.67	0	0	0	0		
Household consumption	2	13.33	0	0	0	0		
Status	0	0	1	6.67	1	3.45		
Draught	0	0	0	0	0	0		
Love for farming	3	20	0	0	2	6.90		
Income and household consumption	1	6.67	2	13.33	10	34.48		
Other	0	0	4	66.68	2	6.90		

Note: Other = (Such as Income and easy to handle; Income and household consumption; Household consumption and status; Easy to handle and household consumption; Income and love for farming)

3.3.5 Mortalities with reasons for cattle loss

The annual mean number of cattle mortalities in the studied communal areas is depicted in Figure 3.3.5. Madietane had the highest mortality rate, followed by Phetole and Phofu but there was no statistical significance among them. The causes of cattle loss in the three communal areas did not differ significantly ($P > 0.05$; Table 3.3.5). Diseases were the most commonly perceived cause of cattle loss in all three villages. It was followed by starvation in Phofu and mysterious death in Phetole ($P > 0.05$).

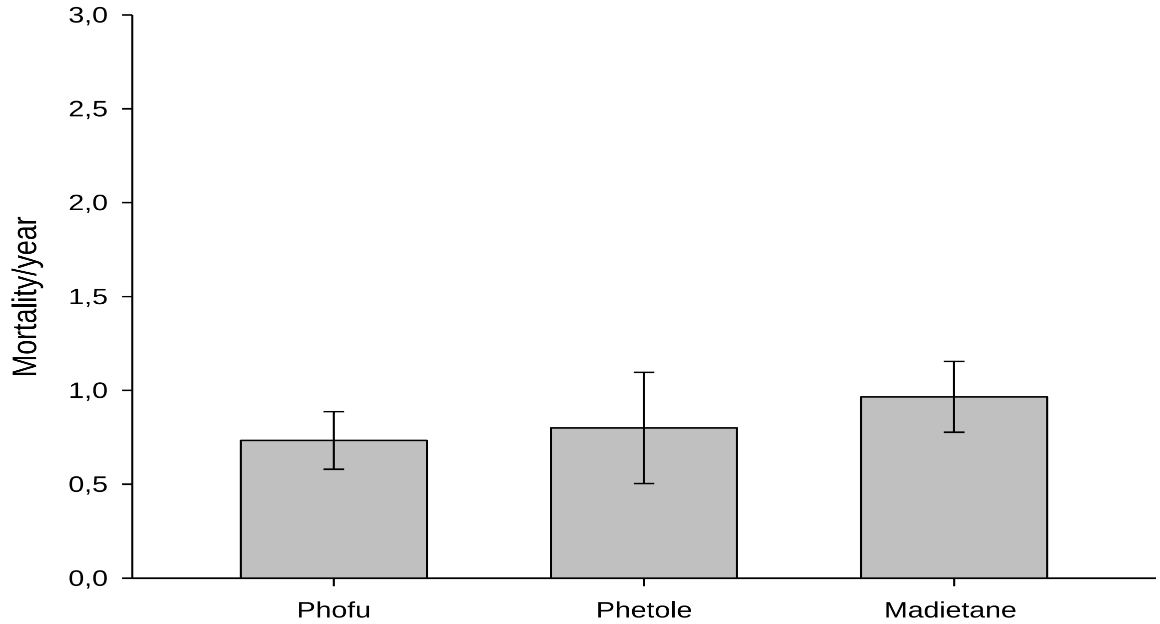

Figure 3.3.5. Mean number of mortalities of cattle in the studied communal areas

Table 3.3.5. The reasons for cattle mortality in three studied communal areas.

Reasons for cattle mortality	Phofu		Phetole		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Diseases	3	30	5	71.4	10	55.6	22.73	0.65
Killed by thieves	1	10	0	0	1	5.6		
Found dead (mysterious death)	1	10	1	14.3	1	5.6		
Starvation	2	20	0	0	0	0		
Plastic consumption	1	10	1	14.3	0	0		
Snake bite	1	10	0	0	0	0		
Poisonous plants	1	10	0	0	0	0		
Other	0	0	0	0	6	33.6		

Note: Other = (Such as Abnormalities from birth; Retained after birth; Diseases and snake bite; Diseases and found dead; Killed by thieves and snake bite; Diseases and killed by thieves)

3.3.6 Challenges in efficiency production

Table 3.3.6 shows the challenges that farmers face, and there were no statistically significant differences between villages ($P > 0.05$). Nevertheless, in Phetole and Phofu, stock theft was regarded as the most challenge, followed by diseases. In Madietane, diseases and stock theft (33.03%) were perceived as the most significant challenge, followed by diseases (13.79%) and stock theft (13.79%).

Table 3.3.6. Challenges faced by the farmers that reduces the efficiency of production in the area.

Challenges	Phofu		Phetole		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Diseases	2	13.33	3	20	4	13.79	31.82	0.28
Stock theft	4	33.33	4	26.67	4	13.79		
Shortage of feed in winter	0	0	0	0	2	6.90		
Lack of water	0	0	0	0	1	3.45		
Lack of rainfall/drought	1	6.67	1	6.67	0	0		
Diseases and shortage of food	0	0	1	6.67	0	0		
Stock theft and shortage of food	0	0	1	6.67	0	0		
Diseases, stock theft and shortage of food	0	0	1	6.67	5	17.24		
Diseases and stock theft	3	20	1	6.67	9	31.03		

Other	4	26.67	3	20	4	13.8

Note: Other = (Such as Shortage of food, plastic consumption, and drought; Stock theft, thieves, and snake bites; Stock theft and snake bites; Diseases, stock theft, and snake bites; Diseases, stock theft, and snake bites; No challenges)

3.3.7 Causes of challenges faced by the farmers

The shortage of herders was the most perceived cause of farmer issues in Phetole and Phofu, whereas it was the second most perceived cause in Madietane, despite no statistical difference between communal areas (P >0.05; Table 3.3.7). In Madietane, however, the high unemployment rate was identified as the leading cause of problems.

Table 3.3.7. The causes of challenges faced by the farmers in the studied communal areas.

Causes of challenges	Frequency (N)	Phetole Percentage (%)	Frequency (N)	Phofu Percentage (%)	Frequency (N)	Madietane Percentage (%)	Chi-square	P-value
High unemployment rate	1	6.67	2	13.33	3	10.34	67.45	0.43
Low rainfall	1	6.67	1	6.67	2	6.90		
No herder	2	13.33	3	20	2	6.90		
High alcohol consumption	1	6.67	0	0	0	0		
Low quality food	1	6.67	0	0	2	6.90		
Poisonous plants	1	6.67	0	0	0	0		
Other	8	53.35	9	60.02	18	65.64		

Note: Other = (Such as No dumping sites; Lack of vaccination, medication, and money; Surrounded by mountains and bushes; Taking bulls to auctions; Mixing of cattle herds; Broken water machines, lack of dams and rivers; Poisonous mosquitoes; Muddy soil; Injuries; Diarrhea etc.)

3.3.8 Perceived solutions to the challenges

Table 3.3.8 shows farmers' perceived solutions to the problems they face. The perceived solutions to challenges differed significantly between villages ($P < 0.05$). The most common solution reported in Madietane was government intervention, followed by the purchase of medicines and community unity. In Phetole, the majority of respondents reported no solutions to the challenges, which was closely followed by the purchase of feed and supplements and community unity. In Phofu, the major recorded solutions were government intervention, hiring more headers, and no solution to the problems.

Table 3.3.8: Perceived solutions to the challenges

Perceived solutions	**Phetole**		**Phofu**		**Madietane**		**Chi-square**	**P-value**
	Frequency (N)	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**		
Government intervention	1	6.67	3	20	16	55.17	36.65	0.02
Buy medicines	2	13.33	0	0	3	10.34		
Buy feed supplements and feeds	3	20	1	6.67	2	6.90		
Hiring more herders	0	0	3	20	1	3.45		
Unite as a community	0	20	3	20	3	10.34		
No solutions	6	40	3	20	0	0		
Other	2	13.34	2	13.34	4	13.8		

Note: Other = (Such as Buy medicines, feed supplements and feeds; Buy medicines and hiring more herders; Government intervention and hiring more herders; Government intervention and buy feed supplements; Buy our own bulls)

3.3.9 Medication and reasons for not purchasing medicines

Madietane had 89.7% of communal farmers who purchases medicine, followed by Phofu (73.3%) and Phetole (60%) (Table 3.3.9).

Table 3.3.9. Purchase of medicines

Purchase of medicine	Phofu		Phetole		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Yes	11	73.3	9	60	26	89.7	5.31	0.07
No	4	26.7	6	40	3	10.3		

3.3.10 Reasons for not purchasing medicines

Table 3.3.10 shows the reasons for not purchasing livestock medication, which did not differ statistically significantly (P > 0.05) between the three communal areas. Although, communal farmers in Phofu and Madietane reported the high expense of medication as the primary reason for not purchasing them for cattle and no specific reason was provided in Phetole.

Table 3.3.10: Reasons for not purchasing medicines

Reasons for not purchasing medicines	Phetole		Phofu		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Government provides vaccinations	1	6.67	2	13.33	0	0	6.46	0.37
Medicines are expensive	0	0	3	20	2	6.90		
Cattle do not experience problems that need medication	1	6.67	0	0	0	0		
No reason	2	13.33	1	6.67	1	3.43		

3.3.11: Name of the medicines

The different types of medicines used in the three communal areas are presented in Table 3.3.11. In Phetole, the most generally used medicines were Terrymycin and dipping medicine, whereas Tacktic was the most regularly used medicine in Madietane. In Phofu, communal farmers were not giving medication to their cattle.

Table 3.3.11: Name of the medicines

Medicine Name	Phetole		Phofu		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Taktic	1	6.67	1	6.67	4	13.79	66.06	0.41
Supona aerosal,	1	6.67	0	0	1	3.45		
Drustic deadline	0	0	1	6.67	2	6.90		
Terramycin	2	13.33	0	0	0	0		
OBP onderstepoort	0	0	0	0	0	0		
Dipping medicine	2	13.33	0	0	0	0		
Tick's medicine	1	6.67	0	0	0	0		
Tipe	0	0	0	0	1	3.45		
Hitet,	0	0	1	6.67	0	0		
Jeyes fluid	0	0	0	0	1	3.45		
Electro guard	0	0	0	0	1	3.45		
Other	3	20.01	5	33.35	16	55.20		

Note: Other = (Such as Tick's medicine; Tipe; Hitet; Jeyes fluid; Electro guard; Drustic deadline, Terramycin and OBP onderstepoort; Terramycin, Pro-vit A supplement, and Obermycin; Taktic and Dewormer; Drustic deadline, Tipe and Ivomack; Terramycin and Lympyvax; Terramycin, Tipe, Dewrmer and Magazine etc.)

3.3.12 Government assistance

Table 3.3.12 shows explanations of government assistance. The explanations for government assistance were statistically significant (P < 0.05) among the villages. The majority of farmers in Phetole and Phofu reported receiving government assistance in terms of vaccination, whereas farmers in Madietane reported receiving no assistance.

Table 3.3.12: Explanations on the government assistance

Explanation	Phetole		Phofu		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Yes, the government provides vaccinations	8	53.33	6	40	9	31.03	22.07	0.02
Yes, but the government delivers after a long time	6	40	3	20	2	6.90		
No, the government is not helping	1	6.67	4	26.67	17	58.62		
Never applied for the government assistance	0	0	2	13.33	1	3.45		

3.4. Discussion

3.4.1 Demographic information of the farmers

Men made up the significant majority of responders in the current survey. This could be ascribed to men's roles in cattle management tasks such as herding cattle to grazing areas on a daily basis. Oladele *et al*. (2013) discovered similar findings, namely that cattle raising is still predominantly a male-dominated business. Furthermore, Ndhlovu and Masika (2013), Katiyatiya *et al*. (2014), and Mdungela *et al*. (2017) discovered that men owned a big number of cattle, which they attribute to management issues such as handling for treatment. This, however, contradicts the findings of Lumu *et al*. (2013) in Kampala, Uganda, who identified females as the dominated questioned farmers because males spend the majority of their time performing business or working for a salary, leaving women to handle livestock on a daily basis.

The majority of farmers in this survey were older than 54, demonstrating that senior people are undoubtedly participating in cattle farming in Ga- Matlala's districts with free communal grazing land. According to the findings of this study, elderly in rural regions have more time to care for cattle than young people who live in cities due to employment and education. Mthi *et al*. (2020) revealed similar findings in the Eastern Cape, stating that young do not participate in livestock farming since they are more focused on metropolitan areas than on rural communities. Mthi *et al*. (2020) discovered, however, that the bulk of responders were between the ages of 31 and 50. According to Motiang and Webb (2016), a substantial number of middle-aged farmers are involved in agriculture in North-West Province, confirming the low participation rate of youngsters in agricultural development. Amakom (2016), on the other hand, discovered that the majority of youth in Anambra State, Nigeria, participated in crop production programs rather than livestock production. The vast majority of respondents were livestock owners. This shows that farmers regard farming as a significant source of income. They tend to their own livestock rather than outsourcing herd management to others. Habiyaremye *et al*. (2017) discovered that in most situations, family leaders are in charge of managing the day-to-day activities involved with livestock rearing. According to the above-mentioned author, a significant number of cattle owners also hire people to care for their cattle. However, it is unclear if the laborers are employed when the family head is present or absent to look after the cattle.

The majority of farmers in the three villages had at least 16 years of cow farming experience. This is consistent with elderly individuals being more involved in cattle farming than younger people. This result is consistent with the findings of Mthi *et al*. (2020), who discovered that the number of years of farming experience was greater than 15 years. Yawa *et al*. (2020) confirmed similar findings, stating that the majority of the farmers had more than 21 years of cow farming experience. These findings contradict those of Goni *et al*. (2018), who reported 10 years of animal farming experience.

High school was reported as the highest educational level achieved by the majority of farmers in Phetole and Madietane in the current study, whereas primary school was recorded in Phofu. This is a significant benefit for integrating communal area farmers into beef cattle value chain development programs. This finding was also surprising given the proportion of elderly participants in the research area who rely on pensions for income and grew up during the apartheid era with limited access to formal schooling (De Cock *et al*., 2013). These findings are consistent with the findings of Ndhlovu and Masika (2013) and Sungirai *et al*. (2016), who discovered that more than 90 percent of farmers in Zimbabwe had a secondary school level. According to Chimonyo *et al*. (1999), the majority of males in Zimbabwe have a secondary education. According to the Food and Agriculture Organization of the United Nations (2009), education, whether formal, non-formal, or in the form of skills training, is particularly important in developing people's capacity to maintain food security. However, Sakyi (2012) contends that education improves food security and poverty reduction by providing the opportunity to improve livelihood alternatives.

3.4.2 Cattle distribution and cattle breeds in the herds

In the current survey, the majority of farmers in Madietane and Phetole reported significant herd sizes. According to Vetter *et al*. (2020), larger herds have lower mortality rates, implying that owners of larger herds are wealthier and have more access to resources and herding labor. This is comparable to previous research that found a significant herd size (Smith *et al*. 2000; Mapiye *et al*. 2018; Santos *et al*. 2019). Bester *et al*. (2003) and Musemwa *et al*. (2008), on the other hand, estimated an average herd size of 5 to 10 cattle per household with the goal of primarily satisfying subsistence needs with limited use of technology in South Africa.

All of the farmers polled raised Afrikaner, Nguni, Brahman, crossbred, or a combination of the foregoing breeds. Most farmers in Phofu and Phetole, however, indicated a preference for keeping Nguni breeds, whilst in Madietane, the most popular breeds were Afrikaner, Nguni, and Afrikaner. This could be due to the ability of these breeds to produce and their increasing adaptability to rural circumstances. Molefi (2015) discovered comparable findings in Chief Albert Luthuli Local Municipality in Mpumalanga Province, noting that approximately 31% of farmers explored farming with the Nguni breed because to its excellent productivity capabilities. In contrast to the current findings, Katikati (2017) discovered that in the communal areas of South Africa's Eastern Cape Province, farmers accidentally farm with cross breeds due to unregulated mating caused by inadequate fencing.

3.4.3 Daily cattle management

Cattle are generally released in the morning and herded to grazing areas before being returned home and kraaled at night in the three settlements. Most farmers in Phetole and Madietane, on the other hand, reported that even though they let cattle graze during the day and kraal at night, they still provide them with feed, water, and medication when they return home later, whereas most farmers in Phetole reported that cattle rely on community water, so they do not provide them with food or water when they return home. Nthakheni (2006) discovered similar findings in Limpopo Province's Vhembe District, where cattle are generally herded because there are no camps and kraaled every night of the year for fear of theft, traffic accidents, and agricultural 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.

3.4.4 Reasons for keeping beef cattle

The survey found no statistically significant differences in the motivations for keeping cattle among the three villages. Cattle, on the other hand, provide a variety of services in the communities studied. In Phetole and Madietane, income was the most important reason for having cattle, whereas in Phofu, income and inheritance were the most important reasons. Community farmers' most profitable business is cattle farming. For example, if a child is needed to attend school and pay a school fee, the farmer cannot sell anything other than cattle because he believes that selling cattle will immediately result in a large number of money and allow him to pay off his debts. Molefi (2015) reported similar findings, noting that cattle producers in Mpumalanga Province's Chief Albert Luthuli Local Municipality kept beef cattle for sale and personal use. These findings contradict those of Musemwa *et al*. (2010), who reported that milk was the primary reason for retaining cattle in two Eastern Cape municipalities. Farmers also admitted to raising beef cattle for heirloom purposes. To bridge the gap and ensure continuity, farmers may inherit livestock from family members such as parents, grandparents, or relatives. According to Nthakeni (2006), another reason community farmers keep cattle is because they are inherited in Limpopo Province's Vhembe District.

3.4.5 Mortalities with reasons for cattle loss

There were no significant differences in livestock mortality among the three groups evaluated. However, the majority of livestock died in Madietane, followed by Phetole and Phofu. These findings are congruent with the findings of Nowers *et al*. (2013), who discovered a 30% fatality rate in communal cow farming. This finding, however, contradicts the findings of Makgatho (2006), who discovered a low cattle fatality rate in communal areas in the Odi district. Diseases were the leading cause of cow mortality in the three villages evaluated. Similarly, Amimo *et al*. (2011) discovered that illnesses were the primary cause of cattle death in Western Kenya.

3.4.6 Challenges in efficiency production, causes of challenges and perceived solutions

Stock theft was identified to be the most major difficulty in the three communities evaluated in the study. Cattle are often taken in these villages on the grazing grounds because farmers leave the cattle on the grazing fields with no herders. These findings are congruent with the findings of Mngomezulu-Dube *et al*. (2018), who indicated that cattle theft is a problem for farmers in South Africa's Northern KwaZulu-Natal Province. The community farmers said that because there are no herders on the fields, young people steal cattle and sell them to make money. These findings are in line with previous research that has connected high unemployment rates to cattle theft (White, 2011; White, 2012). Diseases was another significant concern influencing cattle production efficiency in Madietane. Because cattle graze on communal rangelands, the increasing presence of diseases could be due to poor nutrition or infection from other sick animals. Amimo *et al*. (2011) reported similar findings, highlighting diseases as the key factor affecting cow productivity. To solve the aforementioned difficulties, farmers requested government action in the form of job creation, immunizations, veterinarians, dumping sites, water machine repair, dam construction, feed, and full-time range patrollers. Farmers in Molefi's (2015) study in Chief Albert Luthuli Local Municipality in Mpumalanga Province proposed similar solutions to the diseases and tick problem, such as immunization programs.

3.4.7 Medication and reasons for not purchasing medicines

According to farmers, the majority of farmers in these areas buy medicines for their livestock. This indicates that, even though famers come from communal regions, they are aware that certain cattle ailments cannot be cured without medicines, hence it is vital to purchase medicines at some time. Farmers spend a significant amount of money on animal healthcare and preventative goods, according to Habiyaremye *et al*. (2017). (i.e., medicines, vaccines, and food supplements). Farmers' spending on animal healthcare in South Africa was considerably influenced by factors such as education level and the number of cattle owned in the provinces of KwaZulu-Natal, Eastern Cape, Mpumalanga, North-West, and Free State (Habiyaremye *et al*., 2017).

According to the report, the primary reason for not purchasing medicines is that they are too expensive for them to purchase. According to Habiyaremye *et al*. (2017), most farmers in South Africa's KwaZulu-Natal, Eastern Cape, Mpumalanga, North-West, and Free State provinces state that animal health practitioners visit their animals for vaccination on a frequent basis for disease prevention.

Although most farmers do not treat their cattle with medicines, some can and have named the most significant, such as Taktic, a cattle spray that eliminates ticks, manages mice, and kills lice.

Terramycin LA is used to treat tick-borne gall sickness (anaplasmosis), heartwater, pneumonia, footrot, joint-illness, navel-illness, and pink eye (infectious bovine keratoconjunctivitis) in cattle, and dipping medicine is used to eliminate scab, ticks, lice, blowfly, and keds. The findings reveal that farmers are well aware of the common diseases that affect their cattle and are working hard to regulate and treat them.

Farmers treat sickness in their animals by purchasing antibiotics, dewormers, and tick dips, according to Habiyaremye *et al*. (2017).

3.4.8 Government assistance

According to the study's findings, the majority of farmers in Phetole and Phofu received government immunization support. This suggests that the vast majority of farmers rely on government assistance to maintain their cattle healthy. This is congruent with the findings of Habiyaremye *et al*. (2017), who discovered that most farmers in South Africa's KwaZulu-Natal, Eastern Cape, Mpumalanga, North-West, and Free State provinces indicate that animal health practitioners visit their animals for vaccination on a regular basis.

3.5. Conclusions and recommendations

Farmers' knowledge on problems such as herd size, cattle breeds in herds, cattle management, reasons for keeping beef cattle, and reasons for cattle loss was effectively tested in the Ga-Matlala district of Limpopo, South Africa. The majority of responses were men, it was discovered. Because the majority of the farmers are elderly, it was expected that the highest number of respondents would be those who had never attended school; however, high school and primary school were the most common educational backgrounds, indicating that the majority of the farmers are literate and can assist themselves in most beef cattle farming challenges. They rely not only on educational background, but also on farming experience, which is why the majority of beef cattle farmers have more than 16 years of agricultural experience.

The herd size was bigger in the villages, making it challenging for them to manage their herds, especially when faced with problems such as the dry season when feed is scarce. Most farmers farm with Nguni and Afrikaner breeds, which has an advantage because these breeds can withstand tough weather and so can withstand the dry season issues. The highest mortality rate was reported in one village, and diseases were reported as the main cause of cattle mortalities; this may imply that the majority of farmers with low educational backgrounds are facing challenges, while only a minority of those with higher educational backgrounds are facing these challenges. Another problem that was frequently reported was cow theft, which could be attributed to farmers' inexperience in leaving cattle unattended in grazing grounds. However, solutions to the aforementioned difficulties require the assistance of the government.

In terms of daily cattle management, it is customary in community areas for livestock to be released to grazing pastures and returned late, but the supply of additional water and feed is optional. Income was the most important motive for keeping cattle, and this can be expected from any cow farmer. Farmers who cannot afford medicines rely on the government, and if the government fails to provide them, their cattle productivity decreases as a result of diseases. Furthermore, farmers who are unable to purchase medicines for their cattle due to a lack of funds or understanding about the medicines required for cow health rely on the government. It is thus concluded that there is a need for more knowledge and information on the overall cattle management which will assist by reducing mortality rates and overcome several difficulties they reported, particularly with regard to disease management and theft for enhancing productivity in the communal areas.

1. Encourage knowledge creation and sharing among farmers

Decentralized information management and knowledge exchange are fostered through the use of new technologies such as web-based apps and management database systems. Such methods enable farmers to identify, share, and prioritize their problems and requirements, but most significantly, to seek solutions within their community rather than relying on government extension services. The database will also act as a record keeping platform, as it is capable of producing documented judgments based on accessible and repeatable knowledge. Farmers should be requested to pay an annual charge for system maintenance and upgrades in order for the system to be sustainable.

2. Public and private sector support for infrastructural development

The government must strengthen public-private partnerships in order to finance the creation of production and marketing facilities in community farming areas. Multi-stakeholder cow farming development forums aimed at emerging and communal farmers at the local, district, and provincial levels could be an effective strategy to build these linkages or collaborations. Such forums should subsequently be used to identify relevant infrastructure and potential locations for the farmers' benefit. Investment in production infrastructure will boost productivity and mitigate some of the issues highlighted in this study. Theft, sickness, and predators are examples of these. The availability of marketing infrastructure, on the other hand, will considerably boost farmers' ability to minimize transaction costs, improve market access, and access to market intelligence.

CHAPTER FOUR

IDENTIFICATION OF THE FEED SUPPLEMENTS COMMONLY UTILISED BY COMMUNAL BEEF FARMERS DURING THE DRY SEASON AT GA- MATLALA, LIMPOPO PROVINCE

ABSTRACT

During the dry season in Ga-Matlala, a survey was conducted to identify the feed supplements widely used by communal beef farmers. A total of 59 community cattle ranchers were questioned from three rural villages (Phofu, Phetole, and Madietane). The snowball sampling technique was employed to select interviewees. Madietane had the most respondents (49.2 %, with Phetole and Phofu having an identical amount (25.4 % (25.4 %. Males outnumbered females in all three villages investigated, with the majority of respondents aged 55 and older. During the dry season, the majority of responders in all examined villages used feed additives. Approximately ten feed additives were identified as being employed by farmers during the dry season. Lucerne hay, maize stover, salt lick (block), molasses meal, calf grower, calf milk replacer, beef cattle finisher, cattle feed pellets, sorghum, yellow meal, and sunflower combination, and soybean meal were among the feed supplements discovered in the study locations. During the dry season, the most widely used supplementary feeds were lucerne hay and maize stover. According to the majority of farmers, lucerne hay is the most appropriate feed for cattle, followed by maize stover. The weight growth of cattle as a result of feeding lucerne hay and average weight gain as a result of feeding maize stover were the primary reasons for supplement acceptance. The majority of farmers reported that they do not assess quality of feed supplements. Minority of farmers reported that they assess the quality of dry season supplementary feeds by checking the dryness, freshness, and moulds in the feed. 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 the communal areas.

Keywords: Farmers, Cattle, Feed supplements, Dry season

4.1 Introduction

From its current level, global livestock production is expected to more than double by 2050. (Berners-Lee *et al*., 2018; Froehlich *et al*., 2018). As a component of agriculture, livestock production plays an important role in the natural economy of South Africa and beyond, providing food for both urban and rural residents (Hurley *et al*., 2015). Approximately 80% of South Africa's agricultural land is suitable for extensive grazing (Hendriks *et al*., 2016). Extensive grazing is distinguished by each animal grazing over a large area with little labor and expense (Ripoll-Bosch *et al*., 2014). For productivity, cattle ranchers in many rural communities frequently adopt this sort of grazing, in which cattle solely graze on natural rangeland (Nyamushamba *et al*., 2017; Mapiye *et al*., 2020).

In terms of nutrition, natural grasslands or veld are vital for cattle productivity. Natural pastures may easily maintain cattle output throughout the wet season (Pykälä, 2005). However, during the dry season, these grasslands are unable to support cattle because most feed resources at this time of year are of poor nutritional quality (Kubkomawa *et al*., 2015). This tends to reduce cow performance; unless the cattle are fed with adequate supplements, they will not perform as intended (Bheekhee *et al*., 2002).

The main factor limiting beef output and overall reproductive performance, especially in communal areas, is a lack of sufficient pasture, which is especially problematic during the dry season due to irregular rainfall patterns (Katikati, 2017). Throughout this period, the overall performance of cattle that rely on natural pasture suffers significantly because the high-quality pastures are lignified and heavy in fibre, resulting in decreased consumption, digestibility, and utilization (Lamidi and Ologbose, 2014). The dry season feed and feeding have been identified as a limiting factor to successful cattle production due to insufficient nourishment of the cattle at some point throughout the dry season, resulting in decreased cattle overall performance in terms of growth, work, maintenance, production, and reproduction (Oladotun *et al*., 2003). Farmers have resorted to using whatever available feed resource, particularly food/crop wastes (market crop wastes, leftover food, etc.) and forages obtained from open access lands (roadsides, wetlands/swamps, etc.), as feed supplements during the dry season (Katongole *et al*., 2012); and less information exists on the nutritional quality of these available feed resources (Lumu *et al*., 2013). The purpose of this study was to identify the feed supplements regularly used by community beef cattle producers and to explore farmers' knowledge and perceptions of feed supplement assessments during the dry season in Ga- Matlala, Limpopo Province, South Africa.

4.2 Material and methods

4.2.1. Study site

The research was carried out in three communal areas in the Capricorn District Municipality of South Africa's Limpopo province. Phofu, Phetole, and Madietane were the three communal areas (Figure 1.) Polokwane Platea Bushveld is the vegetation type found in the three communal areas. The area has a semi-arid environment, with an annual mean rainfall of 478 mm. The average temperature is 28.1°C, with the highest temperature being 36.8°C. The average minimum temperature during the dry winter season is 4.4°C.

The detailed description of the study area was described in Chapter 3, Section 3.2.1.

4.2.2. Population and sampling size

The survey was conducted with a total of 59 respondents in the three combined selected rural areas (Phofu, Phetole and Madietane). Participated respondents were 15 from Phetole, 15 from Phofu and 29 from Madietane areas.

The detailed population and sampling size was described in Chapter 3, Section 3.2.2.

4.2.3. Data collection

A systematic questionnaire was used to collect the data. Section D of the questionnaire includes data on the nutritional quality of feed supplements utilized by community beef cattle ranchers during the dry season. Information on the assessment of knowledge on the nutritional quality determination of feed supplements used by community beef cattle farmers during the dry season was acquired under the category of assessment of nutritional quality of feed supplement materials.

4.2.4. Statistical analysis

Data were analysed using Statistical Package for the Social Sciences version 27 (SPSS, 2020). Chi-square (χ^2) statistics were used to compare categorical variables between three villages and between the feedstuffs. P- value was considered significant different at 95% interval ($P < 0.05$).

4.3. Results

4.3.1 Supplementation and feed supplements commonly utilised by communal beef farmers during the dry season

Results recorded in Table 4.3.1 show percentage of farmers using feed resources as dry season supplementation and the results did not differ significantly among the three villages (P > 0.05). Majority of farmers in all selected rural areas 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 4.3.1.1. 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 mixture of sorghum, yellow meal and sunflower. The feed supplements for cattle did not differ significantly among the three villages (P > 0.05). Nevertheless, in Phetole, Madietane and Phofu, lucerne hay was the most common feed supplement used, followed by maize stover.

Table 4.3.1: Supplementation during dry seasons

Supplementation	Phofu		Phetole		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Yes	16	84.2	10	62.5	38	86.4	4.510	0.105
No	3	15.8	6	37.5	6	13.6		

Table 4.3.1.1: Feed supplements commonly utilised by communal beef farmers during the dry season

Feed supplements	Phofu		Phetole		Madietane		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Maize stover	4	21.1	4	25.0	5	11.4	14.658	0.685
Molasses meal	1	5.3	0	0	2	4.5		
Calf milk replacer	0	0	0	0	1	2.3		
Beef cattle finisher	0	0	0	0	1	2.3		
Calf grower	0	0	0	0	2	4.5		
Cattle feed pellets	1	5.3	0	0	0	0		
Soya bean meal	0	0	0	0	1	2.3		
Salt licks	0	0	0	0	4	9.1		
Lucerne hay	10	52.6	6	37.5	21	47.47		
Mixture of (Mabele, Yellow meal and sunflower)	0	0	0	0	1	2.3		

4.3.2 Acceptance of feed supplements

Table 4.3.2 shows the acceptance of feed supplements for cattle. The acceptance of feed supplements differs significantly among the feed supplements ($P < 0.05$). Lucerne hay was the most acceptable feed supplement for cattle which means is a good supplement, followed by maize stover

Table 4.3.2: Acceptance of feed supplements for cattle

Feed supplements	Yes		No		No response		Chi-square	P-value
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Maize stover	10	16.9	3	23.1	15	25.4	94.242	<,001
Molasses meal	3	5.1	0	0				
Calf milk replacer	1	1.7	0	0				
Beef cattle finisher	1	1.7	0	0				
Calf grower	2	3.4	0	0				
Cattle feed pellets	2	3.4	0	0				
Soya bean meal	1	1.7	0	0				
Salt licks	4	6.8	0	0				
Lucerne hay	37	62.7	0	0				

Mixture of (Mabele, Yellow meal and sunflower)	1	1.7	0	0

4.3.3 Reasons for acceptance of feed supplements for cattle

Farmers were further asked the reasons for acceptance of feed supplements (Table 4.3.3). The reasons for acceptability of feed supplements differ significantly among the feed supplements (P < 0.05). Majority of the farmers (59.3%) reported weight gain of cattle as a result of feeding Lucerne hay to cattle, followed by average weight (15.3%) as a result of feeding maize stover.

Table 4.3.3: Reasons for acceptability of feed supplements for cattle

Feed supplements	Average weight		Weight gain		Weight loss		Sickness		Fast growth		Chi-square	P - value
	Frequency (N)	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**	**Frequency (N)**	**Percentage (%)**		
Maize stover	9	15.3	1	1.7	1	1.7	2	3.4	0	0	176.777	<,001
Molasses meal	0	0	3	5.1	0	0	0	0	0	0		
Calf milk replacer	1	1.7	0	0	0	0	0	0	0	0		
Beef cattle finisher	1	1.7	0	0	0	0	0	0	0	0		

Calf grower	1	1.7	0	0	0	0	0	0	1	1.7
Cattle feed pellets	2	3.4	0	0	0	0	0	0	0	0
Soya bean meal	1	1.7	0	0	0	0	0	0	0	0
Salt licks	1	1.7	0	0	0	0	0	0	0	0
Lucerne hay	2	3.4	35	59.3	0	0	0	0	0	0
Mixture of (Mabele, Yellow meal and sunflower)	0	0	1	1.7	0	0	0	0	0	0

4.3.4 Assessment of feed supplements quality

The results on how farmers assess the quality of feed supplements utilised during the dry season are presented in Table 4.3.4. The assessment of feed supplements quality did not differ significantly among the feed supplements ($P > 0.05$). 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 10.2% of farmers assess quality of lucerne hay by checking the dryness, followed by freshness (3.4%) and absence of moulds (3.4%) in the feed.

Table 4.3.4: Assessment of feed supplements quality

Feed supplements	Dryness	No moulds	Freshness	No response	Chi-square	P-value

	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)		
Maize stover	0	0	0	0	0	0	13	22.0	12.996	0.989
Molasses meal	0	0	0	0	0	0	3	5.1		
Calf milk replacer	0	0	0	0	0	0	1	1.7		
Beef cattle finisher	0	0	0	0	0	0				
Calf grower	0	0	0	0	0	0	2	3.4		
Cattle feed pellets	0	0	0	0	0	0	2	3.4		
Soya bean meal	0	0	0	0	0	0	1	1.7		
Salt licks	0	0	0	0	0	0	4	6.8		
Lucerne hay	6	10.2	2	3.4	2	3.4	27	45.8		
Mixture of (Mabele, Yellow meal and sunflower)	0	0	0	0	0	0	1	1.7		

4.4. Discussion

4.4.1 Supplementation and feed supplements commonly utilised by communal beef farmers during the dry season

It has been discovered that the majority of farmers use feed resources to augment their cattle during the dry season. This indicates that more farmers are aware of dry season supplementary feeding. This conclusion is close to that of Katikati and Fourie (2019), who stated that the majority of respondents (77.0 % supplemented their cattle in winter, while 23 percent thought supplements were expensive, and only 2.0 percent said they knew nothing about supplements. Winter supplementing reduces weight loss in livestock, whereas summer licks maximize development (Katikati, 2017). This type of information should be emphasized to farmers.

In the current study, lucerne hay was shown to be the most often used feed supplement in all three selected community areas, followed by maize stover. Farmers in the study area frequently utilize these feed supplements since they are less expensive and frequently available throughout the dry season. For example, because maize is the most important crop farmed in communal areas, after harvesting, maize stovers are left to dry in their backyards before being stored for winter use, but 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 (2012) reported lucerne and barley as the most feed supplements used in Dikidikana and Kwezana villages and 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 majority of the farmers were using salt licks for their herds, Mtengeti *et al*. (2008) reported that maize stover was not very popular among the farmers in Tanzania; and Gwelo (2013) reported that the livestock all grazed on the communally owned natural rangelands without any supplementation even during the dry season, therefore, the livestock at Kwezana and Dikidikana rely on the natural rangelands for nutrition.

4.4.2 Acceptance of feed supplements and reasons for acceptance of feed supplements for cattle

According to the study's findings, the majority of farmers said that lucerne hay is an acceptable cattle feed additive, followed by maize stover. This is consistent with

Suttie's (2000) results that lucerne is an excellent fodder supplement to hay from diverse grasses due to its high quality, digestibility, and roughage value; and Erenstein *et al*. (2011) confirmed that maize is very beneficial for digestion in cattle and can be used as fodder.

According to the study's findings, the majority of farmers cited bovine weight gain as a primary reason for feeding Lucerne hay to cattle, followed by average weight gain as a result of feeding maize stover. This is congruent with the findings of DelCurto *et al*. (2000) and Lattimore (2008), who discovered that cattle fed lucerne hay acquired more weight and had less body condition loss. Faftine and Zanetti (2010), on the other hand, reported that calves fed agricultural residue such as maize stover lose more than 20% of their body weight during the dry season. This weight loss has a severe economic impact since it lowers the rate of conception and, as a result, the number of births and physical condition of adult cattle, resulting in mortality and stunted growth of calves.

4.4.3 Assessment of feed supplements quality

In the current survey, the majority of farmers claimed that they do not evaluate the quality of dry season supplementary feeds used. Other farmers, on the other hand, claimed that they assess the quality of dry season supplementary feeds by inspecting the feed for dryness, freshness, and the lack of moulds. These are the features that farmers notice in feed that indicate a high-quality feed supplement. Because only a few farmers can determine the quality of feed resources used as dry season feed supplements, the majority of communal farmers are still feeding cattle without a proper assessment of feeds, which means the feeds they offer to cattle may be wet, covered by weeds, or mold growth that developed during drying or storage. Colour, according to Rocateli and Zhang (2015), is a quality hay grass supplement attribute. According to Julliand *et al*. (2019), the fragrance of freshly mown hay is commonly employed as a comparison benchmark. As a result, a lovely hay scent should be present. Moldy hay should be avoided.

4.5 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 and these supplements are generally used by communal farmers worldwide which means more farmers in the present study are knowledgeable on the dry season supplemental feeds as they are able to use more of the common and used feed supplements than using any other available feed resources. Even though the majority of farmers do not assess quality of feed supplements used, it is known that with availability of these supplements, cattle are able to survive the dry seasons. Although most of the farmers are knowledgeable on 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. The results have an improvement on farmers on the communal rural areas in terms of supplementation of livestock.

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 best feed supplements and feeding for an improved beef cattle production throughout the farming journey particularly during the dry seasons.

2. Poor animal performance must always be investigated to find out possible causes.

3. Farmers are also recommended to buy feeds or supplementary feeds from formal markets to ensure good quality.

4. More research should be made on the dry season feed supplements for communal beef cattle production and more information on how to assess quality of feeds and feed supplements should be introduced.

CHAPTER FIVE

NUTRIENT COMPOSITION OF FEED SUPPLEMENTS UTILISED BY COMMUNAL BEEF FARMERS DURING THE DRY SEASON AT GA- MATLALA, LIMPOPO PROVINCE

ABSTRACT

About 7 feed supplements were sampled from communal cattle farmers for chemical analysis. Feed supplements that were sampled in the study areas included lucerne hay, maize stover, salt licks, calf grower, calf milk replacer, cattle feed pellets and soya bean meal. The feed supplements were oven-dried, then analysed for nutrient composition (protein, fat, ash, moisture, NDF, ADF and minerals) according to AOAC method. The results revealed that soya bean meal (35.32%) had the most protein content followed by calf milk replacer (19.69%), lucerne hay (18.59%) and complete calf grower (18.1%). Salt licks (99.29%) had the highest ash content. Calf milk replacer had the highest fat content (15.81%). Complete calf grower had the highest moisture (9.2%) content followed by cattle feed pellets (7.43%). The highest NDF value obtained in maize stover (56.31%), cattle feed pellets (42.52%) and lucerne hay (32.12%). ADF was more in maize stover (33.58%) and cattle feed pellets (30.65%). The obtained nutrients contents were compared to the nutritional requirements of beef cattle. Results also revealed that calf milk replacer (1.31%), maize stover (1.13%) and lucerne hay (1.08%) had more adequate calcium content. Lucerne hay (1.85%) had the more adequate potassium level followed by cattle feed pellets (1.67%), calf milk replacer (1.60%) and complete calf grower (1.01%). The highest level of magnesium was obtained in maize stover (0.54%). The highest Na level of 51.56% was obtained in salt licks. Calf milk replacer (0.56%) had more adequate level of phosphorus followed by complete calf grower (0.49%). Complete calf grower had more level of Cu (19 ppm). Maize stover (565 ppm), cattle feed pellets (504 ppm) and complete calf grower (469 ppm) had high level of Fe. Complete calf grower had more level of Mn (101 ppm). Complete calf grower had more level of Zn (142 ppm). The levels of minerals obtained were compared to the nutrient requirements of beef cattle. In conclusion the study revealed that communal beef farmers depended on feed supplements that are adequate in main nutrients such as protein, fat, ash, moisture and NDF; and adequate minerals such as Calcium (Ca) and phosphorus which are recommended nutrient requirements for beef cattle. Magnesium (Mg) and fat contents were found excessive; and ADF, potassium (K), sodium (Na), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) were deficient in some of the feedstuffs. However, feeding cattle with the sampled feed supplements do not entirely put cattle production in danger, therefore, recommended to use.

Keywords: Farmers, Cattle, Dry season, Feed supplements

5.1 Introduction

Feed supplements are used to improve the balance of specific nutrient deficiencies, growth rates, fertility, productivity, and death rates (Gilbreath, 2018). Supplemental nourishment can help an animal survive the winter and reproduce successfully (Robb *et al*., 2008). Cattle can make efficient use of feed resources that have little alternative value, such as agricultural wastes, marginal farmland, and land that is not suited for tillage or cannot grow crops other than grass (Campbell *et al*., 2009). Preserving bulk feed, which is available during the rainy season, or residue from agricultural crops (Unger *et al*., 1991), in the form of hay or silage, can be used to replenish herds at times when forage is sparse, with the goal of achieving sustainable animal production (Moreira Filho *et al*., 2013).

During the dry season, accessible pastures and crop leftovers are typically few and often inadequate, with low concentrations of energy, protein, and other nutrients (minerals and vitamins) essential to maximize rumen microbial activity (Simbaya, 2002). Feeds available during the dry season also have a high dietary fibre content ranging from 35 to 48 percent, which limits feed intake and digestion (Joint, 2002). Inadequate nutrition during the dry season frequently leads in lower body weight and condition scores in adults, low milk outputs and long calving intervals in nursing cows, retarded growth, and increased mortality rates in calves. Poor nutrition is also connected with higher susceptibility of cattle to stress and disease problems, resulting in these cattle functioning below their projected genetic potential (Simbaya, 2002).

Because the nutrient content of many alternative feeds varies greatly, an analysis or some assessment of the feed resources utilized as dry season supplements value is required. Whatever feed products are utilized, the ration must be adjusted in order to meet cattle needs and farmers' goals at the lowest possible cost (Bheekhee *et al*., 2002). To produce balanced, low-cost diets for cattle, communal farmers must understand the primary nutritional levels of the feed supplements they use. This is because many feeds are of poor quality, requiring farmers to choose and use only the best feeds. As a result, the study's goal was to examine the nutrient content of feed supplements used by communal beef farmers in Ga- Matlala, Limpopo Province, during the dry season.

5.2 Material and Methods

5.2.1 Study site

The research was conducted in three communal areas in South Africa's Limpopo province's Capricorn District Municipality. The three community regions were Phofu, Phetole, and Madietane. Chemical analysis was performed on feed samples gathered from communal cattle farmers. Chemical analysis of feed supplements was performed at the Department of Agriculture and Rural Development Kwa-Zulu Natal (KZN) laboratory in Cedera, Pietermaritzburg, Kwa Zulu Natal Province, South Africa.

5.2.2 Preparation of feed supplements

Feed supplements were obtained from communal cattle ranchers and distributed to livestock during the dry season. Feed supplements were dried in a dry dish with a lid in a standard laboratory oven (Henaeus, Model no. T5050). After drying, the dish was placed in the desiccator with a slightly covered lid to chill. Dried samples were stored in sealed containers until they could be analyzed.

5.2.3 Proximate analysis

The methods of the Association of Official Analytical Chemists (AOAC, 1995) were used for determination of moisture, protein, fat, ash, ADF and NDF of the samples. All determinations were done in duplicates. The proximate values were reported in percentage. The samples (5 grams, each) in duplicate were used for determination of moisture content by weighing in crucible and drying in oven at 105 ^{o}C, until a constant weight was obtained. Determination of ash content was done by ashing at 550 ^{o}C for about 3h. The Kjeldah method (AOAC, 1995) was used to determine the protein content by multiplication of the nitrogen value with a conversion factor (6.25). Crude fat was converted into fatty acid by multiplying with conversion factor of 0.80 as described by Akinyeye *et al*. (2010, 2011) and Greenfield and Southgate (2003). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) contents were analyzed using sodium sulfite as described by Van Soest *et al*. (1991).

5.2.4 Mineral analysis

The mineral contents (elements) of the following samples were determined using an atomic absorption spectrophotometer (AAS-Buck 205), as described in the methods of the Association of Official Analytical Chemists: calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), iron (Fe), zinc (Zn), manganese (Mn), and copper (Cu) (AOAC, 1995). Phosphorus was measured using a calorimeter (AOAC, 1990). All of the determinations were carried out in duplicate. Calcium, phosphorous, magnesium, potassium, and sodium values were stated as percentages, whereas iron, zinc, manganese, and copper values were reported as parts per million (ppm).

5.2.5 Statistical analysis

Each nutrient analysis was done in duplicate. Results were presented in percentage (%) and parts per million (ppm).

5.3. Results

5.3.1 Proximate analysis of the main nutrients

The chemical composition of protein, ash, fat, moisture, NDF and ADF are shown in Table 5.3.1. The protein values of feed samples range from 3.98 to 35.32%. Soya bean meal (35.32%) had the highest protein content followed by calf milk replacer (19.69%), lucerne hay (18.59%) and complete calf grower (18.1%) compared to the required protein amount (≥10 to 15%) of beef cattle. Salt licks (3.98%) had the lowest protein content.

The Ash content values in feed samples range from 6.78 to 99.29%. The highest ash 99.29% obtained in salt licks followed by maize stover (13.75%) and calf milk replacer (10.53%). Complete calf grower (6.51%) had the least ash content as compared to the required ash content (10 to 15%) of beef cattle.

The fat content values of feed samples range from 0.45 to 15.81%. Calf milk replacer had highest fat content (15.81%) of beef cattle. It was followed by lucerne hay (3.75%). Salt licks (0.45%) had the least fat content as compared to the required fat content (4.00 to 37.59%).

Results revealed that the moisture content of feed samples ranges from 0 to 10% as compared to the required amount of moisture for beef cattle (10 to 15%). Complete calf grower (9.2%) had more moisture content followed by cattle feed pellets (7.43%). The least moisture content was found in salt licks (0%). Moisture content of feed samples were less than the required amount of moisture for beef cattle.

The NDF content values of feed samples range from 0.02 to 56.31%. The highest NDF value obtained in maize stover (56.31%) followed by cattle feed pellets (42.52%) and lucerne hay (32.12%) as compared to the required NDF content (30%) of beef cattle. The least NDF was found in salt licks (0.02%). ADF was more in maize stover (33.58%) followed by cattle feed pellets (30.65%) as compared to the required NDF content (18 to 25.5%) and was found less in salt licks (0%).

Table 5.3.1. Proximate analysis of the main nutrients for supplementary feeds utilized during the dry season in the study area

Chemical composition						
Sample ID	**Protein (%)**	**Ash (%)**	**Fat (%)**	**Moisture (%)**	**NDF (%)**	**ADF (%)**
Cattle feed pellets	13.65	8.02	2.4	7.43	42.52	30.65
Complete calf grower	18.1	6.51	1.89	9.2	22.86	9.29
Lucerne hay	18.59	8.48	3.75	2.63	32.12	23
Maize stover	9.57	13.75	3.32	10	56.31	33.58
Calf milk replacer	19.69	10.53	15.81	5.88	11.07	1.69
Salt licks	3.98	99.29	0.45	0	0.02	0
Soya bean meal	35.32	6.78	2.58	8.7	27.38	12.45

5.3.2 Chemical composition of the minerals: (calcium (Ca), potassium (K), sodium (Na), phosphorus (P), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn))

The chemical composition of the minerals. The level of Ca in feed samples was ranging from 0.25 to 1.31% which is compared to the required range value of Ca (0.18 to 0.53%) and the maximum tolerable calcium level (2%). Calf milk replacer (1.31%), maize stover (1.13%) and lucerne hay (1.08%) had more Ca content. Soya bean meal (0.25%) had the least calcium content but not less than the required level of Ca.

The level of K in feed samples was ranging from 0.03 to 2.13% and were not more than the maximum tolerable K level (3%). Lucerne hay (1.85%) had highest K level followed by cattle feed pellets (1.67%), calf milk replacer (1.60%) and complete calf grower (1.01%). The least K level was found in maize stover (0.73%) and salt licks (0.03%).

The level of Mg in feed samples was ranging from 0.03 to 0.54%. The highest level of Mg was obtained in maize stover (0.54%) followed by lucerne hay (0.36%) as compared to the required Mg level (0.05- 0.25%) and the maximum tolerable Mg level (0.40%). Salt licks (0.03%) had the lowest Mg level.

The level of Na in feed samples was ranging from 0.14 to 51.56%. The highest Na level of 51.56% obtained in salt licks is more than the required range level of Na (0.06-0.10%) and maximum tolerable Na level (10%). This was followed by adequate level of Na in calf milk replacer (1.06%). The least Na content was found in maize stover (0.14%).

The level of P in feed samples was ranging from 0.18 to 0.56% which is either not lower than the required range level of P (0.18 to 0.37%) or more than the maximum tolerable P level (1%). Calf milk replacer (0.56%) had more adequate level of P followed by complete calf grower (0.49%). Maize stover (0.18%) had the least P content.

The level of Cu in feed samples was ranging from 1 to 19 ppm. Complete calf grower had more level of Cu (19 ppm) followed by soya bean meal (12 ppm), lucerne hay (8 ppm) and maize stover (7 ppm) as compared to the required Cu level (4 to 10 ppm) and the maximum tolerable Cu level (115 ppm). Salt licks (1 ppm) had the least level of Cu.

The level of Fe in feed samples was ranging from 138 to 565 ppm which is more than the required range level of Fe (50- 100 ppm) and less than the maximum tolerable Fe level (1000 ppm). Maize stover (565 ppm), cattle feed pellets (504 ppm) and complete calf grower (469 ppm) had high level of Fe and lucerne hay (138 ppm) had the lowest level of Fe.

The level of Mn in feed samples was ranging from 6 to 101 ppm. Complete calf grower (101 ppm) had more level of Mn followed by maize stover (75 ppm) as compared to the required Mn level (20- 40 ppm), however not more than the maximum tolerable Mn level (1000 ppm). The least level of Mn was found in salt licks (6 ppm).

The level of Zn in feed samples was ranging from (34 to 142 ppm). Complete calf grower (142 ppm) had more level of Zn followed by maize stover (69 ppm) and calf milk replacer (57 ppm) compared to the required range level of Zn (20- 40 ppm), however not more than the maximum tolerable Zn level (500 ppm). Lucerne hay (34 ppm) had the least level of Zn.

Table 5.3.2. Chemical composition of the minerals for supplementary feeds utilized during the dry season in the study area

Chemical composition									
Sample ID	**Ca (%)**	**Cu (ppm)**	**Fe (ppm)**	**K (%)**	**Mg (%)**	**Mn (ppm)**	**Na (%)**	**P (%)**	**Zn (ppm)**
Cattle feed pellets	0.66	3	504	1.67	0.24	48	0.35	0.29	41
Complete calf grower	0.7	19	469	1.01	0.25	101	0.37	0.49	142
Lucerne hay	1.08	8	138	1.85	0.36	36	0.31	0.27	34
Maize stover	1.13	7	565	0.73	0.54	75	0.14	0.18	69
Calf milk replacer	1.31	4	242	1.6	0.14	26	1.06	0.56	57
Salt licks	0.57	1	171	0.03	0.03	6	51.56		
Soya bean meal	0.25	12	247	2.13	0.25	35			

5.4 Discussion

5.4.1 Proximate analysis of the main nutrients

The study found that soya bean meal had the highest protein level, followed by calf milk replacer, lucerne hay, and complete calf grower. Erickson (2015) found that soybean bean meal has a high protein content since it was appropriately processed. However, extra protein beyond the animal's requirements may result in resource loss and may have negative environmental consequences, because most excess protein is expelled as NH3 in urine and faeces (Cortese *et al*., 2019). The research also found that salt licks had the lowest protein content. This is due to the fact that salt licks are not utilized in animal feed to provide protein, but rather as mineral supplements in addition to what is gained through forages. As a result, it is too low to support rumen microbial activities and energy supply, and hence too weak to be employed alone as a protein source in animal feed. Similar findings were published by Chase *et al*. (2009), who discovered that the lowest protein reduction in diets increased the likelihood of decreased milk output. These findings contradicted those of Geleta *et al*. (2013), who found urea mineral block to be a great supplementary feed that could be prepared and used to promote roughage digestion, give protein, and energy to ruminant animals. Similarly, Brar and Nanda (2007) found that urea mineral block delivers crude protein, which is typically lacking in dry feed.

In the current investigation, salt licks had a high ash content value. This is because salt licks are becoming increasingly polluted with soil. This is congruent with the findings of DuPonte (1998), who discovered that meals with a high ash content dilute the amount of nutrients available to the animal. However, because minerals are vital components of an animal's diet, some ash is good (Iqbal *et al*., 2006). Excess minerals, according to Ferket *et al*. (2002), can also cause bone and joint problems in cattle, hence feeds with a high ash content should be avoided. Complete calf grower also had the lowest ash content. This is congruent with the findings of Olijhoek *et al*. (2006), who discovered that feeds with reduced ash content help minimize urinary tract issues in livestock.

According to the study's findings, calf milk replacer had the highest fat content. This finding contrasts with the findings of Gautam *et al*. (2016), who discovered fat levels ranging from 3 to 5.5 percent and concluded that if the fat content in feed exceeds 6 percent, it can cause digestive disturbance, diarrhoea, and reduce feed intake; thus, the findings of the current study revealed a fat level of 15.81 percent in calf milk replacer. Salt licks were discovered to have the lowest fat content. This is due to the fact that the salt licks were completely solid-dry.

The results showed that the complete calf grower had an appropriate moisture content, followed by cow feed pellets. This is due to the fact that the feed samples were not totally solid feeds. The findings also demonstrated that there was no moisture content in salt licks. Rasby and Walz (2011) discovered that beef cattle that consume feeds high in water content have lower water intake, whereas diets low in water content have higher water intake. The water content of feeds varies from up to 85 percent in some pastures to 10 to 15 percent in stored, dry feeds, according to Govender *et al*. (2017).

NDF values were highest in maize stover, cattle feed pellets, and lucerne hay, but lowest in salt licks. Gandhi (2009) observed that forages with higher levels of NDF produced significantly more milk or gain than forages with lower levels of NDF. When the NDF is low, one option is to replace the forage with another forage that has a higher NDF digestibility or to add highly digestible fibre commodities.

ADF levels were higher in maize stover and cattle feed pellets, but lower in salt licks. According to DuPonte (1998), ADF content must be lower than NDF content, with the difference reflecting the amount of hemicellulose present. However, according to the study's findings, the ADF of maize stover and cattle feed pellets is more than the NDF. As a result, because ADF influences feed digestibility, the higher the ADF level, the lower the cattle digestibility (Andrae *et al*., 2001).

5.4.2 Chemical composition of the minerals

Mineral elements are essential in the nutrition of beef cattle. According to KO *et al*. (2010), an important mineral element is required to demonstrate that a diet lacking in any beef cattle might cause deficiency symptoms in cattle. This study collected feed samples and analyzed the mineral element composition of important elements such as Ca, K, Na, and P, Cu, Fe, Mn, and Zn in the feeds.

levels in the meal samples tested. This implies that the Ca and P levels in the feed samples are appropriate. Cattle fed with Ca and P requirement recommendations of beef cattle showed enhanced milk yields, feed intakes, efficiency of milk production, bone formation, and excellent growth performance, according to Kincaid *et al*. (2000).

According to the results of the present study, Mg was found excess in maize stover, more than the nutrient requirement recommended for beef cattle. Similar results were reported by Gentry *et al*. (2000), who stated that the extent and intensity of the diarrhoea was related closely to the high Mg content.

The lowest levels of K, Mg, Cu and Mn, obtained in salt licks indicate a deficiency. This is similar to the results of Miller (2017) who reported that salt licks lack some of the minerals because they contain essential mineral nutrients of salt deposits and trace minerals such as P, Fe, Zn, and Ca. Moreover, the highest level of Na obtained in salt licks is because of Na contains more salt than any other mineral.

The present study also discovered a low level of Cu in cattle feed pellets. Similar results were observed by Kumar *et al*. (2011), who stated that deficiencies of the Cu in cattle feeds result in decreased intake and gain, reduced fertility, and libido, retained placentas, abortions and stillbirths, low birth weights and poor calf performance. Thus, supplementation of feeds deficient in this mineral cannot be used alone in animal feeding.

5.5 Conclusions and recommendations

In conclusion, the study revealed that, feed supplements quality on studied communal area vary in nutrients. However, from the results obtained, it is evident that there are different feed supplement types used during the dry season and if used carefully, it could combine to improve the quality of the beef cattle' daily diet. Most of the feed supplements in the study areas were adequate in main nutrient and mineral contents and are able to meet the animal requirement. Some feed supplements such as maize stover, cattle feed pellets, lucerne hay and salt licks have been found to lack some of the nutrients. Therefore, to improve beef cattle production in the study area there is a need to supplement cattle with minerals and these feed resources should not be used alone more especially maize stover and lucerne hay to be treated with urea/alkali to enhance digestibility. However, feeding cattle with the sampled feed supplements do not entirely put cattle production in danger, therefore, recommended to use.

1. The National Department of Agriculture or agricultural extension agents implement a skills development and training programme among communal beef cattle farmers in the communal areas to improve practices that promote good feed management and the maintenance of healthy cattle. This will improve these farmers' productivity. In the

long term, it could result in better production efficiency and income, better standards of living, and lifting the social and educational standards of rural life.

2. Farmers are also recommended to buy feeds or supplementary feeds from formal markets to ensure good quality.

CHAPTER SIX

GENERAL DISCUSSION

6.1 General discussion

South African economy and food security of many communal farmers, particularly in rural areas depend on beef production. Communal farmers keep beef cattle for multiple purposes. Rural households depend on cattle for milk, meat, hides, horns, bride price, draught power for the cultivation of crops and income in communal areas. However, the dry winter season could become a major threat to cattle production, as the quality and quantity of available forage often decline during this season and communal farmers are known to be affected the most. Although livestock can utilize low-quality pastures to some degree, good quality feed supplementation will be necessary to meet nutrient requirements during the dry seasons to improve the diet balance so optimum productivity of the livestock herd is maintained. Therefore, the aim of this study was to investigate the cattle' farmer's knowledge on feed supplements and evaluate the nutritional quality of feed supplements utilised by communal beef farmers during the dry season at Ga- Matlala, Limpopo Province, South Africa.

In chapter 3 of this study, the findings revealed farmer's knowledge on issues such as herd size, cattle breeds in the herds, cattle management, reasons for keeping beef cattle and reasons for loss of cattle, challenges faced by the farmers, causes of challenges, perceived solutions, medication and assistance from the government have been successfully evaluated in Ga-Matlala area, Limpopo South Africa. Highest number of male respondents was expected due to men's role in cattle management daily activities, similar findings were reported by Oladele *et al*. (2013). This study showed that elders have more time to care for cattle in rural areas than young people who reside in cities due to employment and school and have more of experience farming with cattle. Similar results were reported by Mthi *et al*. (2020). Most of the respondents 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). The highest educational level of high school was 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, similar with the reports of Ndhlovu and Masika (2013).

Large herd size in Madietane and Phetole was reported. This is comparable with studies that reported large herd size (Mapiye *et al*. 2018; Santos *et al*. 2019; Smith *et* *al*. 2000). Most farmers in Phofu and Phetole indicated that they preferred to keep Nguni breeds, whereas in Madietane, the most popular breeds were Afrikaner, 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.

Cattle are normally freed in the morning and herded to the grazing areas, returned home later, and kraaled at night in the three villages. Nthakheni (2006) observed similar findings. In Phetole and Madietane, income was the most important reason for having cattle, while in Phofu, income and inheritance were the most important reasons. This is expected because cattle farming is considered by communal farmers to be the most lucrative business. Molefi (2015) reported similar findings. Madietane was the area where the majority of cattle died, followed by Phetole and Phofu. These findings are consistent with those of Nowers *et al*. (2013), who found a 30 % death rate in communal cattle farming.

Stock theft was the most significant challenge in the three villages studied. Cattle are regularly stolen in these villages in the grazing areas because famers leave the cattle with no herders on the grazing fields. These findings are consistent with those of Mngomezulu-Dube *et al*. (2018). High unemployment leads the young people to steal cattle and selling them in order to make money since no herders on the fields. These findings are consistent with research that have linked high unemployment rates to cattle stealing (white, 2011; White, 2012)**.** Farmers proposed government action in the form of job development, vaccinations, veterinarians, dumping sites, water machine repair, dam construction, feed, and full-time range patrollers to address the above-mentioned challenges.

Majority of the farmers in these areas buy medicines for their cattle. Factors such as education level and number of cattle owned significantly influenced farmers’ spending on animal healthcare in South Africa, KwaZulu-Natal, Eastern Cape, Mpumalanga, North-West and Free State provinces (Habiyaremye *et al*., 2017)**.** Those who cannot buy reported that is because medicines are expensive, and they cannot afford to buy. The most important medicined mentioned were Taktic, Terramycin LA and dipping medicine. The results show that, farmers are very aware of the common diseases that attack their cattle, and they are trying by all means to control and treat diseases. Majority of farmers in Phetole and Phofu reported receiving government vaccination assistance. This indicates that the majority of farmers rely on government help to keep their cattle healthy. This is consistent with the findings of Habiyaremye *et al*. (2017).

The objective of chapter 4 was to identify the feed supplements commonly utilised by communal beef farmers during the dry season at Ga- Matlala, Limpopo Province. Majority of the farmers were using feed resources as dry season supplementation for their cattle, similar results were reported by Katikati and Fourie (2019). Lucerne hay was found to be the most common used feed supplement in all three selected communal areas, while maize stover was the second used. Farmers commonly use these feed supplements in the study area because they are cheaper and often available throughout the dry season. Comparable results were reported by Beyene *et al*. (2014); Gwelo (2012); and Gxasheka *et al.* (2017).

The majority of the farmers reported that lucerne hay is acceptable feed supplement for cattle followed by maize stover. This is consistent with the findings of Suttie (2000), who reported that lucerne is an excellent fodder supplement to hay from various grasses because of its high quality, high digestibility and roughage value; and maize is very good for digestion in cattle and can be used as fodder (Erenstein *et al*., 2011). The majority of the farmers reported weight gain of cattle as a major reason of feeding Lucerne hay to cattle, followed by average weight gain as a result of feeding maize stover. This is consistent with the findings of DelCurto *et al*. (2000); and Lattimore (2008). The majority of the farmers reported that they do not assess quality of dry season supplementary feeds utilised. However, other farmers reported that they assess the quality of dry season supplementary feeds by checking the dryness, freshness, and absence of moulds in the feed.

In chapter 5 of this study, the chemical composition of protein, ash, fat, moisture, NDF and ADF and minerals such as calcium, potassium, sodium, phosphorus, copper, iron, manganese and zinc were determined. The highest protein content was obtained in soya bean meal, soya bean meal followed by calf milk replacer, lucerne hay and complete calf grower. Erickson (2015) reported similar results stating that soybean bean meal had high protein content because it was properly processed. The lowest protein was also obtained in salt licks. This is because salt licks are not used in animal feeding to supply protein but as mineral supplements. This is in contrast with the findings of Brar and Nanda (2007) who reported that, urea mineral block provides crude protein that is usually deficient in dry feed. The high ash content value was found in salt licks. This is because salt licks are likely contaminated with increasing amounts of soil. This is consistent with the findings of DuPonte (1998). Salt licks was found to have lowest fat content. This is because the salt licks were entirely solid-dry.

The highest NDF value obtained in maize stover, cattle feed pellets and lucerne hay, however, low in salt licks. Similar results were reported by Gandhi (2009). ADF was more in maize stover and cattle feed pellets, however, less in salt licks. According to DuPonte (1998), ADF must be lower than NDF content and the difference between the two reflects the amount of hemicellulose present.

Mineral elements play an important role in the nutrition of beef cattle. The results revealed that there was no deficiency or excess of Ca and P levels in the analysed feed samples. This indicates that the feed samples containing adequate levels of Ca and P. Mg was found in excess in maize stover, more than the nutrient requirement recommended for beef cattle. Similar results were reported by Gentry *et al*. (2000). The lowest levels of K, Mg, Cu and Mn, obtained in salt licks indicate a deficiency. This is similar to the results of Miller (2017) who reported that salt licks lack some of the minerals because they contain essential mineral nutrients of salt deposits and trace minerals such as P, Fe, Zn, and Ca. Low level of Cu was discovered in cattle feed pellets. Similar results were observed by Kumar *et al*. (2011), who stated that deficiencies of the Cu in cattle feeds result in decreased intake and gain, reduced fertility, and libido, retained placentas, abortions and stillbirths, low birth weights and poor calf performance.

CHAPTER SEVEN

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Appendix A: Questionnaire

QUESTIONNAIRE FOR COMMUNAL BEEF CATTLE FARMERS

All the information provided here will be treated as strictly exclusive. Data gathered by this questionnaire will be used only for the purpose of this intended evaluation and nothing else. Personal and socio-economic information of respondents will be kept confidential and no mention of names shall be made in the final report that shall be compiled. For purposes of report, it is hereby required that consent is given through signing the declaration below by the respondent before the beginning of the application.

1. SECTION A: ***Demographic Information***

Names:						
Contact Number:						
Village name:						
Please mark the appropriate answer with an X in the box of the table provided						
What is your gender	*Male:*		*Female:*			
Indicate your age group	*24 years and younger*	*25 to 34 years*	*35 to 44 years*	*45 to 54 years*	*55 years and over*	
Indicate your Position	*Cattle farmer (Owner):*	*Cattle herder*	*Other (Specify):*			
Indicate your farming experience	*Less than 2 years*	*3 to 5 years*	*6 to 10 years*	*11 to 15 years*	*16 years and over*	
Indicate your educational background	*Never attended*	*Primary school*	*High School*	*College Diploma*	*University Degree*	*Post-Graduate qualification*

2. SECTION B: ***Herd size and management***

2.1 How many cattle are under your care (including calves)?

2.2 Which beef cattle breeds are you farming with?

2.3 How many cattle die over a period of 12 months (Mortality rate)?

2.4 What are the causes of mortalities mentioned in 2.3?

2.5 How do you manage your cattle daily? Please explain.

3. SECTION C: ***Farmers' opinions on the challenges of cattle farming in the area*****.**

3.1 Why did you decide to farm with cattle?

3.2 What are the challenges faced by beef cattle farmers that reduces the efficiency of production your area?

3.3 What are the reasons/causes of the problems listed in number 3.2?

3.4 What are perceived solutions to the challenges listed in number 3.3?

3.5 Do you buy medicine/drugs for your animals? If yes, list them, if no provide a reason.

3.6 Do you get assistance from the government? Please explain.

4. SECTION D: ***Knowledge of farmers on the nutritional quality of feed supplements utilised during the dry season.***

4.1. Feed supplement sample collection: Each supplement material they feed during the dry season will be sampled for chemical analysis. Communal beef cattle farmers will be requested to rank and indicate whether the feed supplement is good/bad and reason for their judgment.

Feed supplement	*Ranking*	*Indicate good/bad*	*Support your judgment*

4.2 How do you assess the quality of feed supplement materials?

**************************** End of Survey **************************

Appendix B: Translated Sepedi questionnaire

Sehlomathiso B: Lenanego La Dipotsiso

LENANEGO LA DIPOTSISO TSA BALIMI BA DIKGOMO

Dinhla kamoka tseo di filwego mo di tla swarwa bjalo ka sephiri. Dinhla tse kgobokantshitswego ke lenaneo le la dipotsiso di tla somiswa fela go hlahlobo yona ye eseng go gongwe gape. Hlagisoleseding ya barui goba badishi bao ba arabileng dipotsiso e tla bolokwa bjalo ka sephiri gomme a gona maina a batho ao atla bolelwago mafelelong a lenaneo. Goya ka morero wa repotho/tlalego, go hlokagala gore tumelelo e fanwe ka go saena phatlalatso e ka fase ke moarabi pele kgopelo e thoma.

1. Karolo ya A: ***Tsebiso ya batho***

Maina:					
Nomoro ya mogala:					
Ka kgopelo, swaya karabo ya maleba ka X ka gare ga lepokisana leo le filwego					
Bong bag ago ke bofeng	*Monna*		*Mosadi*		
Bontsha sehlopha sa mengwaga:	*Mengwaga ye 24 go ya fase.*	*Mengwaga ye 25 go ya go ye 34.*	*Mengwaga ye 35 go ya go ye 44.*	*Mengwaga ye 45 go ya go ye 54.*	*Menwaga ye 55 le go feta.*
Bontsha boemo bja gago	*Molemi wa dikgomo. (Mong)*	*Modisa wa dikgomo.*	*Tse dingwe. (hlakisa):*		
Bontsha boitemogelo bja gago bja temo	*Ka fase ga mengwaga ye 2.*	*Mengwaga ye 3 go ya go ye 5.*	*Mengwaga ye o ya go ye 10.*	*Mengwaga ye 11 go ya go ye 15.*	*Mengwaga ye 16 le go feta.*
Bontsha semelo sa dithuto tsa gago	*Ka fase ga sekolo se se phagameng.*	*Sekolo se se phahameng.*	*Diploma ya kholetshe.*	*Dikiri ya Unibesithi.*	*Mangwalo a bao ba apereng phurabura*

2. Karolo ya B: ***Bogolo bja mohlape le tsamaiso.***

2.1 Ke dikgomo tse kae tseo di lego ka fase ga hlokomelong ya gago (tsentsha le dinamane)?

2.2 Ke mehuta efe ya dikgomo yeo o lemago ka yona?

2.3 Ke dikgomo tse kae tseo di hwang nakong ya dikgwedi tse 12?

2.4 Mahu ao a hlola ke eng?

2.5 O kgona bjang go laola dikgomo tsa gago ka mehla? Ke kgopela o hlalose.

3. Karolo ya C: ***Maikutlo a balemi mabapi le mathata a temo ya dikgomo nageng yeo.***

3.1 Ke ka lebaka la eng o tseri sephetho sago lema ka dikgomo?

3.2 Ke mathata afe ao dikgomo di balemi ba dikgomo ba lebanego le ona ao a fokotsago go shoma gabotse gwa dikgomo nageng ya geno?

3.3 Ke mabaka afe ao a hlolang mathata go nomoro ya ka godimo 3.2?

3.4 Ditharollo tsa mathata ao a tsweleleditsego go nomoro 3.3 ke afe?

3.5 Naa o rekela diphoofolo tsa gago dihlare? Ge gole bjalo, di tsweletse, gee le Aowa efa lebaka.

3.6 Naa o humana thuso go mmuso? Ke kgopela o hlalose.

4. Karolo ya D: ***Tsebo ya balemi ka ditlaleletso tsa dijo tseo di somiswago nakong ya komelelo.***

4.1 Kgobokanyo ya disampole tsa tlaleletso ya dijo: ditlaleletso tsa dijo tseo ba fepago ka tsona nakong ya komelelo di tla tla sampulwa sebakeng sa hlahlobo ya dikhemikhale ka laboratoring ya hlagiso ya diphoofolo. Balemi ba dikgomo batla kgopelwa go hlaola lego bontsha gee le gore ditlaleletso tsa dijo ke tse botse goba ke tse dimpe ebe bafa le mabaka go thekga seo ba se bolelago.

Ditlaleletso tsa dijo	Hlaola	Bontša bo botse / bobe	Thekga kahlolo ya gago

4.2 O hlahloba bjang khwalithi ya ditlaleletso tsa dijo?

***********************Mafelelong a lenanego la dipotsiso ***********************

Appendix C: Consent form

CONSENT FORM

I……………………………………………hereby voluntarily consent to participate in the following project titled, "Evaluation of the nutritional quality of feed supplements utilised by communal beef farmers during the dry season at Ga- Matlala, Limpopo Province, South Africa." I realise that:

1. The aim of the study is to evaluate the nutritional quality of feed supplements utilised by communal beef farmers during the dry season at Ga- Matlala, Limpopo Province, South Africa.
2. The researcher is a master's student in the Department of Agricultural Economics and Animal Production at the University of Limpopo.
3. The researcher will make efforts to safeguard and adhere to the confidentiality of the information provided by the respondents and anonymity is guaranteed. **The information within the questionnaire will only be used for this research purpose and It is ensured the privacy and confidentiality of each participant participated that none of the information will be shared with any other source besides this study.**
4. I may withdraw from the study at any time I feel like.
5. I am aware that it is anticipated that my participation in this study will enhance my understanding of the nutritional qualities of Beef supplementary feeds utilised by Communal farmers in my area.
6. I have every right to ask questions at the end of the interview.
7. I have every right to be interviewed in a private space if I want to.
8. If I have any question or problems regarding the study, I will contact the University Research Office (the University of Limpopo, Private Bag X1106, Sovenga, 0727, Tel: 015 268 2401)
9. My signature below indicates that I have given my informed consent to participate in the abovementioned study.

Signature of respondent: ………… Date: ……………………

Signature of the researcher: Date: …………………

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email:anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: **17 August 2021**

PROJECT NUMBER: **TREC/125/2021: PG**

PROJECT:

Title:	Evaluation of the Nutritional Quality of Feed Supplements Utilised By Communal Beef Farmers during the Dry Season at Ga - Matlala, Limpopo Province, South Africa
Researcher:	TR Monkwe
Supervisor:	Dr B Gunya
Co-Supervisor/s:	Mr M Gxasheka
School:	Agricultural and Environmental Sciences
Degree:	Master of Science in Agriculture (Animal Production)

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE
The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**