APPRAISAL OF PRODUCTION PRACTICES OF GOAT FARMERS IN SELECTED DISTRICT OF THE KWAZULU-NATAL PROVINCE

By

NTULI LONDEKA

A dissertation submitted in fulfilment of the requirements for the degree

MASTER OF AGRICULTURE: AGRICULTURAL MANAGEMENT

DEPARTMENT OF AGRICULTURE

FACULTY OF HEALTH AND ENVIRONMENTAL SCIENCES

CENTRAL UNIVERSITY OF TECHNOLOGY

Bloemfontein, South Africa

Supervisor: PROF PJ FOURIE

2021 JANUARY

DECLARATION

I, Londeka Ntuli declare that this dissertation contains my own original wok and has not been submitted before to any institution for assessment purposes.

Furthermore:

1. I know what plagiarism is and that it is not acceptable.
2. I have not copied from others, nor have I made my work available to others.
3. I have acknowledged all authors whose intellectual property was used.

Student number:	**Supervisor**
LONDEKA NTULI (*Cand.Sci.Nat*)	**Prof PJ FOURIE (*Pr.Sci.Nat*)**
.....	.....

Date: 21 January 2021

LIST OF ABBREVIATIONS

ANA	African News Agency
EB	Encyclopaedia Britannica
DAFF	Department of Agriculture, Forestry and Fisheries
DARD	Department of Agriculture and Rural Development
IVG	Indigenous Veld Goats
KZN	KwaZulu-Natal
MGA	Manitoba Goat Association
NAFIS	National Farmers Information Service
SAP	South Africa's Provinces
STATSA	Statistics South Africa
TIKZN	Trade and Investment KwaZulu-Natal

ABSTRACT

The study was conducted to assess management practices by goat farmers in uMgungundlovu of the KwaZulu-Natal province. A total of 70 farmers were interviewed by means of structured questionnaires. The average farm size in the uMgungundlovu district is 108.3 hectares. Most farmers farm with indigenous veld goats (78.6%). A considerable number of respondents have a low level of education n= 28 (40%). Management activities performed by respondents included control of internal and external parasites which was done by 94% and 96% respectively. The diseases most vaccinated for were Pulpy kidney (61.5%) and Pasteurella (51.9%). n = 58 respondents (78.6%) grazed their animals on natural veld. An insubstantial percentage of respondents had cultivated pastures (15.7%) n=11. Respondents provided winter and summer supplementary feed (46%) and supplementary lick (83%). A total of 17 farmers (24.3%) had a specific breeding season. Breeding management activities were done by farmers, and 5.7% of respondents were testing bucks for fertility, while 18.6% were provided flush feeding and 11.4% performed pregnancy diagnoses.

Farmers culled animals that did not measure up to standard (39%), while 61% did not have a culling programme. A number of 57 farmers (81.4%) farmers had made an average amount of R33 614.29 from selling goats in the uMgungundlovu district, but 12.9% respondents were not willing to share their sales records. A small percentage of farmers (5.7%) did not keep financial records at all. The majority of the farmers (60%) sold their goats to private buyers (individuals). The majority of the farmers (36.2%) obtained their information from farmers' days.

To discover what influence various management practices had on the production of goats, the following four production variables were investigated: conception rate, kidding percentage, mortality rate and weaning percentage. Management practices investigated were: internal parasite control, external parasite control, provision of supplementary feed during winter and summer, provision of supplementary lick, fertility testing of bucks before mating; provision of flush feed before breeding season starts; the presence of specific breeding seasons and pregnancy diagnosis. There was a statistical significance ($P<0.05$) in the conception rate where flush feeding was provided and a specific breeding season existed. A statistically significant higher kidding percentage with the control of internal parasites, provision of supplementary

feed, flush feeding and the existence of a specific breeding season was obtained. There was a statistically higher weaning percentage with the provision of supplementary feed ($P<0.05$), flush feeding, the existence of a specific breeding season and pregnancy diagnosis.

ACKNOWLEDGEMENTS

My sincere gratitude goes to the Lord Almighty for granting me strength to complete my work. I would like to thank my supervisor, Professor P.J. Fourie for his patience, constructive criticism and guidance throughout. I am forever grateful to the Central University of Technology for granting me the opportunity to further my studies and for the financial assistance which helped carry out my research.

I would like to thank Mr P. Du Plessis for helping me meet with farmers and welcoming me into the KwaZulu-Natal Veld Indigenous Goat Club. I sincerely thank all the farmers who put aside time to participate. Special thanks to Ms Venter for her patience and great assistance in carrying out the statistical analysis of this study. I thank all who have taken trouble to help me where assistance and guidance was needed.

I would like to express my heartfelt thanks to my mother and uncle for the great support and prayers from the beginning right through the completion of my work. My sisters (Nondumiso Ntuli and Zama Ntuli) are greatly appreciated for their never-ending words of encouragement. I thank my betrothed for his immense support and continuous motivation and patience.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE

General Introduction

1.1 INTRODUCTION

Livestock production is one of the most important activities of agriculture in South Africa and worldwide. It contributes to food security and plays a role in the socio economic in South Africa (Meissner, Scholtz & Palmer, 2013). Most people depend on animal production to satisfy survival needs. According to Meissner *et al.* (2013), there has been an increase in South Africa's livestock production of up to 47% in the years 2006-2010.

According to Van der Walt (2018), South Africa's gross domestic product increased at a faster rate in the year 2017, with the agricultural sector playing a leading role. In the fourth quarter, the agriculture industry, together with forestry and fisheries, increased by 37.5%, which added a 0.8 percentage point to the GDP growth (ANA, 2018). Greyling (2015) states that statistics on agricultural employment vary; however, the sector employs approximately 700 000 workers. This makes the agriculture sector one of the biggest employers in the economy.

South Africa has a small goat producing industry which only contributes about 3% of Africa's goats and less than 1% of the world's number of goats (DAFF, 2012). According to Steyn (2017), the goat industry can expect many exciting and interesting future developments. Uys (2015), however, states that there are unscrupulous importers of Namibian Boer goats who go against the South African import legislation by selling goats imported as slaughter animals, as breeding stock. This supresses the market price of quality breeding animals produced by SA farmers Uys (2015).

Goats are important as they ensure food security through aiding seasonal food variability and availability (Dube, 2015). They also play key role in the economic livelihood to smallholder farmers in the rural areas (Monau, Raphaka, Zvinorova-Chimboza & Gondwe, 2020).

Dube (2015) explains that although some research has been done on goats, most of it lacked farmer participation as it was mainly researcher-driven, resulting in a lack of adoption of the latest technologies. This study will therefore identify management

practices and their effects on goat production in the selected district of the KwaZulu-Natal province by conducting surveys.

1.2 PROBLEM STATEMENT

The Department of Agriculture, Forestry and Fisheries (2017) reported that the live goat distribution in the KwaZulu-Natal province, was measured at 13%. The Eastern Cape had more goat distribution in South Africa, accounting for 38 %, followed by Limpopo at 18%. The North West took up 12%. The provinces with less number of goats were Mpumalanga and Gauteng with 1% respectively. Remy (2010) opines that KZN is the biggest consumer of goat meat in the country, yet commercial farming is not a common practice. Sikhakhane (2010) stated that most goats in the province are imported from other provinces for consumption.

According to Dube (2015), farmers lack access to technical, as well as market information and their management strategies are not properly defined. Despite the multiple roles goat farming exhibit, it is still largely ignored by sources of credit, with priority given to cattle and crop production (Dube, 2015).

Therefore, the problem is low goat production in KZN and this could be attributed to a lack of knowledge of best goat farming practices. Assessment of production practices will give a clear discernment and therefore options to improve on farmers' skills and knowledge. This is vital so that farmers can incorporate advanced ways of farming into their daily management.

This study will question the following: Are there challenges in producing one's own goats? Are the management practices effective? What needs improvement?

1.3 MOTIVATION

Goats can be an important source of income especially for rural communities in uMgungundlovu district. Production of goats can also play a role in the wellbeing of the community by supplying food and creating employment opportunities. Improving goat production will play a role in eradicating poverty and increase food security. A detailed analysis of current management practices is imperative in order to identify

shortcomings and thereby improve. This study will provide detailed information on management and production practices of goat farmers in the selected district. The results will reflect the efficiency of management practices in production, what the farmers do that hinder the success of the farming enterprise, and what could be done to ensure optimum production.

Information obtained from the study will be made available to farmers, researchers and individuals in need of such information. The results could provide a guide of best goat farming practices to improve the goat industry as a whole. That is to:

- Develop and grow goat farming enterprise in small emerging farmers (commercialize)
- Increase the goat production share of the selected district relative to the provisional and national figures.
- Promote the production of quality goat meat which is also disease free.

1.4 HYPOTHESIS AND OBJECTIVES

1.4.1 Hypothesis

The levels of production and performance are relatively low in the selected areas due to poor management practices.

1.4.2 Objectives

a) To assess the effect of management practices on goat production
b) To identify the existing management practices that are limiting goat production in the selected district

REFERENCES

ANA-African News Agency., 2018. Agriculture leads as SA economic growth quickens in fourth quarter of 2017.Creamer Media's Engineering News.

DAFF-Department of Agriculture, Forestry and Fisheries., 2012. A profile of the South African goat market value chain.

DAFF-Department of Agriculture, Forestry and Fisheries., 2017. Economic review of the Southern African agriculture.

DUBE, K., 2015. Characterisation of goat production systems in selected Coastal areas of the Eastern Cape province, South Africa. Master of Science in Agriculture, University of Fort Hare, South Africa.

GREYLING, J., 2015. A look at the contribution of the agricultural sector to the South African economy. Grain SA.

MEISSNER, H.H., SCHOLTZ, M.M. & PALMER, A., 2013. Sustainability of the South African livestock sector towards 2050. Part 1: Worth and impact of the sector. *South African Journal of Animal Science*, 43(3) pp 282-297.

MONAU, P., RAPHAKA, K., ZVINOROVA-CHIMBOZA, P. & GONDWE, T., 2020. Sustainable Utilization of Indigenous Goats in Southern Africa. *Diversity*, 12-20.

REMY, R. & SIKHAKHANE, D., 2010. KZN government start goat farming project. The Witness. [Online] Retrieved from: https://m.news24.com/Archives/Witness/KZN-government-starts-goat-farming-project-20150430
Accessed: 9 April 2018

STEYN, J., 2017. Why SA's goat farmers must get down to business. Farmer's Weekly. [Online] Retrieved from: https://www.farmersweekly.co.za/opinion/by-invitation/sas-goat-farmers-get-to-business/
Accessed: 7 April 2018

UYS, G., 2015. The Boer goat: a winning investment. Farmers Weekly. [Online] Retrieved from: https://www.farmersweekly.co.za/bottomline/the-boer-goat/
Accessed: 4 April 2018

VAN DER WALT, J., 2018.Agriculture takes the lead in GDP growth. Farmer's Weekly.

[Online] Retrieved from:

https://www.farmersweekly.co.za/agric-news/south-africa/agriculture-takes-lead-gdp-growth/

Accessed: 12 April 2018

CHAPTER TWO

Literature Review

2.1 Introduction

This literature review will focus on goat farming in South Africa in general and in KwaZulu Natal in particular. The literature review will specifically look at the agricultural sector in South Africa concentrating mainly on the following sub-headings; goat industry, goat breeds, goat production systems, goat production areas, factors affecting goat production breeding seasons, nutrition, management practices in goat farming, handling facilities and marketing.

2.2 Agricultural sector in South Africa

Large areas of South Africa are suitable for extensive animal production and it is often economically possible to farm with more than one livestock species (Ramsay & Donkin, 2000). The gross farm income from all agricultural products increased by 12.7% for the year ending in 2016 and was estimated at R259 620 million (DAFF, 2017). Agriculture constitutes an important sector in the economy of South Africa and plays a vital role in employment, especially in rural areas. According to DAFF, (2017), it is a major earner of foreign exchange. A survey on household economy and expenditure analysis shows that a typical South African household spends 25% of its food budget on meat, with 26% on cereals and 9% on milk, eggs and cheese and the remaining 10% on vegetables (Greyling, 2015).

Census 2011 results showed that 2.9 million households were involved in agriculture (Statistics South Africa, 2011). Statistics South Africa (2013) noted participation levels in terms of livestock farming across provinces in South Africa and found out that the Eastern Cape Province had the highest percentage (30%) of agriculture households in livestock production, followed by KwaZulu-Natal at 25%. The Eastern Cape (4.7%), KwaZulu-Natal (6.6%), Limpopo (12.4%) and Northern Cape (8.4%) showed a high percentage of households owning goats only.

2.3 Goat industry in South Africa

The gross value of goat meat depends on the amount produced and prices received by producers. It is reported by DAFF (2012) that the average gross value of goat meat

produced has been R3.6 billion for the past ten years with a drastic increase in 2008 of R753 978 as a result of the high price per kg of meat goat.

Haynes (2020) states that the Boer goat has better quality and quantity of meat compared to any other breed. Indigenous goats represent approximately 63% of the goats in South Africa.

In a study conducted by Braker, Udo & Webb (2002) thirteen households were interviewed, and all households kept goats, it showed that goats are kept by a large population in the rural areas of South Africa. These goats are used for social purposes such as dowry and ceremonies or religious purposes; and according to Tapson (1993), they provide income as well as meat and milk for households.

2.4 Goat breeds in South Africa

Goat breeds can be categorised into three groups: indigenous breeds, meat breeds and dairy breeds (Department of Agriculture and Rural Development, 2015). Indigenous breeds have been selected naturally to adapt to harsh environmental conditions. These are for the production of meat and cultural purposes. According to Kruger (2015), meat breeds in South Africa include Boer goats, Savana goats and Kalahari red goats. They are specifically bred for their meat- producing characteristics. Dairy breeds, which are all imported are selected for milk production and related milk products. The common dairy breeds listed by DARD (2015) are the Saanen and Toggenburg.

2.5 Goat production systems

Farming is a long process, as it involves days of hard work and proper agricultural procedures to be followed to get the intended results. A range of farming practices has emerged to increase the productivity of the agricultural land. Two such farming practices are intensive and extensive farming (Surbhi, 2017).

a) Intensive farming system

This system is ideal for areas where browsing and grazing fields are limited. It is suited for a small size flock and where land is limited and involves confinement of the goats. The goats are housed and fed (National Farmers Information Services, 2017) whilst in confinement.

b) Extensive farming system

Under this system goats are allowed to browse and graze freely. This system is suited for areas where there is adequate browsing and grazing areas. To be effective for dairy goats, the flock should have a stockman and the bucks and does should be kept separately to control random mating (NAFIS, 2017). The goats should be supplemented with licks if there are certain deficiencies and generally when the rangeland reaches nutritional bottleneck (Prinsloo, 2015).

2.6 Goat production areas

Goats are found country -wide; with the Eastern Cape, Limpopo and KwaZulu-Natal provinces having most producers, making up 72% of the total goat population in South Africa as shown in Figure 2.1 below (DAFF, 2017).

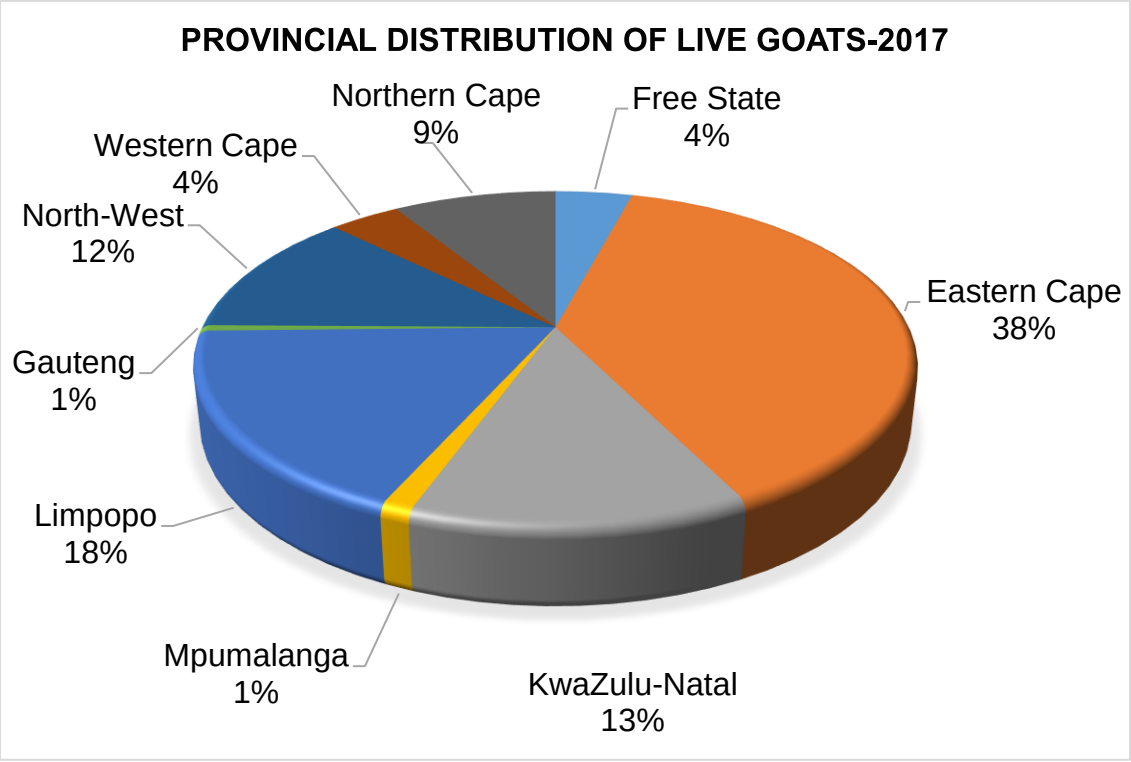


Figure 2.1: Provincial distribution of live goats (DAFF, 2017)

The normal production environment for goats is coastal bush veld to mixed sweet and sour bush veld (Snyman, 2014); and they adapt well to both intensive pasture systems and bush veld.

2.7 Factors affecting goat production

2.7.1 Health

Infectious diseases and parasites cause major problems to goat farmers and are endemic in many regions of Southern Africa (Githiori, Athanasiadou & Thamsborg, 2006). The impact of diseases and parasites may be through high morbidity, mortalities, abortions or subclinical effects manifested as weight loss or reduced gains, as well as the financial implications involved in controlling or overcoming the effects of disease. Van Rooyen (2014) opines that animal production can be affected adversely at weaning, because weaning can cause stress which leads to weight loss, susceptibility to diseases and death.

The common diseases and conditions encountered in goat farming were identified by Vatta, Abbot, DeVilliers, Gumede, Harrison, Krecek, Letty, Mapeyi & Pearson (2007) as enzootic abortion, heartwater, mastitis, orf, pulpy kidney and tetanus. Stress resulting from starvation is usually the cause of abortion. Infectious and parasitic organisms such as Chlamydia and Coxiellacan also cause abortion in goats (Last, 2015). Heartwater is a disease characterized by high fever, nervous signs and oedema of lungs and brain and death (Coetzer & Oberem, 2018). Steyn, McCrindle &Du Toit (2010) stated that heartwater is a tickborne disease caused by *Ehrlichia ruminantium* and is considered to be the significant cause of mortality amongst domestic ruminants in South Africa. Heartwater should be treated immediately with oxytetracycline. In endemic areas, the disease can be controlled by vaccinating the animals (Marais, 2011).

Mastitis is another common disease in goat farming (Vatta *et al.,* 2007) and is associated with poor hygienic practices and it is caused by the bruising of mammary tissue or teats from traumas, fly bites and other wounds to the skin which provides barrier to infection (Mhlangu, Maina & Kagira, 2018). Mastitis decreases the amount and quality of the milk and it also reduces weight gain in kids (Metzger, 2019). Leite-Browning (2008) stated that prevention of mastitis includes providing a clean environment, disinfecting pens and removing bedding daily.

The study done by (Zhang, Lu, Shang, Zheng, Jin, He & Liu, 2010) indicated that the orf outbreak was caused by *Parapoxvirus*. Zhang *et a*l. (2010) further stated that this disease has an economic impact on farmers worldwide. Pulpy kidney, caused by a

sudden bacterium, often follows a sudden change in diet (Hobson, 2017). Hassen, Shifa & Bedaso (2016) stated that pulpy kidney is a fatal disease that produces epsilon toxin which damages endothelial cells. Antibiotic therapy may be helpful in reducing bacterial growth (Mazikelana, 2015).

Outbreaks of tetanus have been described as a result of wound contaminated with spores of *Clostridium tetani* (Lotfollahzadeh, Heydari, Mohhebi & Hashemian, 2018). When infection has occurred, a large number of animals can be affected, and mortality rates can be high (Queensland, 2016). Lotfollahzadeh *et al.* (2018) stated that annual vaccination can prevent tetanus, however, standard hygienic practices still need to be applied when performing procedures that cause wounds.

2.7.2 Availability of feed

Inadequate nutrition in the dry season often results in reduced productivity and reproductive performance of livestock, which leads to economic losses to farmers (Simbaya, 2005). Urban Farmer (2017) explains that animals need to consume a nutritious diet to maintain good health and achieve best production levels. Feeds consisting of only basic raw materials, for example maize (energy source), soybean meal (protein source) and fat, lack certain essential nutrients and are not enough for animals to achieve high performance. Therefore, in addition to these raw materials, feeds should also include supplements to provide minerals, vitamins and specific amino acids.

Goats are mainly browsers: they eat leaves off trees and bushes, but they also graze (eat grass). They are ruminants as they regurgitate feed and ruminate (DARD, 2015). It is important that farmers develop a year forage programme which will allow availability of feed throughout. Mukwevho (2013) states that no matter how good the immune system of an animal is, if it does not receive adequate nutrients and is constantly hungry, it will become sick eventually.

The feed requirements will depend on the weight and condition of the goat. Additional feed is required for growth, pregnancy and lactation (DARD, 2015). Does feeding twins and triplets also require more feed. Goats grazing on hilly pastures will have higher nutritional requirements than goats on level pastures of the same quality because they will use more energy while out grazing.

According to Foster (2017), there are four main components of feed and each plays a vital role in the health of an animal:

a) Energy: Goats need energy to grow and reproduce (Mukwevho, 2013). Energy requirements for different physiological stages differ. The energy required for maintenance is the same for most goats, with dairy kids being the exception, because they require 21% more than the average (MGA, 2008). It is important to feed rations that are high in energy during mating, late gestation and lactation. Lactation has the highest energy requirement. DARD (2015) lists some of the feeds that are high in energy, maize grain, oats, molasses and sorghum.

b) Minerals and Vitamins: Minerals are needed for proper functioning of physiological systems. Goats need access minerals if there is deficiency in their diet (Mukwevho, 2013). DARD (2015) says that most minerals, such as phosphorus and selenium and sodium chloride are better given in granular form and assist in prevention of mineral deficiency, thereby improving performance. Most minerals that are likely to be deficient are calcium, salt, phosphorus and magnesium. Minerals can be given in a block or a lick (Mukwevho, 2013).

Feeding fat soluble vitamins (A, D, E and K) is important because goats are unable to make these vitamins (MGA, 2008). Rumen flora can make enough vitamin B for metabolism and vitamin C is for the immune system to work efficiently.

c) Protein: Protein is needed as a source of nitrogen for the ruminal bacteria, as well as for the supply of amino acids for protein synthesis in the animal's body. (Luginbuhl, 2015). If protein is low in the feed, the digestion process will be slow, and intake of feed will be high. Protein is important for the formation of antibodies (Foster, 2017); and deficiencies can lead to goats becoming sick. Examples of protein rich feeds are soya bean meal, lucerne and cottonseed.

d) Water: The general performance, production and growth of an animal will be affected if water is not sufficiently available. Water needs are very high during early lactation and when warm weather conditions prevail (Luginbuhl, 2015). Access to clean water is important, as DARD (2015) points out that one goat will drink 3 to 20 litres of water per day, depending on the environmental temperatures and condition of the animal.

2.8 Breeding seasons

While some Boer goat producers prefer to have their bucks run with the does all year round, it is good management practice to have specific breeding seasons. The reason is that a management cycle can be planned that significantly reduces the workload. Steyn (2015) says that commercial production uses mainly mass mating, while stud breeders use artificial insemination or single mating. Prinsloo (2015) believes that it is important to consider various factors when planning the breeding season, namely fodder flow and feed availability, the natural oestrus cycle of the Boer goat, market cycle, marketing date, and personal management factors.

Normally does start their cycle between February and March which lasts to June or July. However, it is possible to induce cycling by introducing bucks. The response of the doe to the buck is sudden and ovulation occurs within two to ten days after the buck has been introduced (Kelly, unknown date).

2.9 Management practices in goat farming

2.9.1 Goat identification

Goat identification is necessary for accurate record keeping. Each animal is individually identified which enables the farmer to keep important records such as parentage, animal birth weight, weaning weight, production and health records. It is also important for registration purposes and proof of ownership (Extension, 2015). Identification proves to be helpful for goat breeds with more uniform colouring such as Toggenburgs and many Boer goats.

Identification can be done permanently or temporarily. Permanent identification includes methods such as freeze branding, hot iron and tattoos (Extension, 2015). Temporary identification consists of ear tagging, coloured sprays and chalks, and wax marking crayons (Thelen, 2013).

2.9.2 Creep feeding kids

Creep feeding provides supplementary feed for nursing kids and is important to accelerate kidding (Mukwevho, 2014). Machen, (date unknown) lists the following advantages of providing creep feed:

a) It increases pre-weaning weight gain, especially for kids born as twins and triplets.

b) The conversion of creep feed to body weight is an efficient process and kids that are creep fed will gain more weight per day.

c) Kids will reach target market weight early and therefore be marketed at a young age.

d) Creep feed reduces stress at weaning.

2.9.3 Castration

Castration is an important management practice to maintain and control the breeding programme. Castration is the removal or destruction of testes, epididymis and a portion of each spermatic cord from a buck (Yami, 2008). The main reason for castration is to prevent inbreeding which results in genetic defects and poor growth (Yami, 2008). As the buck becomes older, its carcass flavour, texture, fat composition, and overall palatability change. Van Rooyen (2014) states that castration should be done at a young age, from the age of three weeks because it becomes more difficult and painful at later stages. Bassett (2009) says that castration can be done physically and chemically. Physical common methods are the burdizzo method, the elastrator and the knife method.

2.9.4 Vaccination

Goats are susceptible to a number of diseases and it is vital for a farmer to have a specific vaccination programme to prevent such diseases. Diseases that are not prevented can harm live goats and minimise their production. Sick goats should be isolated so that the disease from which they are suffering does not spread to healthy animals (Rowe, 2017). Every sick goat should be treated, and records of treatments received should be kept.

Van Rooyen (2014) is of the opinion that there are different factors to consider in order to determine which vaccine to use and when to use. The area in which the farm is located, the diseases that are most common in the area and the management system are factors that must be considered (Van Rooyen, 2014). DARD (2015) lists the following diseases as most common in goats: heartwater, coccidiosis, orf, mastitis, abortion, tetanus, pasteurellosis and enterotoxaemia.

2.9.5 Weighing

Animal weighing is one of the most important tasks in farm management. A farmer should understand the importance of staying up to date with all facts about individual animals (Hill, 2016). Hill (2016) also states that a livestock scale is a critical tool to optimize animal performance.

Hill (2016) lists the following benefits of weighing animals:

a) Monitoring animal health-It is easy to monitor the health of a farmer's animals by checking for any sudden weight loss.

b) Breeding purposes- By weighing the animals, the optimal time to breed will easily be identified, which will prevent complications in future. With the weight data collected, farmers are in a better position to make informed decisions that guarantee healthier kids in the herd.

c) Measure feed consumption- When the right feed conversion rate is determined the right food portions are distributed to help achieve particular growth rates within a set period of time.

d) Picking the weaning time- It is crucial to include all kids in weight measuring. The decision to wean determines how well kids are integrated into the herd.

e) Evaluating breeding performance- When animals are regularly weighed, it is easy to determine the right breed for a specific farm. Breeds that are constantly gaining weight are preferable for breeding, as they guarantee better returns on investment and healthier kids.

2.9.6 Record keeping

Farm records serve a number of purposes on a farm. There are different types of records that can be used to monitor farming operations (McKenzie, date unknown). Records are kept for management of the farm and to keep track of progress. Yami (2009) explains that there are two categories of goat farm records, namely. Production records which consist of information on herd health and performance of the herd. The second category constitutes the financial records, which show how profitable a farm is and include information such as operating expenses (feed costs, forage seeds), equipment purchases, inventory, loan balances and depreciation records. According

to Arzeno (2004), many producers find keeping and analysing financial records difficult.

The criteria for records as listed by Arzeno (2004) are that records must be useful; they should be kept in such a way that they can be easily converted to useful information; record systems should be simple and should lead to action being taken. There are two types of record systems (McKenzie, date unknown) the hand system and the computer system. The hand system is cheaper, easy to implement but time consuming, while the computer system is fast, accurate but expensive. It is always up to a farmer to decide which system to implement.

2.10 Handling facilities and equipment

Suitable facilities for goats are an important aspect of goat production. Animals need to be confined to provide shelter from bad weather; to prevent predation and theft (DARD, 2015). The ability of a goat to withstand adverse weather conditions is related to prevailing conditions (Luginbuhl, 2015).

2.10.1 Housing

Goats can tolerate cold weather, but they should not be exposed for a long period of time (Schoenian, 1999). Shade is needed during summer to prevent exposure to direct sunlight. DARD (2015) says that when building shelters for goats, there are important aspects to consider:

a) There must be a roof for protection against rain and direct sunlight;

b) There should be sidewalls to prevent exposure to wind;

c) Drainage or a cement floor to prevent the ground from being muddy;

d) There should an area where goats can escape from wet and muddy conditions.

2.10.2 Fencing

Fencing is the key to safety and health. Fencing is needed to keep the goats inside and secured, while keeping out predators such as jackals, dogs and foxes (Arcuri, 2018). The whole area of the farm needs to be fenced and where fencing has been cut loose, it must be fixed. Fencing also helps in reducing livestock theft (Prinsloo, 2015). It should be high enough to prevent the goats from jumping over.

2.10.3 Handling facilities

Handling facilities are important in every farming operation. They are mostly used for treatment and prevention of diseases during vaccination, dosing and dipping. DARD (2015) states that handling facilities should consist of a gathering pen that leads into a crush-pen or passageway where farmers can dose and provide a footbath in a race to control foot rot. Other important components of handling facilities include a loading ramp, which helps when loading goats into a vehicle for transportation (Prinsloo, 2015). A scale for weighing is also important, as well as a head gate that allows the restraining of animals. Handling facilities that are well designed and maintained provide safety for both animals and handlers. The environment and location of the farm should be considered when designing handling facilities (Stull et al., 2007).

2.10.4 Equipment

DARD (2015) is of the opinion that the goat farmer should have access to the following key equipment: a cooler box to store vaccines, ear tag applicator, hoof trimmers, dosing gun, knapsack sprayer, gloves and blades. Consumable medicines and equipment that a farmer should have on hand are further listed as disposable syringes, dosing/ drenching gun, antibiotic eye powder, broad spectrum de-wormer for wireworms, tapeworms and flukes, tick grease, long- acting antibiotics such as Terramycin LA and short acting antibiotics such as Oxytetracycline 120. Goat farmers should also keep Iodine spray and vitamins.

Feed and water troughs should be provided. Feed troughs should keep feed off the ground to avoid it being trampled and soiled by goats (DARD, 2015), which results in waste because goats will not eat feed that is soiled. Hay racks also prevent wastage. Feed troughs should be free from sharp and loose objects which could injure the animals. Clean water should be provided and there should be even distribution of water troughs in the camps (Van Lingen, 2014). DARD (2015) states that kids should be able to reach water without the danger of drowning.

2.11 Marketing

DAFF (2017) asserts that goats produce meat and milk, but the main reason for keeping goats is for meat. This fact contributed to meat goats constituting the major proportion of the world goat population. Over the past ten years, goat meat production averaged 19 million kg per year. The figure below shows the goats slaughtered.

Figure 2.2: Goat slaughtering (DAFF, 2017)

The figure above shows an increase from 2006/07 to 2015/16. The peak was reached in 2016-2017, with approximately 823 108 goats slaughtered. Goat slaughtering increased by 7% in the 2015/2016 marketing period.

DAFF (2012) claims that the majority of goats marketed in South Africa are sold privately in the informal market to be slaughtered for religious purposes. A very small percentage of goats are marketed through registered abattoirs. According to Macaskill (2018), almost all goats are marketed live.

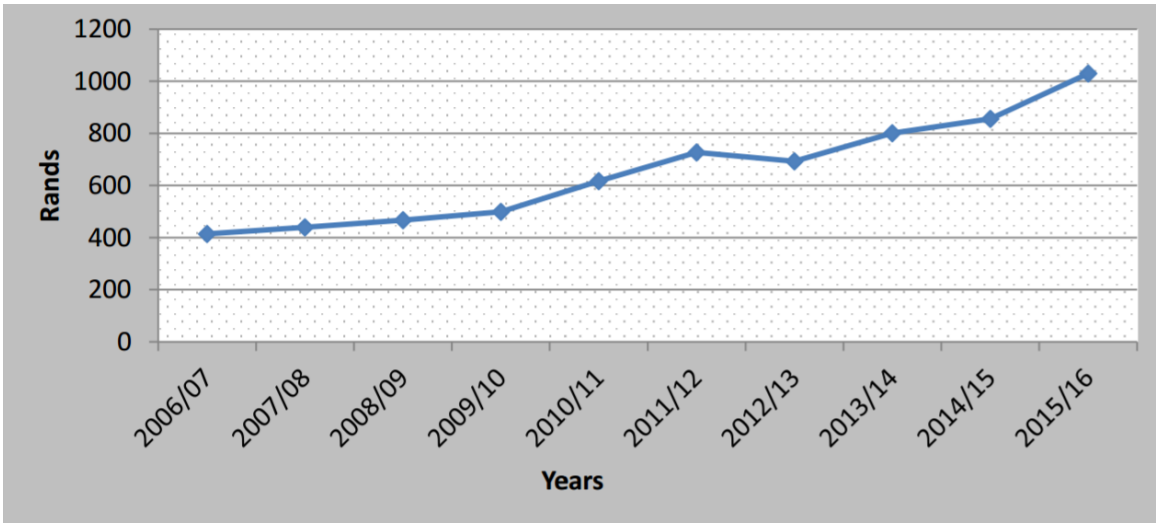


Figure 2.3: Average price per slaughtered unit/carcass (DAFF, 2017)

The above figure shows the local average price received by producers per carcass in South Africa. The average prices have been increasing from 2006/07 to 2016/17, except in 2012/13, where the prices show a slight decrease.

South Africa has two types of livestock marketing channels: formal marketing channel and informal marketing channels (Soji, Chikwanda, Chikwanda, Mushonga & Muchenje, 2015).

a) Formal livestock marketing channels: Meat in the formal sector is mainly supplied by commercial farmers. The process when marketing formally is when animals reach the desired market weight, they are taken to the abattoirs where inspection takes place (Soji *et al*., 2015).

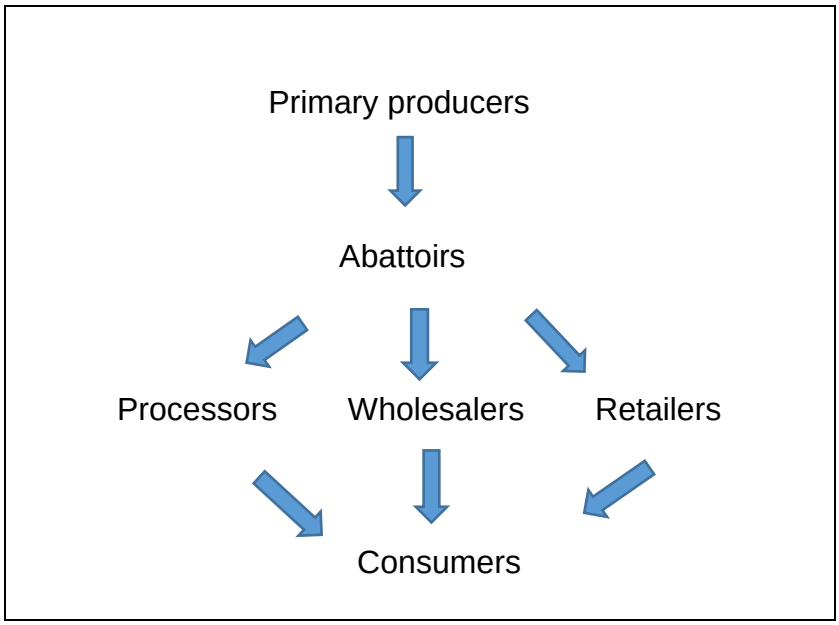
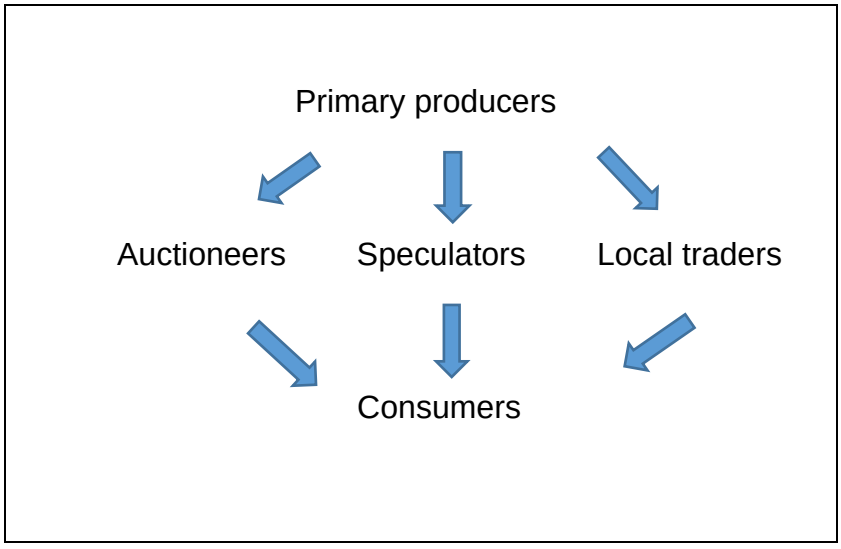


Figure 2.4: Formal marketing channels of livestock in SA (Soji *et.al*., 2015)

b) Informal livestock marketing channels: Smallholder farmers sell their livestock through this channel to speculators and at auctions (Soji *et al., 2015*). Old farmers and farmers that are illiterate prefer selling their livestock privately to neighbours, while young farmers use private sales, auctions, abattoirs and speculators.



Figures 2.5: Informal marketing channels of livestock in SA (Soji *et.al*., 2015)

CONCLUSION

The production of goats plays an important role in ensuring food security, reducing poverty and ensuring income in the rural households of the KwaZulu Natal province. Goat production can therefore be contemplated to be a more viable option to improve the communities from poverty due to their high ability to survive under severe conditions such as drought.

Even though goats can tolerate heat, they should not be exposed for prolonged time. Proper housing should protect them against inclined weather conditions. Fencing also provides protection against theft and predators.

Goat health management can reduce mortality rate through regular vaccination and deworming. Handling animals during vaccination and deworming is convenient with suitable handling facilities. Optimum production is possible with proper knowledge and management practices. Adequate nutrition is important to ensure increased productivity and reproductive performance of livestock.

There is a wide range of marketing channels at farmers' disposal, a farmer can choose to either market their goats through either formal or informal marketing. Livelihoods of the rural area could be greatly improved with sound management practices.

REFERENCES

ARZENO, A., 2004. Record Keeping in Farm Management. College of Agriculture & Biological Sciences. South Dakota State University. pp 1-6.

ARCURI, L., 2018. Housing and fencing Goats on a small farm. [Online] Retrieved from: https://www.thespruce.com/housing-and-fencing-goats-3016795 Accessed: 04 April 2018

BASSETT, A., 2009. Animal welfare approved. Technical Advice Fact Sheet Number 9. *Food and Agriculture Organization of the United Nations*: pp1 – 9.

BRAKER, M. J., UDO., H.M.J., & WEBB, E.C., 2002. Impacts of intervention objectives in goat production within subsistence farming systems in South Africa. South African Journal of Animal Science 2002, vol 32 (3), pp 185-191.

COETZER, J.A.W. & OBEREM, P., 2018. Heartwater. Anipedia. [Online] Retrieved from https://www.anipedia.org/resources/heartwater/1146 Accessed: 28 November 2020

DAFF-Department of Agriculture, Forestry and Fisheries., 2012. A profile of the South African goat market value chain.

DAFF-Department of Agriculture, Forestry and Fisheries., 2017. Economic review of the Southern African agriculture.

DARD-Department of Agriculture and Rural Development., 2015. Goat production Handbook.

EXTENSION., 2015. Goat identification system. [Online] Retrieved from: http://articles.extension.org/pages/58487/goat-identification-system Accessed: 17 April 2018

GITHIORI, J.B., ATHANASIADOU, S. & THAMSBORG, S.M., 2006. Use of plants in novel approaches for control of gastrointestinal helminths in livestock with emphasis on small ruminants. *Veterinary Parasitology* (139): pp 308–320.

GREYLING, J., 2015. A look at the contribution of the agricultural sector to the South

African economy. Grain SA.

HASSEN, D.J., SHIFA, M. & BEDASO, K., 2016. Review on Pulpy Kidney Disease. Journal of Veterinary Science and Technology, 7 (5)

HAYNES, S., 2020. 15 Best Goat Breeds for Meat. [Online] Retrieved from: https://petheplful.com/farm-pets/best-meat-goat-breeds
Accessed: 28 November 2020

HILL, K., 2016. Weighing and measuring livestock. [Online] Retrieved from: https://www.progressivedairy.com/topics/barns-equipment/weighing-and-measuring-livestock
Accessed: 29 March 2018

HOBSON, M., 2017. Pulpy Kidney, 'Bloednier', Enterotoxeamia Clostridium perfringens type D. SA Mohair Growers. [Online] Retrieved from: https://www.angoras.co.za/article/clostridium-perfringens-type-d
Accessed: 30 November 2020

KELLY, R., Unknown date. Reproductive cycle of goats. [Online] Retrieved from: http://www.acga.org.au/goatnotes/B011.php
Accessed: 20 April 2018

KRUGER, L., 2015.Indigenous sheep and goat breeds list. [Online] Retrieved from: https://www.farmersweekly.co.za/farm-basics/how-to-livestock/indigenous-sheep-and-goat-breeds/
Accessed: 18 April 2018

LAST, R., 2015.Enzootic Abortion of Small Ruminants. LHPG Review, vol 9. [Online] Retrieved from: https://vet360.vetlink.co.za/enzootic-abortion-small-ruminants/
Accessed 28 November 2020

LEITE-BROWNING, M.L., 2008.Mastitis in Goats. Alabama Extension System, p 1-5

LOTFOLLAHZADEH, S., HEYDARI, M., MOHEBBI, M.R. & HASHEMIAN, M., 2018. Tetanus outbreak in a sheep flock due to ear tagging. Veterinary Medicine and Science. vol 5 (2)

LUGINBUHL, J, M., 2015. Nutritional feeding management of meat goats. [Online] Retrieved from: http://content.ces.ncsu.edu/nutritional-feeding-management-of-

meat-goats

Accessed: 12 April 2018

MACASKILL, C., 2018. Meat goats. Agri Handbook (Beta). [Online] Retrieved from: www.agrihandbook.co.za/index.php/book/livestock/meat-goat?showall=&start=1

Accessed: 03 May 2018

MACHEN, R., Unknown date. Creep feeding kid goats. [Online] Retrieved from: http://www.boergoats.com/clean/articleads.php?art=650

Accessed: 06 May 2018

MAHLANGU, P., MAINA, N. & KAGIRA, J., 2018. Prevalence, Risk Factors, and Antibiogram of Bacteria Isolated from Milk of Goats with Subclinical Mastitis in Thika East Subcounty, Kenya. *Journal of Veterinary Medicine*, p 1-8.

MARAIS, P. G., 2011. Heartwater in Sothern Africa. Grootfontein Agricultural College. [Online] Retrieved from: http://gadi.agric.za/articles/Agric/sajas04_heartwater.php

Accessed: 28 November 2020

MAZIKELANA, M., 2015. Understanding pulpy kidney in goats, sheep. The Sunday News. [Online] Retrieved from: https://www-sundaynews-co-zw.cdn.ampproject

Accessed: 30 November 2020

MCKENZIE, A., Unknown date. Establishing A Record Keeping System for Goats. Getting started in the meat goat business. Bulletin I, Vol.X.

MGA-Manitoba Goat Association., 2008. Goats and their nutrition. goats-and-their-nutrition.pdf

Accessed: 27 April 2018.

METZGER, M., 2019. Mastitis in sheep and goats. Michigan State University Extension. [Online] Retrieved from: https://www.canr.msu.edu

Accessed: 30 November 2020.

MUKWEVHO, L., 2013. Animal Nutrition. Ration formulation. Grootfontein College of Agriculture, Delivered February.

NAFIS-National Farmers Information Service., 2017. Production systems. [Online] Retrieved from:

http://www.nafis.go.ke/livestock/dairy-goat-production/production-systems/
Accessed: 22 April 2018

PRINSLOO, L., 2015. Boer Goat Minifarm. Grootfontein College of Agriculture. Delivered May 2015

QUEENSLAND GOVERNMENT., 2016. Tetanus. [Online] Retrieved from: htpps://business.qld.gov.au
Accessed 30 November 2020

RAMSAY, K.A. & DONKIN, E.F., 2000. A review of the current status of goat research and development in South Africa. University of Pretoria.

ROBSON, T.F., 2005. An assessment of land cover changes using GIS and remote sensing: A case study of the uMhlathuze Municipality,KwaZulu-Natal,South Africa. University of KwaZulu-Natal.

ROWE, A., 2017. Basic health management: All you need to know. *Farmer's Weekly*. [Online] Retrieved from: https://www.farmersweekly-co-za.cnd
Accessed: 15 April 2018

SCHOENIAN, S., 1999. Facilities and equipment for commercial meat goat production. University of Maryland Cooperative Extension. [Online] Retrieved from: https://www.gov.gov.za/about-sa/south-africas-provinces#kzn
Accessed: 23 April 2018

SIMBAYA, J., 2005. Availability and feeding quality characteristics of on-farm produce feed resources in the traditional small-holder sector in Zambia.

SNYMAN, M.A., 2014. South African goat breeds: Boer goat. Info pack ref.2014/002 Grootfontein Agricultural Development Institute.

SOJI, Z., CHIKWNDA, D., CHIKWAMDA, A.T., JAJA, I. F., MUSHONGA, B. & MUCHENJE, V., 2015. Relevance of the formal red meat classification system to the South African informal livestock sector. *South African Journal of Animal Science* vol.45 no.3. pp 263-277.

STATSSA- STATISTICS SOUTH AFRICA., 2011. Agricultural households. Report No. 03-11-01 (2011)

STEYN, H.C., MCCRINDLE, C.M.E. & DU TOIT, D., 2010. Veterinary extension on

sampling techniques related to heartwater research. *South African Veterinary Association*, 81 (12) ; 160-165.

STEYN, J., 2015. Breeding season for goats. Farmer's Weekly. [Online] Retrieved from: https://www.farmersweekly.co.za/farm-basics/how-to-livestock/breeding-season-for-goats/
Accessed: 29 April 2018

SURBHI, S., 2017.Difference between intensive and extensive farming. [Online] Retrieved from: https://keydifferences.com/difference-between-intensive-and-extensive-farming.html
Accessed: 19 April 2018

TAPSON, D.R.,1993. The economic role of livestock in developing countries. Livestock production under traditional systems. Irene Animal Production Institute, South Africa.

THELEN, J., 2013. Importance of Animal Identification. [Online] Retrieved from: http://www.extension.colostate.edu/logan/newsletters/newsdocs/
Accessed: 02 May 2018

URBAN FARMER., 2017. Feed additives – playing a vital role in livestock feed and animal production. [Online] Retrieved from: http://urban-farmer.co.za/2017/07/16/feed-additives-playing-a-vital-role-in-livestock-feed-and-animal-production/
Accessed: 07 May 2018

VAN ROOYEN, J., 2014. Animal health. Common goat and sheep diseases, Grootfontein College of Agriculture. Delivered May.

VAN LINGEN, M., 2014. Veld Management. Grootfontein College of Agriculture. Delivered May.

VATTA, A.F., ABBOTT, M.A., DE VILLIERS, J.F., GUMEDE, S.A., HARRISON, L.J.S., KRECEK, R.C., LETTY, B.A., MAPEYI, N. & PEARSON, R.A., 2007.Goat Keepers' Animal Health Manual. Agricultural Research Council pp 1-52.

YAMI, A., 2008. Castration of goats. [Online] Retrieved from:

www.esgpip.org/PDF/Technical%20bulletin%20No18htnl

Accessed: 11 May 2018

YAMI, A., 2009.Records and record keeping on sheep and goat farms. [Online]

Retrieved from: http://www.esgpip.org

Accessed: 14 May 2018

ZHANG, K., LU, Z., SHANG, Y., ZHENG, H., JIN, Y., HE, J & LIU, X., 2010. Diagnosis and phylogenetic analysis of Orf virus from goats in China: a case report. Virology Journal, 7:78.

CHAPTER THREE

Research Methodology

3.1 Introduction

The methodology used in this study has been chosen to obtain necessary information through a structured questionnaire. A brief description of the study area has been given with the questionnaire included.

3.2 Study area

The study was conducted in the KwaZulu-Natal province, in uMgungundlovu district. Figure 3.1 shows the map of the uMgungundlovu district with all seven municipalities.

Figure 3.1: Map of uMgungundlovu district with seven municipalities (KZN Online, 2016)

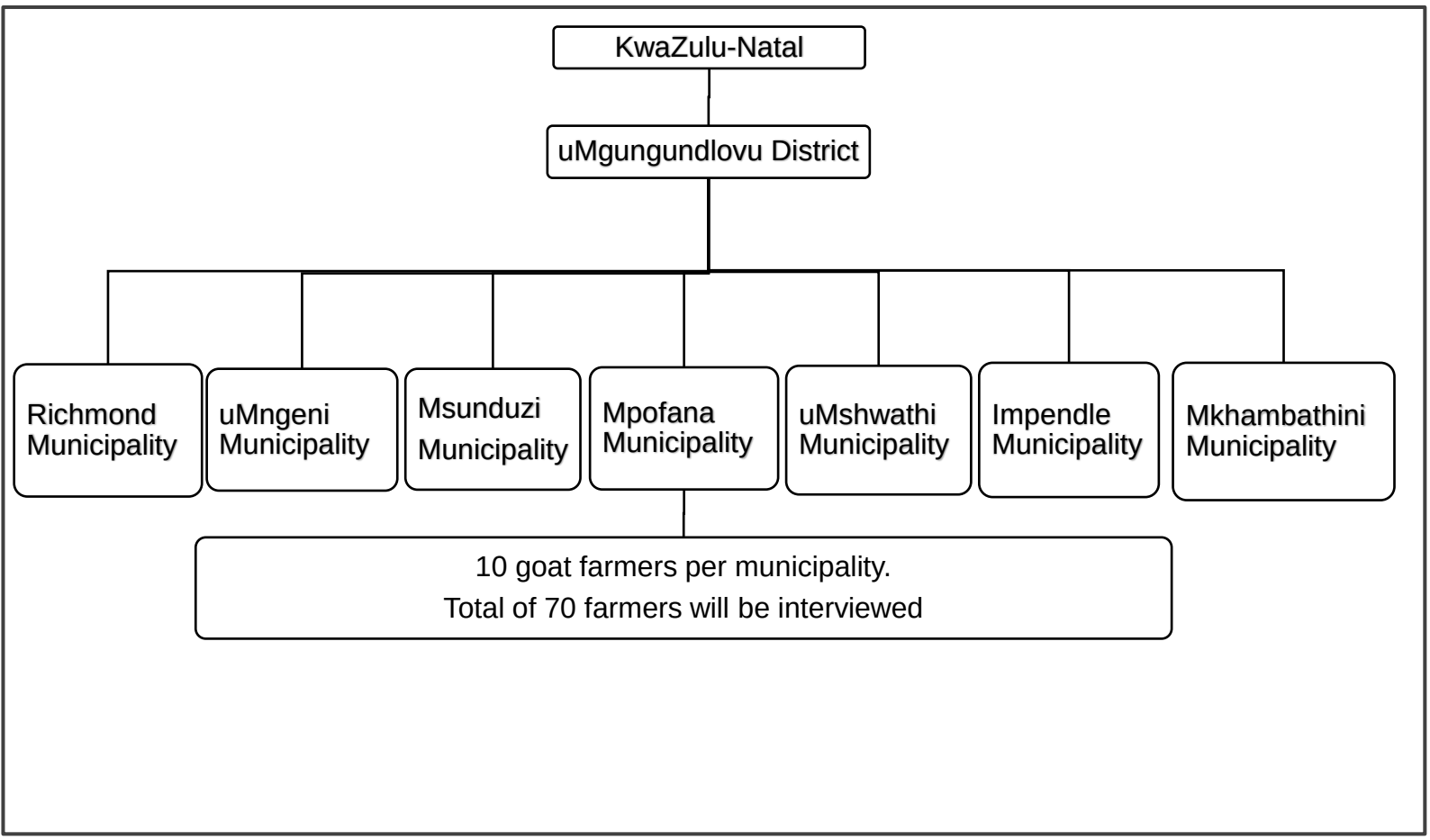


Figure 3.2: District that were assessed and its municipalities

3.3 Study area

A brief description of the uMgungundlovu district is given below. The topography, climate, vegetation, population, agricultural activity and land cover respectively are discussed

3.3.1 Topography

The uMgungundlovu district is found in the Midlands of KwaZulu Natal, Pietermaritzburg. It covers 8 307 square kilometres with a population of 1 095 865 that live in dwellings ranging from traditional farmland communities, informal rural settlements to urban areas (STATSSA, 2016).

3.3.2 Climate

UMgungundlovu is characterized by summer rainfall and its climate is warm and temperate with an average of annual rainfall of 865.3 mm. the average maximum temperature ranges from 22.6 ˚c to 24.5 ˚c and the minimum from 9.9 ˚c to 16 ˚c (Hlahla & Hill, 2018).

3.3.3 Vegetation

The grassland biome dominates the district, making up over 70% of its area (Ezemvelo KZN Wildlife, 2014). There are two categories of grass plants: sweet grasses which are therefore palatable to stock and sour grasses, unpalatable to stock (Low & Rebelo, 1996). Forests are also found in the area together with Savana and the Indian Ocean Coastal Belt.

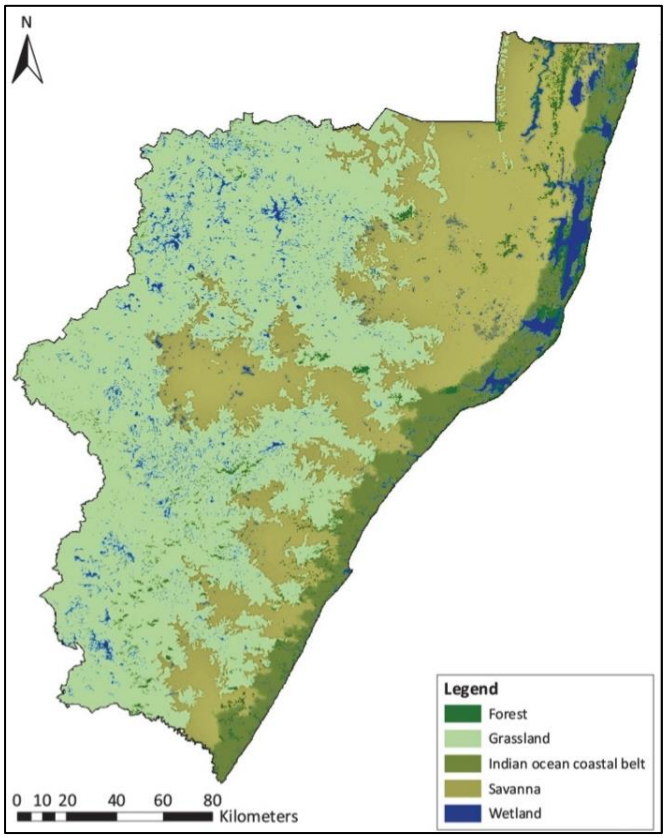


Figure 3.3: The biomes of KwaZulu Natal (Jewitt,2016)

3.3.4 Population

KwaZulu-Natal is the province with the second highest population. It has a population of 11 million, which constitutes 19.9% of the total population of the country. In the year

2016, uMgungundlovu district had a population of 1 095 865. The district covers an area of 9 513 km². The languages most spoken are isiZulu (82.5%), English (12.5%) and Afrikaans (1.0%) (South Africa's Provinces, 2017).

3.3.5 Agricultural activity

The agricultural sector in the mentioned province is diverse. About 4% of KZN's value added GDP derives from agriculture and 3.6% of the province's workers are employed in this sector (Trade & Investment KwaZulu Natal, 2013). According to Jewitt *et al.* (2015), agriculture in KZN consists of sugarcane, orchards, commercial and subsistence crops, as well as agro-forestry (timber). The economy of the province also relies on cattle and maize production (EB, 2017). A total of 6.5 million hectares of land is used for farming, of which 82% is suitable for livestock farming and 18% is regarded as arable land (TIKZN, 2013).

3.4 Sampling procedure

One district with seven municipalities was assessed with a total of seventy (70) respondents. Ten goat farmers from each municipality were interviewed. Areas with high goat populations were selected as suggested by the extension staff from each municipality. Farmers, however, were selected using the simple random sampling method (every farmer had an equal chance of being selected) and they participated voluntarily in the survey.

3.5 Data analysis

Data was captured and coded on Microsoft Excel® and analysed using SPSS version 26 (2019). The Shapiro Wilk test was conducted to test the normality, where the normality assumption for conducting a t-test was violated, a Mann-Whitney U test was conducted in order to determine if there was a statistical significant difference.

REFERENCE

DIMADICK., 2014. Category: Rivers of KwaZulu-Natal. [Online]. Retrieved from http://en.m.wikipedia.org/wiki/Category:Rivers_of_KwaZulu-Natal Accessed on 30 April 2018

DRIVER, A., NEL, J.L., SMITH, J., DANIELS, F., POOLE, C. J., JEWITT, D. & ESCOTT, B.J., 2015. Land and Ecosystem Accounting in KwaZulu-Natal, South Africa.

EB-Encyclopaedia Britannica., 2017. KwaZulu-Natal, province of South Africa [Online]. Retrieved from: http://www.britannica.com/place/KwaZulu-Natal Accessed: 7 May 2018

EZEMVELO KWAZULU-NATAL WILDLIFE., 2014. UMgungundlovu Biodiversity Sector Plan, vol 10.

HLAHLA, S. & HILL, T.R., 2018. Responses to Climate Variability in Urban Poor Communities in Pietermaritzburg, KwaZulu-Natal, South Africa. *SAGE Journal*, 116.

JEWITT, D., GOODMAN.P., ERASMUS.B., O'CONNOR.T. & WITKOWSKI.T.F., 2015. Systematic land-cover change in KwaZulu-Natal, South Africa: Implications of biodiversity. South African Journal of Animal Science,2015; 111(9/10).

JEWITT, D., 2016. Vegetation type conservation targets status and level of protection in KwaZulu Natal in 2016. *Bothalia African Biodiversity*, vol 48.

LOW, A.B. & REBELO, A.G., 1996. Vegetation of South Africa, Lesotho and Swaziland. [Online] Retrieved from: http://www.ngo.grida.no/soesa/nsoer/Data/vegrsa/vegstart.htm Accessed: 4 May 2018

ROBSON, T.F., 2005. An assessment of land cover changes using GIS and remote sensing: A case study of the uMhlathuze Municipality,KwaZulu-Natal,South Africa. University of KwaZulu-Natal

SAP-South Africa's Provinces., 2017. South Africa's provinces, KwaZulu- Natal.

[Online] Retrieved from: www.gov.za

Accessed: 29 April 2018

SEKWADI, P.K., 2014. Veld management. Vegetation type. Grootfontein College of Agriculture. Delivered June.

TIKZN-Trade & Investment Kwazulu-Natal., 2013. Doing business in KwaZulu-Natal [Online] Retrieved from: www.tikzn.co.za>resources>docs

Accessed: 8 May 2018

CHAPTER FOUR

Results and discussion

4.1 Introduction

This chapter focuses on the findings from the survey on management practices by goat farmers in the selected district. It outlines biographical details, goat breeds, education level, gender distribution and farm details such as farm size, farm herd, vegetation type, veld management, farming system and farm infrastructure.

4.2 Age of respondents, farm size and farm herd

4.2.1 Age of respondents

Figure 4.1 below shows different age groups of interviewed farmers. The average age of goat farmers in the uMgungundlovu district (illustrated in table 4.1 below) was 47years. This indicates that there are more elderly people in the farming sector particularly with regards to goat farming. The median age of farmers in this district was 45 years. According to Prinsloo (2015), older farmers are wiser and more prone to making sound farming decisions, therefore their farming ventures are usually a success. Lubambo (2011:28) argues that the age of farmers is regarded as a crucial factor for the success and sustainability of a farm, as it is an indicator of some farmers' abilities, that is, the level of decision-making and interest. As a farmer ages and gains experience, he or she may become more productive with improved managerial ability (Tauer, 1995:63).

Physical strength is required during the process of agricultural production. The decline in physical strength that comes after middle age necessitates investment in labour for production activities (Guo *et al.*, 2015:2). The experience of older farmers leads to more efficient combinations of inputs, which make labour more effective (Guo *et al*., 2015:2).

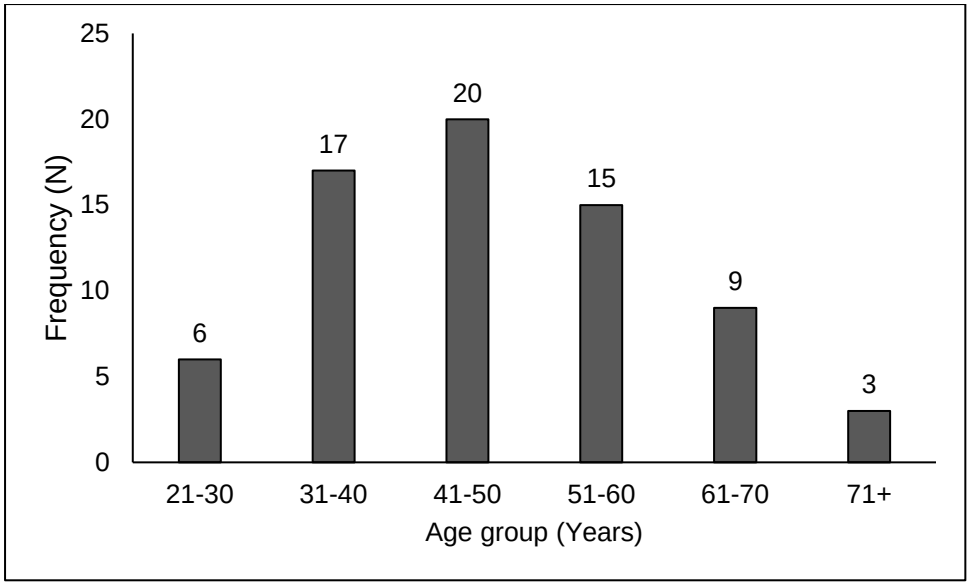


Figure 4.1: Age groups of interviewed farmers

4.2.2 Farm size

As farms get larger, it is easier to invest in labour-saving machinery, technology and specialized management (Haspel, 2014). This, however, will lead to fewer people being employed because machinery replaces them. Greenberg (2015) states that productive land sizes vary by agro-ecological context. The average farm size in the uMgungundlovu district is 108.3 hectares (ha), (table 4.1). Some of the respondents clearly stated that the land they own is not only for farming purposes, as they reside on the same land, which is limiting in terms of having adequate farming facilities.

Table 4.1: Mean±SD of age and farm size in the uMgungundlovu district.

District	Respondent's age	Farm size (Ha)
uMgungundlovu	47.3±12.8	108.3±149.5

4.2.3 Farm herd

The average farm herd in this study consisted of 80 animals. Table 4.2 shows that there was an average of 3 bucks, 50 does, 16 kids and 11 weaners. According to Bester *et al*. (2009:9), herds in the communal sector were small, with 56.8% of keepers owning fewer than ten goats as compared to 10% in the emerging sector. Ngqangweni

and Delgado (2002:5) believe that various factors can affect the size of the herd, including socio-economic factors such as farm assets, access to finance or credit institutions and household head characteristics, namely age, gender, marital status and educational level. The respondents in this district were mainly faced with stock theft. A total of 28.6% respondents had poor fencing (Figure 4.3), which could be a contributing factor to stock losses.

Table 4.2: Mean±SD of farm herd (bucks, does, kids and weaners) in the uMgungundlovu district.

Farm herd	Bucks	Does	Kids	Weaners
Mean±SD	3.4±3.5	49.96±73.9	15.6±22.2	10.96±20.4

A total of 47 farmers farmed with other animals beside the goats. A percentage of 39.7% farmers were farming with cattle, 50% were farming with chicken and 10.3% had sheep as well. The different species play important roles for food production and income generation from different animals (FAO, 2017).

4.3 Gender distribution

Gender inequalities in access to land is overwhelming. Across regions, women are less likely to own agricultural land as compared to their male counterparts, and when they do operate or own agricultural land; it is usually on smaller plots (ESA, 2011:8). Despite this, women continue to play a significant role in the agriculture sector. In this study, there were (n=9) 13% female respondents and (61) 87% male respondents (Figure 4.2). This means that there are only a few females farming with goats in this district, compared to males. According to Sihlobo and Kapuya (2018:2), women in South Africa suffer from legal and cultural constraints in terms of inheritance, ownership and use. While conducting this survey, most of the farmers were sceptical about having a woman with their herd, which is a clear indication that there are still gender inequalities as a result of cultural beliefs.

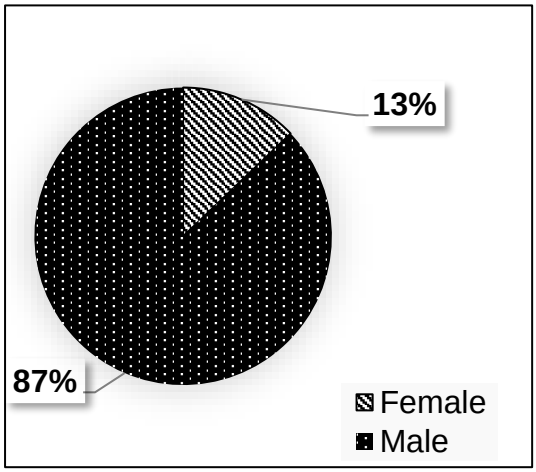


Figure 4.2: Percentage of gender distribution in uMgungundlovu district.

4.4 Educational level

Figure 4.3 below shows educational level and age group of respondents in the uMgungundlovu district. Dube (2015:42) reveals that most farmers attained the lowest primary level of education. The level of education influences the ability to make sound decisions, which can determine the success of the farming business (Prinsloo, 2015). Table (4.3) shows that the majority of respondents, namely (n=28) 40%, which consists of (n=27) males and (n=1) female had low levels of education (lower than grade 12) and one female (1.43%) had a degree in Animal Science, which is the highest level of education obtained for this study.

Oduro-Ofori *et al*. (2014:1951), state that the returns on agricultural productivity increase as the educational level increases. According to Lubambo (2011:30), the level of education has an influence on the ability to make decisions and it is directly related to the success of a farm. In this study 38.57% of respondents were in the age group 51 to 70+ years. STATSSA (2011:42) reports that most elderly people in South Africa have no formal education. Katikati (2017:56) points out that this may have been caused by the fact that old people grew up during the time when education was not easily accessed.

Table 4.3: Education level and gender of respondents in the uMgungundlovu district.

Level of education	UMgungundlovu district				
	Female	Male	Total	Total %	SD
No matric	1	27	28	40	**18.4**
Grade 12	2	17	19	27.1	**10.6**
Diploma in Agriculture	1	3	4	5.7	**1.4**
Degree in Animal Science	1	-	1	1.4	**0.7**
Masters' degree in Agriculture	-	-	-	-	**-**
Doctorate in Agriculture	-	-	-	-	**-**
Other qualifications	4	14	18	25.7	**7.1**
Total	**9**	**61**	**70**	**100**	

In this study, none of the farmers in the age group 51-60 years (n=14) had Grade 12. The highest level of education obtained by most farmers (n=12) was Grade 12, among the group aged 41- 50 years. Figure 4.3 shows that most respondents n=6 (21-30 years) and n=7 (31-40 years) have tertiary education levels not related to agriculture. Older farmers of age over 71 had no higher level of education which could be as a result of poor access to education in their youth.

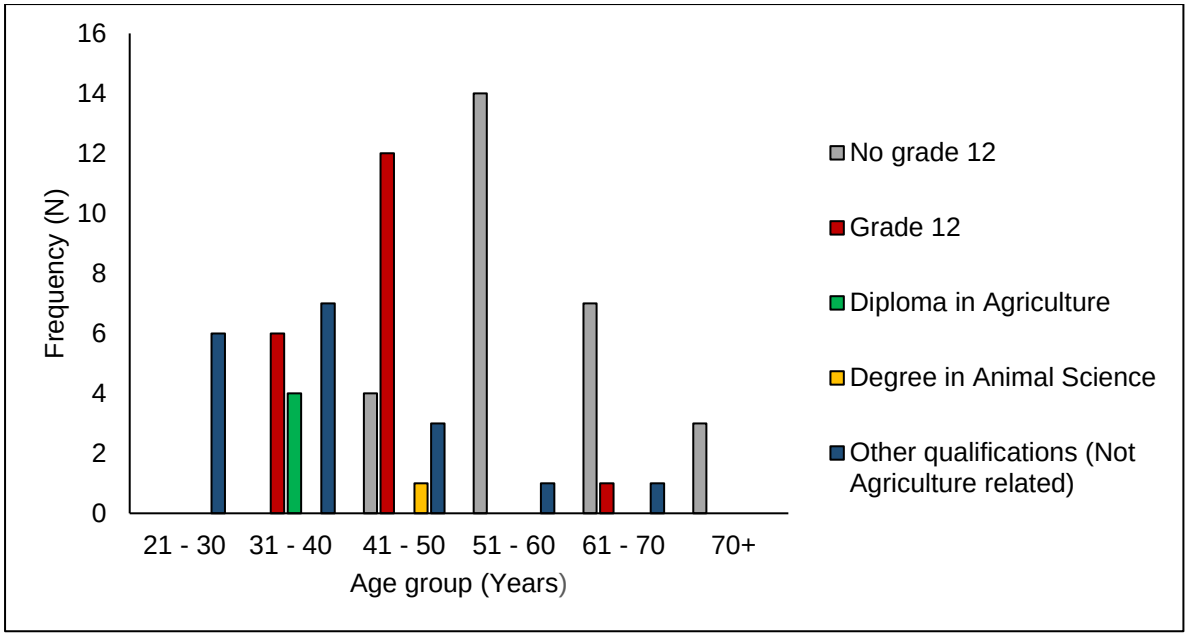


Figure 4.3: Educational level and age group of respondents in the uMgungundlovu district.

4.5 Land ownership

There are a few farmers that farm on rented land (n=7). Most farmers in the uMgungundlovu district are emerging farmers and small-scale farmers farming on own land (n =35) and those that farm on communal land (n=26). These results corroborate to a statement made by Kukung (2014:1) that a substantial portion of smallholder and emerging farmers in South Africa farm on communal land.

Table 4.4: Land ownership by respondents.

Land ownership	UMgungundlovu district	Total %
Communal land	26	37.14
Own land	35	50
Rented land	7	10
Other	*2*	2.86
Total	**70**	**100**

4.6 Breed types

Most farmers farm with Indigenous veld goats (n=55), followed by the Boer goat (n=7) and cross breeds (n=7). Farmers who farm with cross breeds stated that they breed the Boer goat with the Indigenous veld goats in order to get hybrid vigour. Louw (2018:1) opines that Indigenous goat farmers and breeders were previously mainly concentrated in the Eastern Cape Province, but are now found in the KZN Province, as well as other provinces of South Africa. The indigenous breeds recorded were the Nguni (Imbuzi) breed, Xhosa lob ear and Skilder. The table below (Table 4.5) shows the goat breeds of the assessed farmers.

Table 4.5: Goat breeds of assessed farmers.

Breed	Frequency	Total %
No response	1	1.4
Indigenous veld goats	55	78.6
Boer goats	7	10
Cross breeds	7	10
Total	**70**	**100**

4.7 Vegetation type and vegetation cover

The vegetation type comprises mainly grass on most farms (Table 4.6). A total of 57.14% respondents had grass as the dominant vegetation type on their farms. De Winnaar (2017:6) points out that vegetation types that are associated with the grassland biome dominate the uMgungundlovu district. They make up to 74% of the area, followed by savannah vegetation type with 22% and the remaining 5% consists of other biomes such as forest, coastal belt and azonal vegetation. Figure 4.4 shows that the vegetation cover was mainly dense, as reported by most farmers (71.4%).

Table 4.6: Vegetation type of respondents' farms in the uMgungundlovu district.

Vegetation type	UMgungundlovu district	Total %
Grass	40	57.14
Shrubs	1	1.43
Bushes	3	4.29
Mixed (Grass & shrubs)	*22*	31.43
Other	*4*	5.71
Total	**70**	**100**

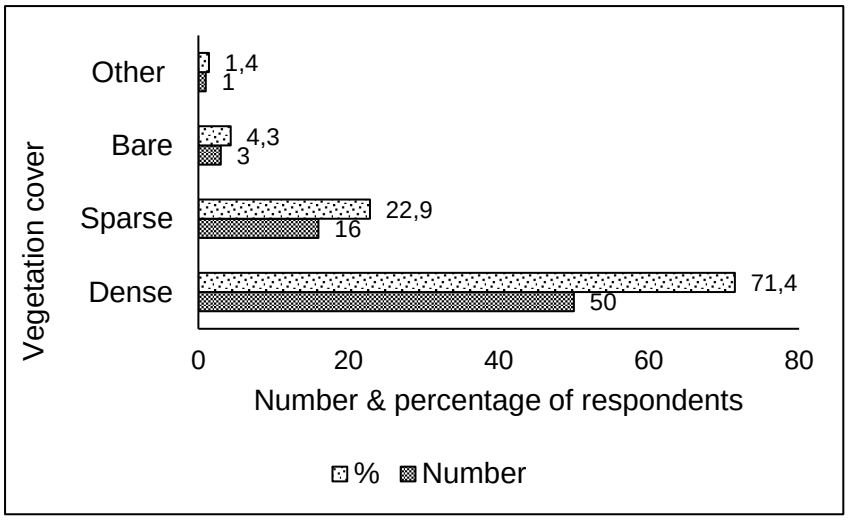


Figure 4.4: Vegetation cover of respondents' farms

4.8 Veld division

A single farm may have veld types differing in regard to nature of the vegetation, the palatability of plants and accessibility of certain parts of veld (Roux & Skinner, 2012:1). It is therefore important that veld should be separated by fencing off. Veld separation allows the utilisation of different plant communities (Van de Pol & Jordaan, 2008:40). Veld division is important to goat farming in KZN to protect vegetation from continual grazing. This allows the vegetation to grow, produce sees and establish root systems (Steyn, 2015:1). Thirty- one percent of farmers divided veld into camps, while 67% did not divide veld into camps. Hewett (2008:146) states that the separation of different

types of veld on a farm helps to keep the grazing inside each camp fairly uniform. In this study, some farmers stated that they did not have big enough land to divide into camps.

4.9 Farming system

The uMgungundlovu district had more farmers farming extensively (n=37), 53%, followed by a semi-intensive farming system with 40% (n=28) and intensive farming system with the lowest number of respondents (n=5) 7% (Figure 4.5). Odhiambo (2015:5) states that an extensive farming system is more common because less labour is required, and animal welfare is improved since animals are not kept in confined spaces. However, according to Prinsloo (2015) there is poor control over breeding, and this can lead to inbreeding.

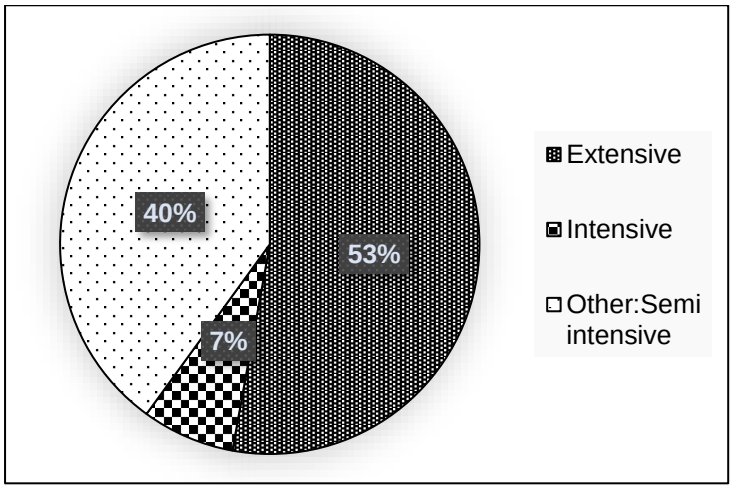


Figure 4.5: Farming system of respondents in the uMgungundlovu district.

4.10 Farm infrastructure

The figure 4.6 below illustrates the infrastructure and its condition, as given by the respondents. More than twenty-eight percent (28.6%) of respondents had poor fencing, 68.57% had no handling facilities and 34.3% had farm housing in moderate conditions. During the course of the study, farmers with no handling facilities stated that health management was mostly affected by that, as it is a challenge to vaccinate, dose and dip animals without handling facilities. This may result in stock losses. According to Fungo *et al*. (2017:94), adequate infrastructure raises farm productivity

and lowers farming costs. Farm infrastructure provides assurance for the supply of the agricultural inputs and facilitates delivery of farm outputs to the markets. All respondents (100%) had access to roads.

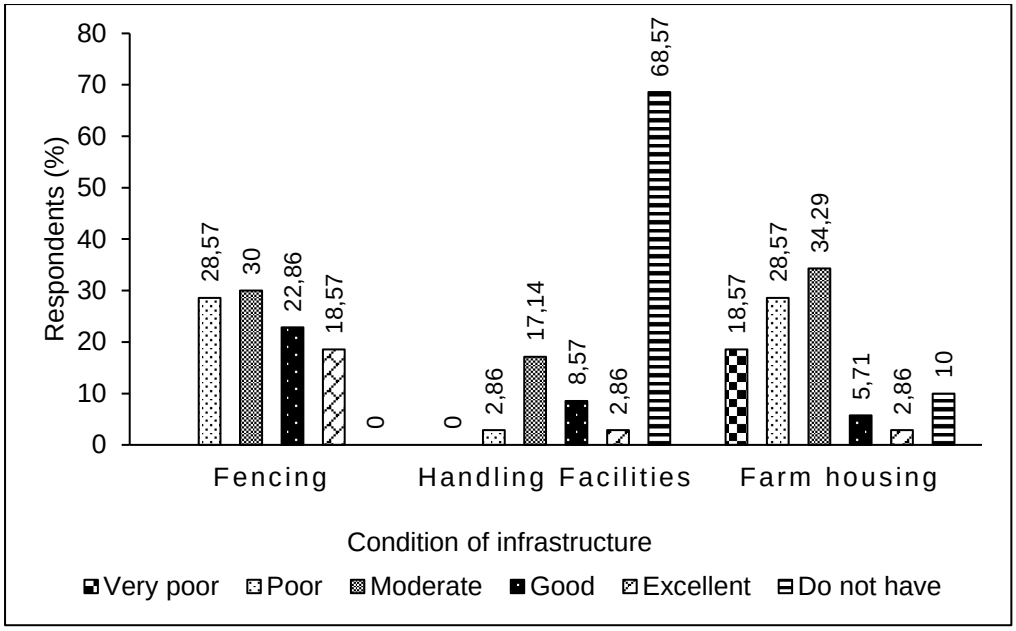


Figure 4.6: Farm infrastructure and conditions in the uMgungundlovu district

Conclusion

The study revealed that goat farming in the uMgungundlovu district is dominated by male farmers farming with indigenous veld goats, boer goats and crossbreeds. The average farm size in the uMgungundlovu district is 108.3 hectares (ha). The involvement of youth in goat farming is low, the average age of goat farmers in the uMgungundlovu district is 47 years. Engaging and including the youth in goat farming through local learnerships to improve knowledge and develop skills can help increase the involvement of youth in farming.

Most farmers in the uMgungundlovu district are emerging farmers and small-scale farmers farming on own land (n =35) and those that farm on communal land (n=26) and have acquired at least a primary level of education. Agriculture as a whole is evolving and becoming technologically advanced, an extension worker can help ensure that appropriate knowledge is applied to ensure the best of results.

Thirty-seven (53%) of farmers in uMgungundlovu district were farming extensively. Extensive farming requires less labour. Farmers should improve the farm fencing and handling facilities, as 28.6% farmers had fencing in poor condition and 68.6% had no handling facilities.

REFERENCES

AUCAMP, A.J., 2008. Linking cultivated pastures with rangelands. Grassroots: Newsletter of the Grassland Society of Southern Africa, Vol 8 No (8): pp19-25.

BESTER, J., RAMSAY, K.A. & SCHOLTZ, M.M., 2009. Goat farming in South Africa: Findings of a national livestock survey. Applied Animal Husbandry and Rural Development, Vol 2: pp 9–13.

De WINNAAR, G., 2017. UMgungundlovu District Municipality Environmental Management Framework: Terrestrial Biodiversity Report: pp 1-19.

DUBE, K., 2015. Characterisation of goat production systems in selected Coastal areas of the Eastern Cape province, South Africa. Master of Science in Agriculture, University of Fort Hare, South Africa.

ESA., 2011. Gender differences in assets: pp 1-34 [Online] Retrieved from: www.fao.org/economics/esa
Accessed: 18 February 2019

FAO-FOOD AND AGRICULTURE ORGANIZATION., 2017. Animal Production [Online] Retrieved from: http://www.fao.org/animl-production/en/
Accessed: 12 October 2019

FUNGO, E., KRYGSMAN, S. & NEL, H., 2017. The Role of Road Infrastructure in Agricultural Production, Stellenbosch University, South Africa, pp.94 -108.

GUO, G., WEN, Q. & ZHU, J., 2015. The Impact of Aging Agricultural Labor Population on Farmland Output: From the Perspective of Farmer Preferences: pp. 1-7 [Online] Retrieved from:
http://www.hindawi.com/journals/mpe/2015/730618
Accessed: 15 February 2019

GREENBERG, S., 2015. Why size matters for farmers [Online] Retrieved from: https://mg.co.za › article ›2015-03-12
Accessed: 19 February 2019

HASPEL, T., 2014. Small vs large: Which size farm is better for the planet? [Online] Retrieved from: www.washingtonpost.com Accessed: 19 February 2019

HEWETT, G., 2008. Veld conditions. Selecting and classifying grazing camps. *FCS Animal Production L3:* pp 146-150.

HOUSEHAM, S. D., 2011. Forage systems for goat production in South Africa. Master of Science in Agriculture Thesis. University of KwaZulu-Natal, South Africa.

JEWITT, D., GOODMAN, P.S., ERASMUS, B.F.N., O'CONNOR, T.G. & WITKOWSKI, E.T.F., 2015. Systematic land cover change in KwaZulu-Natal, South Africa: Implications for biodiversity. *S. Afr. J. Sci.* vol 111: pp 1-9.

KATIKATI, A., 2017. Assessment of production practices of emerging cattle farmers in the selected districts of the Eastern Cape Province, South Africa. MTech Thesis, Central University of Technology, South Africa.

KUKUNG B., 2014. Rural insight, Communal farming under threat. [Online] Retrieved from: https://www.farmersweekly.co.za/rural-insight/communal-farming-under-threat Accessed: 03 May 2019

LOUW M., 2018. Goat Breeds in South Africa [Online] Retrieved from: http://southafrica.co.za/goat-breeds-in-south-africa.html Accessed: 03 May 2019

LUBAMBO P.T., 2011. An appraisal of post-transfer production trends of selected land reform projects in the North-West Province, South Africa. MSc Thesis, University of Pretoria.

NGQANGWENI S. & DELGADO C., 2002. Decision on livestock keeping in the semi-arid areas of Limpopo province: pp.1-8

ODHIAMBO, J., 2015. Extensive Livestock Production with Emphasis on Extensive Livestock Breeding. [Online] Retrieved from: https://www.google.com/url?q=https://images.agri-profocus.nl/upload/post/ Accessed: 19 May 2016

ODURO-OFORI, E., ABOAGYE, A. & ACQUAYE, N., 2014. Effects of Education on the Agricultural Productivity of Farmers in the Offinso Municipality. International Journal of Development Research. Vol 6, pp 1951 -1960.

PRINSLOO, L., 2015. Boer Goat Minifarm. Grootfontein College of Agriculture.

ROUX, P.W. & SKINNER, T.E., 2012. The group camp system. Farming in South Africa 45 (10) [Online] Retrieved from: https://gdi.agric.za/articles/Agric/groupcamp.php Accessed: 18 January 2019

SIHLOBO, W. & KAPUYA, T., 2018. Role of women in Agriculture: South Africa [Online] Retrieved from: http://www.farmingportal.co.za/index.php/farminglifestyle/agri-women/438-role-of-women-in-agriculture-south-Africa Accessed: 26 May 2019

STATSSA- Statistics South Africa., 2011. Profile of older persons in South Africa. Report-03-01-602011.pdf: pp.41-48.

STEYN, J., 2015. Goat farming: nutrition and veld management. *Farmer's Weekly*. [Online] Retrieved from: https://www-farmersweekly/farm-basics/how-to-livestock/ Accessed: 22 December 2020

TAUER, L., 1995. Age and Farmer Productivity. Journal of Review of Agricultural Economics Vol 17, No 1: pp. 63-69

VAN DE POL, R. & JORDAAN, J.J., 2008. The fodder bank system: its current place in veld management. Grassroots: Newsletter of the Grassland Society of Southern Africa. Vol 8. No1 36-44.

CHAPTER FIVE

Profiling of Management practices in goat farming in selected district of KwaZulu Natal

5.1 Introduction

This chapter focuses on production practices and therefore management practices and their effects on goat production are discussed. Animal health, animal nutrition, general goat management practices and breeding management will also be discussed in this chapter.

5.2 Animal health

5.2.1 Parasite control

Parasite management is about managing risk, as reducing the risk of parasite infestation is important to any goat production operation. Stehman and Smith (2004:1) state that the effect of parasitism is determined by the interactions between the type of parasites present in an area, parasite life cycles, the environmental weather conditions and the type of farm management.

5.2.1.1 Internal parasites

This study shows that 94% (n=66) of the respondents controlled internal parasites, while 6% (n=4) did not (Figure 5.1). A systematic way to consider internal parasites is by the orgasms in which they inhabit (Bibby, 2015:1). There are only a few tested drugs to treat parasites in goats and sheep (Villarroel, 2013:3). In this study, a meagre of farmers does not buy deworming remedies and are of the opinion that homemade remedies are better. The grazing animals are always exposed to parasite and are constantly being re infected in chain reactions mode (Kumar, Rao, Varghese & Rathor, 2013:151). The problems associated with parasites, especially those in the gastrointestinal tract of goats can cause major damage or even death (Hepworth, year unknown: 1). Sixty-six respondents (Figure 5.2) controlled parasites, of which 51.5 % use the oral dosing method, (12.1%) injecting and those who use both the dosing and injection method account to 36.4%.

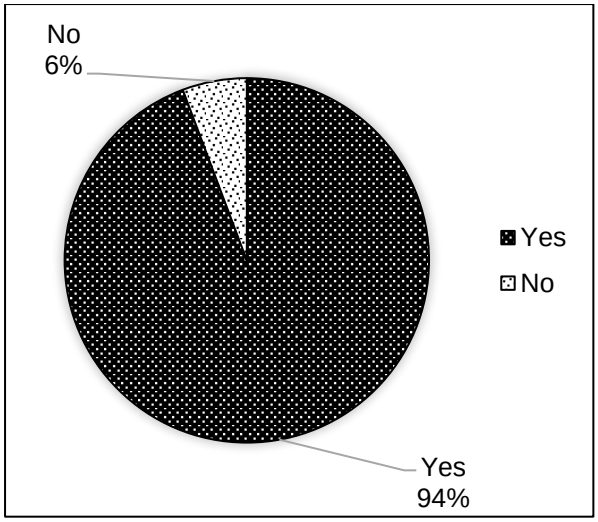


Figure 5.1: Control of internal parasites by respondents

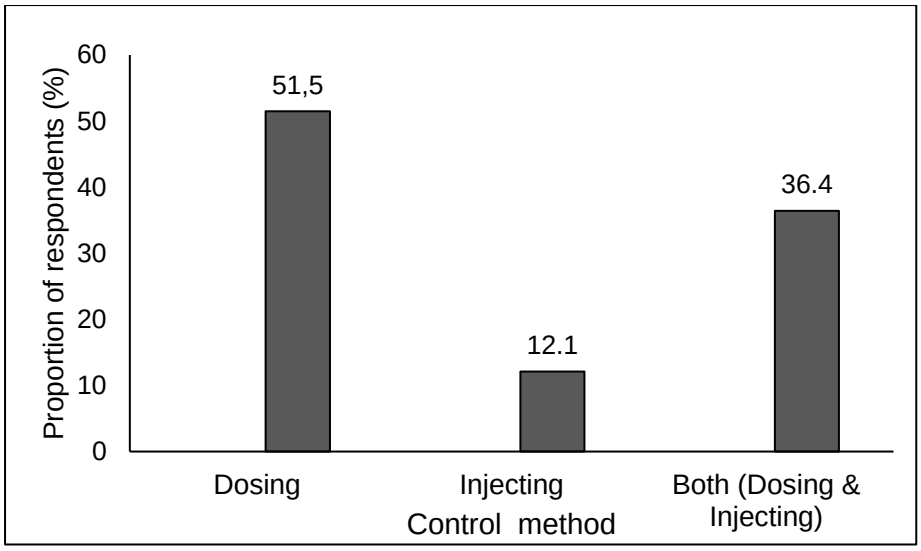


Figure 5.2: Respondents' method of controlling internal parasites

5.2.1.2 External parasites

Figure 5.3 below shows that 95.7% of the respondents controlled external parasites and 4.3% did not control at all. Ticks were a major problem, resulting in heartwater disease (also known as Ehrlichiosis). Heartwater disease can be fatal and usually begins with fever and may involve neurological signs and respiratory distress (Yunker, 1996:159). Respondents use different methods of controlling external parasites, with most farmers using the spot treatment method (n=31) and the least used method is the injectable method (n=12).

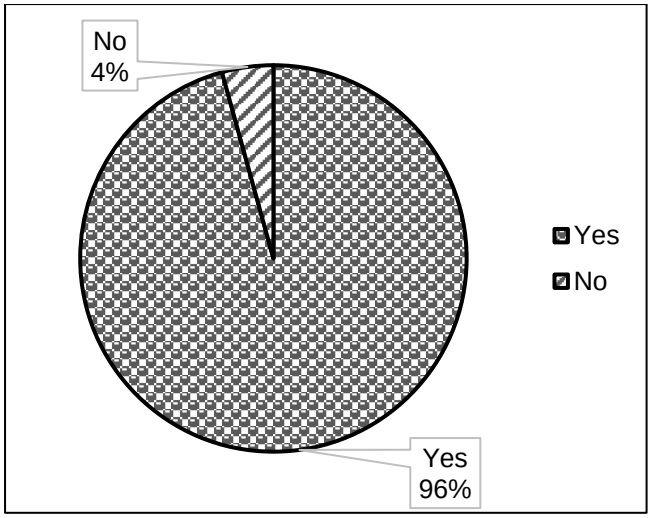


Figure 5.3: Control of external parasites by respondents

Table 5.1: Respondents' method of controlling external parasites

Control method	No. of farmers	Total %
Plunge/Spray dip	24	34.3
Injection	12	17.1
Spot treatment	31	44.3
Other	-	-
Do not control at all	3	4.3
Total	**70**	**100**

5.2.2 Animal vaccination

Figure 5.4 shows the diseases against which the interviewed farmers vaccinate. A total of 18 (25.7%) farmers do not vaccinate at all, while 52 (74.3%) vaccinated at least against one disease. Most farmers stated that they hardly buy vaccines because they are expensive instead, they would rather buy PulpyVax because it is affordable. Their statement was in line with the findings of this study; revealing that the highest proportion of respondents vaccinated for pulpy kidney (61.5%). According to Rowe (2016), prevention is better than cure and it is therefore important that any goats introduced to an existing flock be disease- free and healthy. It is important to have a strict vaccination programme to control common diseases.

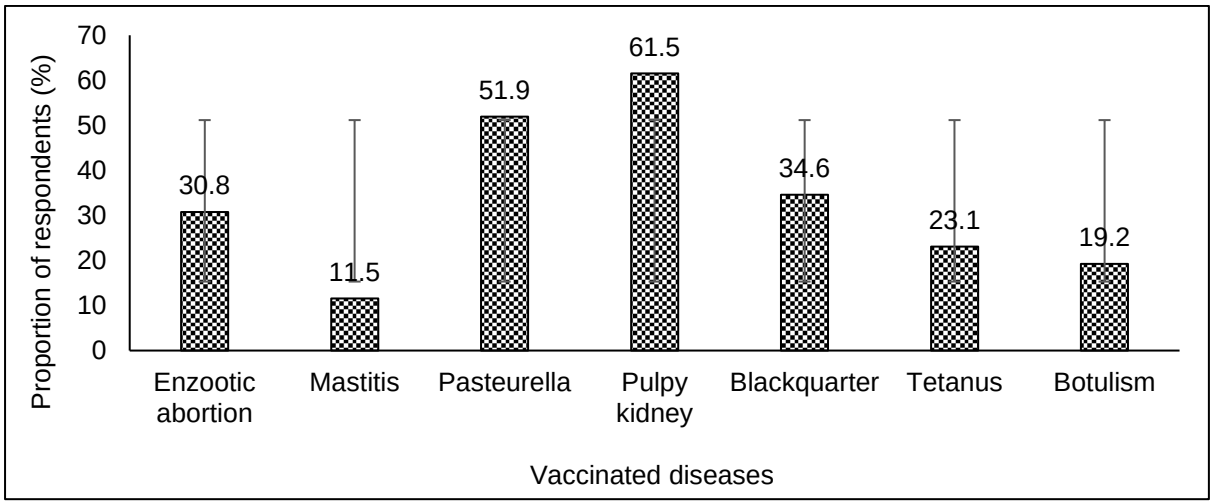


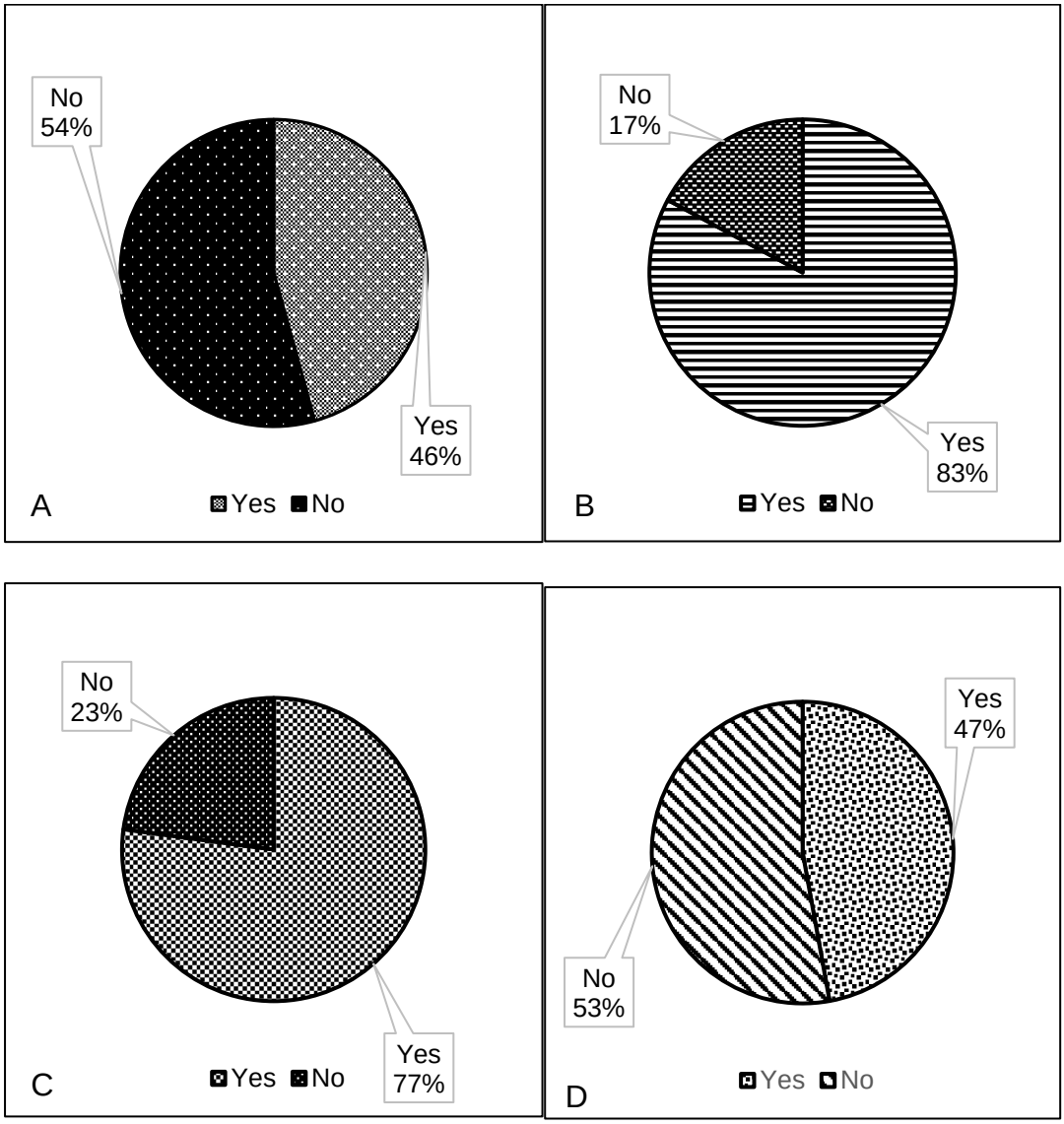
Figure 5.4: Vaccinated diseases by respondents

5.3 Animal nutrition

The nutrition of goats is the most important factor affecting performance. Poor nutrition results in lower rates of production (Senthilkumar & Purushothaman, 2017:13). Vatta *et al*. (2015:1) point out that goats obtain most of the nutrients they need from grazing. In the dry season however, the quality of available forage decreases, and it becomes important to provide supplementary feed to the flock.

Figure 5.5-A indicates that 46% of respondents provide supplementary feed while 54% does not provide any supplementary feed. Some of the respondents stated that feed is expensive, therefore they graze animals on the veld without the provision of additional supplementary feed. Figure 5.5-C shows that 77% of the farmers graze their animals. Most of the farmers (83%), as indicated in figure 5.5-B, provided

supplementary licks, while 17% did not provide supplementary licks. There were few reasons for that, some respondents stated they did not have knowledge of supplementary licks and did not see the need for them, as they are expensive.



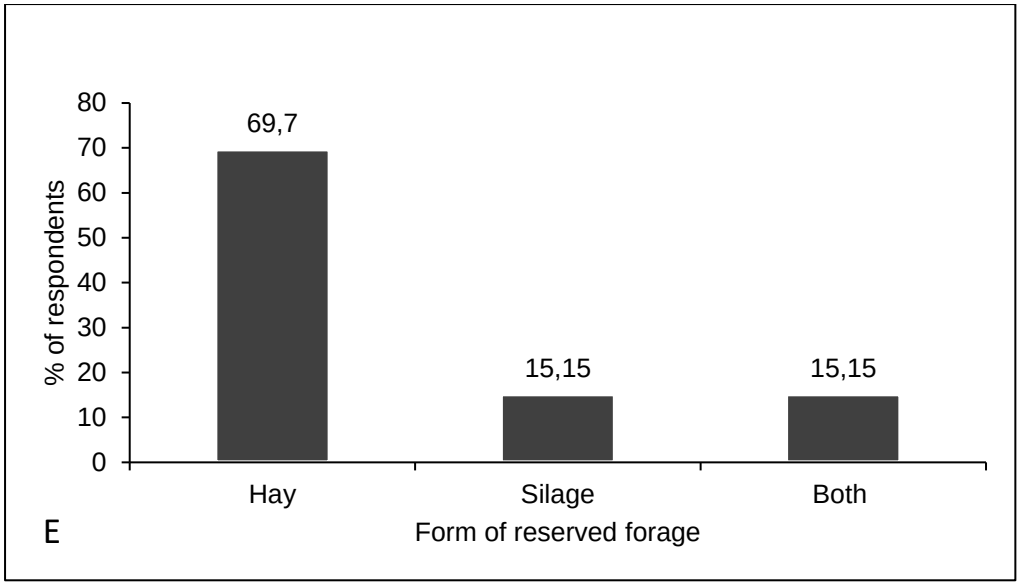


Figure 5.5: *A-* Provision of supplementary feed (Winter/Summer) by respondents; ***B-*** Provision of supplementary lick by respondents; ***C-*** Grazing animals on veld; ***D-*** Forage reservation by respondents; ***E-*** Form of forage reservation by farmers.

Figure 5.5-D confirms that 47% of respondents had forage stored while 53% did not reserve any forage. Those that kept forage, reserved it in the form of hay (69.7%), silage (15.2%) and 15.2% in both silage and hay form. (Katikati (2017:72) noted that a limiting factor could be lack of information, because there are procedures to be followed when conserving feed forage to reduce waste and produce nutritive and economic feed.

5.4 General management

5.4.1 Castration

Table 5.2 demonstrates general management practices by farmers, namely castration, tagging and hoof trimming. In this study, 60% of respondents castrated their bucks with most farmers (27.1%) using the elastrator method. The interviewed farmers stated that this method is the safest and easiest, while 24.3% used a burdizzo. Yami (2009) states that castration is important to control and maintain the breeding programme. A considerable amount of 40% famers did not castrate at all, this could

be because this method is the most painful and according to Yami (2009:12), it has the greatest potential of infection and fly infestation.

5.4.2 Animal identification

Stuart (2016) opines that being able to identify individual animals on the farm is critical to good farm management. Table 5.2 shows that 67.1% of farmers used the ear tag application method to identify livestock while 10% used ear notching and (2.9%) ear tattooing. Stuart (2016) further explains that ear tagging is not as reliable as ear notching and ear tattooing. Most farmers in this study found the ear tag application method the quickest and easiest procedure.

5.4.3 Hoof trimming

Hoof trimming is an important aspect of goat management. Animal Welfare (2013) states that hoof growth should be checked regularly because overgrown hooves may make walking painful, expose the animal to other foot and leg problems and competing for feed may become difficult. Table 5.2 shows that 38.6% of the respondents trimmed hooves while 61.4% did not trim hooves. Some of the respondents stated that they did not see a need to trim hooves which could be due to lack of knowledge. Animals with overgrown hooves are susceptible to joint and tendon problems. The amount of time between trimmings depend on factors such as the goat's age, level of activity, nutritional level and even the type of breed (Nix,2014). Once a farmer is familiar with how a hoof should look like, this practice will be easier.

Table 5.2: General management practices by respondents (Castration, animal Identification and hoof trimming)

General management activity	Method	Number of respondents	Percentage of respondents
Castration	Burdizzo	17	24.3%
	Elastrator	19	27.1%
	Knife	6	8.6%
Do not castrate	-	28	40%
Animal identification	Ear notch	7	10%
	Ear tag	47	67.1%
	None	14	20%
	Other (Tattoo)	2	2.9%
Hoof trimming	Yes	27	38.6%
	No	43	61.4%

5.5 Breeding management

Figure 5.6 indicates the breeding management practices by interviewed farmers. A total of 17 farmers (24.3%) had a specific breeding season, while 75.7% (n=53) had no particular breeding season. All 17 farmers (24.3 %) employed the group mating system. Four (5.7%) respondents tested their breeding bucks for fertility, while 18.6% were flush feeding does prior to breeding. This could be because of lack of knowledge, as some of the interviewees stated that they were not aware of this management practice. Eight farmers (11.4%) were doing a pregnancy diagnosis and 88.6% (n=62) did not do any pregnancy diagnosis. Karadaev (2015:184) points out that pregnancy diagnosis is essential for improved efficacy and management of reproduction.

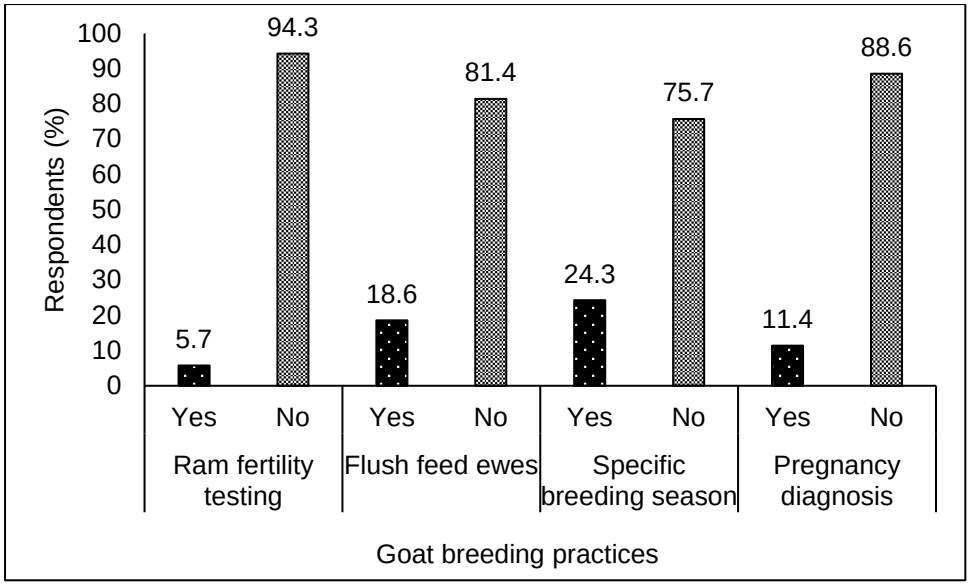


Figure 5.6: Goat breeding practices

5.5.1 Doe management

A total of 17 (24.6%) farmers reported that they separated does before breeding 12.9% separated the does according to age, while 11.4% of farmers separated them according to both age and weight. Four farmers (5.7%) separated their does after kidding and 21.4% housed does that have kidded. The separation of pregnant and non-pregnant does into different groups reduces losses from abortions and stillbirths (Karadaev, 2015:184).

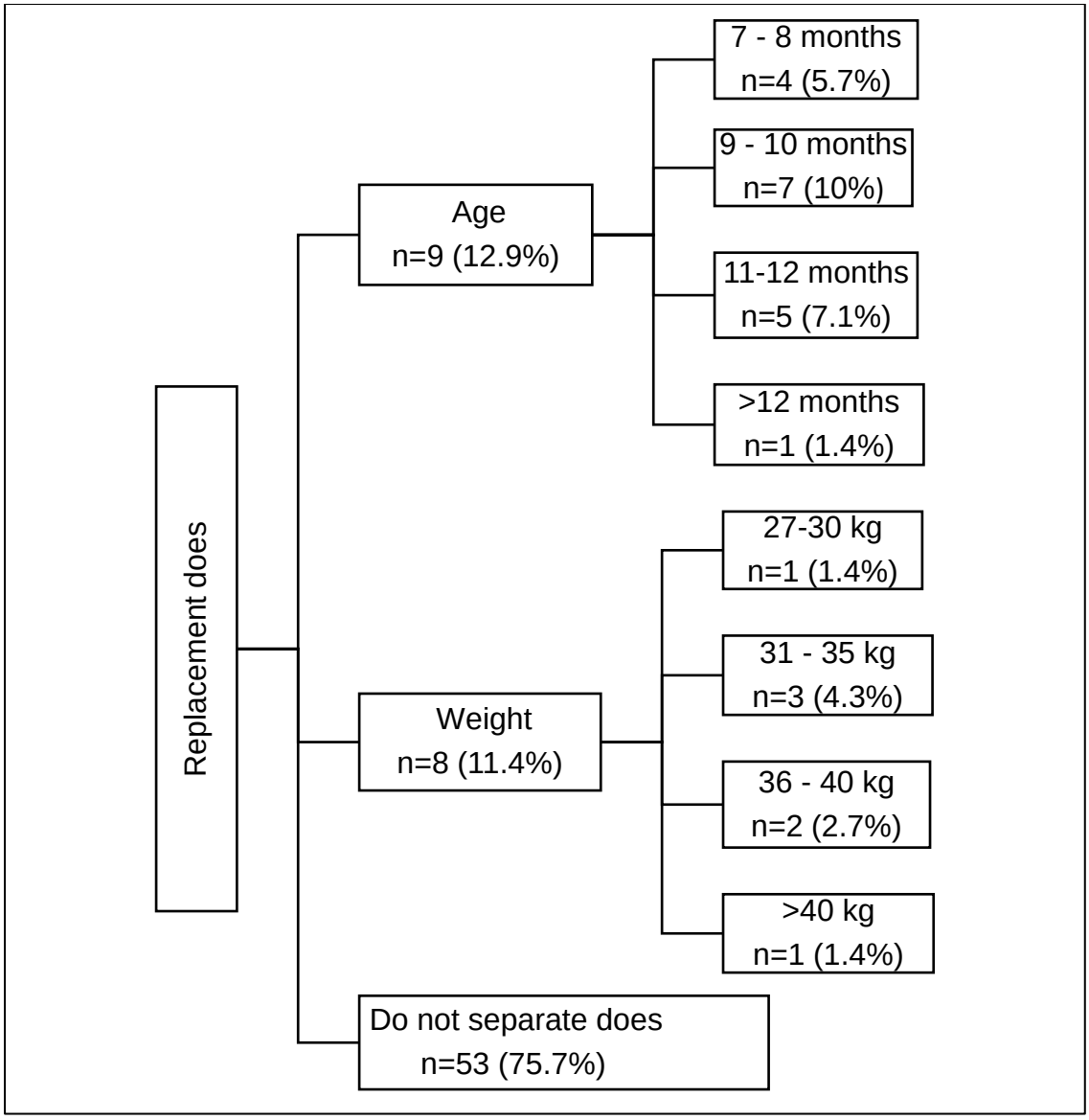


Figure 5.7: Replacement does separated before mating

5.5.2 Reproduction parameters

To establish the productivity of the goats in the uMgungundlovu district; the conception rate, kidding rate, weaning rate and mortality rate were computed (Figure 5.8). The district had a total of 3 497 and 63.6% (n= 2 212) of those does were bred during the years 2017/2018. The conception rate, which is used to express the proportion of does that kidded compared to the does that had been mated, for this study was 71.7%. According to Olivier (2014:1), the ideal conception rate is above 90%, therefore these results are questionable. Davila (2017:95) points out that factors that affect conception rate include nutritional management and body condition of goats. Figure 5.5-A shows that 54% of respondents did not provide winter and summer supplementary feed and

only 18.6% of farmers were flush feeding their does (Figure 5.6). In relation with this study, the conception rate could be influenced by knowledge, and consequently nutrition management. The effect of reduced fertility due to inadequate nutrition was also reported in communal goats by Chikwanda (2004:75).

Ensuring a proper nutritional management programme throughout the doe's production cycle ensures a high kidding percentage (Van der Vyver, 2014). The kidding rate was 84.8% (Figure 5.8). Does with low body condition scores will display reduced reproductive performance compared to than those with greater body condition scores (Kenyon, Maloney & Blache, 2014:45). The kidding percentage can range from below 100 to above 100, depending on the number of kids that were born (Olivier, 2014:1).

A farmer has the ability to control or manipulate factors that influence the reproductive performance of livestock by having a strict selection of breeding animals, providing correct nutrition and having a strategic and suitable deworming and vaccination programme (Petrovic, Muslic, Maskimovic, Ilic, Milosevic, & Stojkovic, 2012:519). The fecundity, which expresses the number of kids born per doe, was 1.2 kids per doe. A relatively low fecundity means that a small proportion of does produced one kid in the breeding season (Olivier, 2014:2).

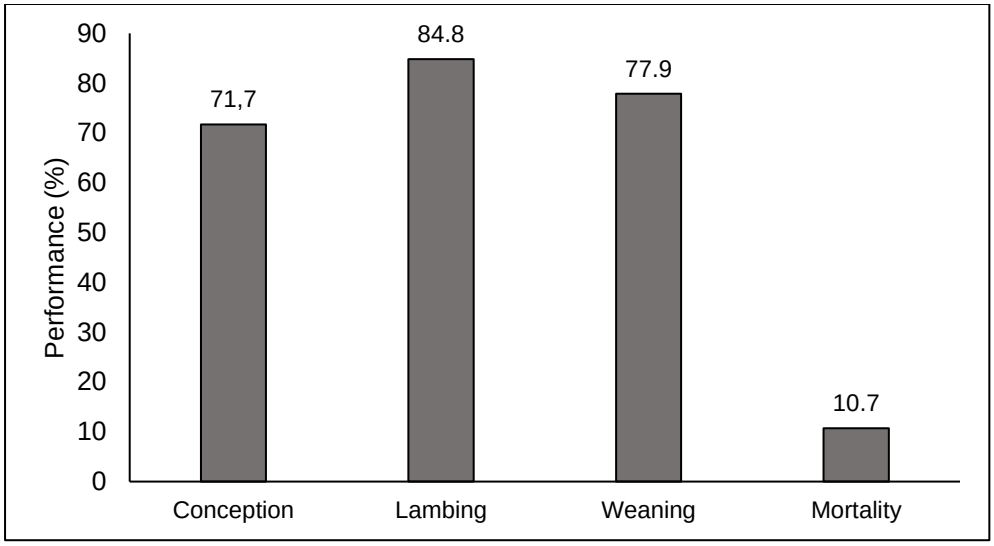


Figure 5.8: Reproductive performance of goat flock in the uMgungundlovu district

Figure 5.8 shows that the weaning percentage was 77.9%. Weaning is an important parameter which assists in identifying problems during the breeding season, especially with regard to the ability of does to successfully rear good quality kids (Olivier, 2014:2).

Mortality was 10.7%. Snyman (2010:54) reports that the most common causes of death were predators and small kids abandoned by does. In this study, however, the most prevalent causes of mortality were predation (64.5%), diseases with 45.2%, inclement weather (35.5%) and poor mothering abilities (17.7%%); while twelve respondents experienced problems with theft. Theft and predation problems may be due to the condition of the fencing, because 28.6% (Figure 4.4) reported to have poor fencing. Farmers should aim at keeping the mortality rate as low as possible.

5.5.3 Housing

Dube (2015) states that in the communal areas, goat enclosures are generally characterized by open or roofed kraals made of locally available resources, especially wood poles. The indoor housing of ruminants has received critical observation because of perceived intensiveness and lack of naturalness (Zobel, Neave & Webster 2018:212). A total of 14 (20%) farmers enclosed does that had kidded and does that were lactating.

Table 5.3: Type of housing for kidding and lactating does

Type of housing	No. of farmers	Total %
Brick wall without roofing	6	8.6
Brick wall with roofing	7	10
Wooden poles with roofing	-	-
Open pen without roofing	-	-
Other	1	1.4
No housing	56	80
Total	**70**	**100**

5.6 Culling of animals

Farmers got rid of animals that did not measure up to their standards for various reasons (Figure 5.10). Most farmers were culling for functional traits (faulty teeth at 26.3% and faulty legs and inverted eyelids at both 25.3% respectively). For reproduction, only a few farmers (31.6%) removed infertile bucks while most (35.1%) culled dry does. Old bucks and does were culled by 34.9% of the farmers. Most

farmers stated that they mostly sold their cull animals to private buyers for traditional purposes. However, some kept these cull animals for own slaughtering.

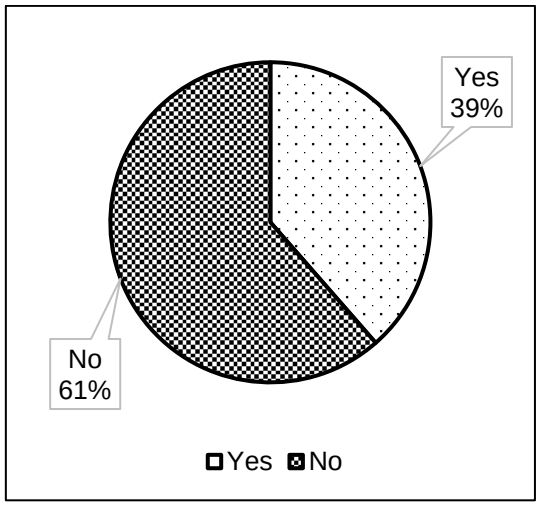


Figure 5.9: Farmers with culling programme in the uMgungundlovu district

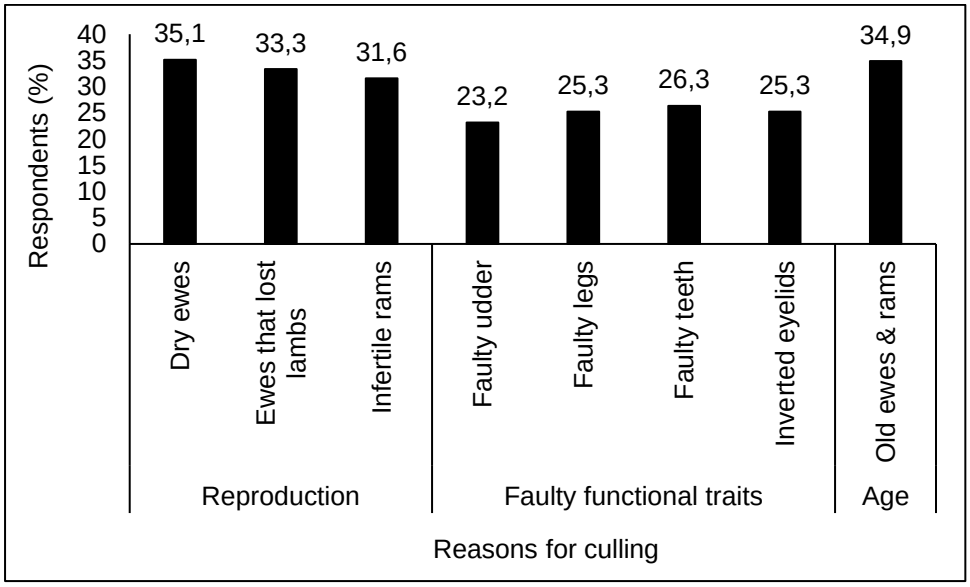


Figure 5.10: Reasons for culling by respondents

5.7 Farm income

Figure 5.11 indicates the percentage of farmers that sold their goats and the percentage that did not sell goats. Of the 9% of respondents that did not sell their goats, most stated that having more animals in the herd is regarded as a form of wealth, therefore they would rather keep them. This could be influenced by the level of education and the principles of the past. However, these farmers had other sources of income.

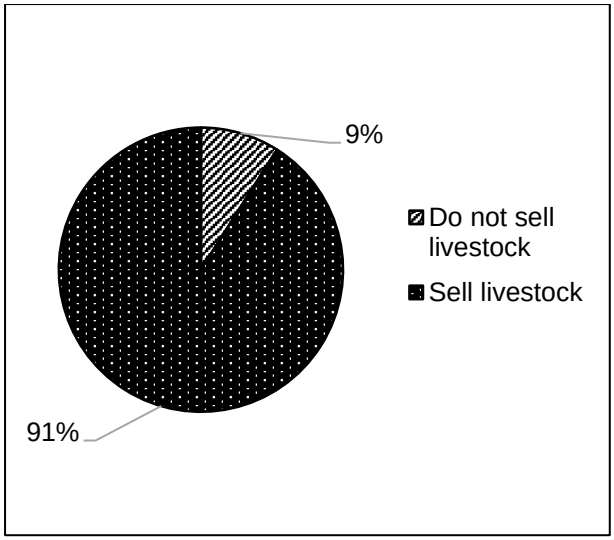


Figure 5.11: Livestock marketing

An average of R33 614.29 was made from selling goats in the uMgungundlovu district, but nine (12.86%) respondents were not willing to share their sales record and four respondents (5.71%) did not keep financial records at all, and therefore could not share their sales information.

5.8 Marketing channels

Simon (2013) states that goat meat is an important food source worldwide. The availability of goat meat in South Africa is low compared to lamb, mutton and other red meat. In this study (figure 5.12), the majority of the farmers (60%) sold their goats to private buyers.

The marketing channel that was least used by the farmers was abattoirs (4%), auctions (14%), butchers (10%) and speculators (12%). The majority of meat goats marketed in South Africa are sold privately in the informal market to be slaughtered for religious or traditional purposes. The choice of marketing channel depends on a number of issues which include the availability of market, prices offered in the market and the distance to the market (Sehar, 2018:9).

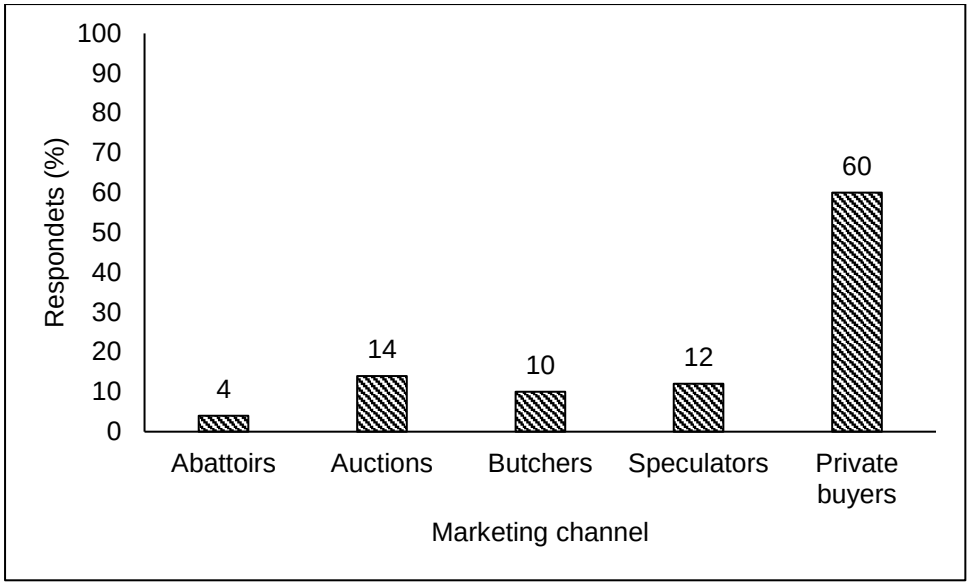


Figure 5.12: Marketing channels

5.9 Sources of information

Table 5.4 displays the sources of information and the proportion of respondents. Most farmers (36.2%) obtained their information from farmers' days, while many rely on information from face -to -face exchanges (Mittal & Mehar, 2015:11). Agricultural magazines constituted the second most important source (33.3%), then fellow farmers at 31.9% and extension officers (27.5%).

Table 5.4: Sources of information

Source of information	Respondents (%)
Agricultural magazines	33.3
Extension officers	27.5
Farmers' days	36.2
Fellow farmers	31.9

Conclusion

Farmers are aware of management practices such as control of internal and external parasite, vaccination, importance of nutrition and general management of goats, however, the execution is outdated and there is a great lack of knowledge. Farmers vaccinated at least against one disease; the most vaccinated disease was pulpy kidney (61.5%).

The kidding percentage in this study was 84.8% and the mortality rate was 10.7%. The majority of the farmers (80%) did not have housing for kidding and lactating does, this could've attributed to kid mortality.

Farmers relied greatly on other farmers for information, in which case the information may be inaccurate, one-sided or outdated. Farmers used different marketing channels. The majority of farmers sold their livestock privately, and this led to farmers selling their animals at substandard prices.

Lack of information and poor involvement of government services by extension workers resulted in farmers making poor marketing choices and not being profitable. Most farmers however, had other sources of income.

REFERENCES

ANIMAL WELFARE. 2013. Why is it important to regularly trim the feet of sheep and goats? [Online] Retrieved from: https://articles.extension.org/pages/67152/ Accessed: 28 May 2019

BIBBY, T., 2015. Internal Parasites of Goats. Shepton Vets. [Online] Retrieved from: https://sheptonets.com/post/2015/12/01/internal-parasites-ofgoats/59/ Accessed 26 December 2020

CHIKWANDA, A.T., 2004. Characterisation of goat production systems and productivity in Rushinga communal area. M.Phil. Thesis, University of Zimbabwe, Harare, Zimbabwe:, pp. 1-87.

DAVILA, F.S., 2017. Reproduction in Goats. Goat Science. [Online] Retrieved from: https://www.intechopen.com/books/goat-science/reproduction in goats/ Chapter 5, pp. 87-105. Accessed: 10 October 2019

ECONOMIDES, S., 1986. Nutrition and Management of sheep and goats. Small ruminant production in the developing countries. Food and Agriculture Organization, pp. 61-73.

HEPWORTH, K., Unknown year. Managing internal parasitism in sheep and goats. University of Kentucky. [Online] Retrieved from: https://www.extension.purdue.edu/extmedia/as/as-573-w.pdf Accessed: 16 May 2019

KARADAEV, M., 2015. Pregnancy diagnosis techniques in goats. Bulgarian Journal of Veterinary Medicine, vol 18, pp. 183 -193.

KATIKATI, A., 2017. Assessment of production practices of emerging cattle farmers in the selected districts of the Eastern Cape Province, South Africa. MTech Thesis, Central University of Technology, South Africa, pp. 1-129.

KENYON, P.R., MALONEY, S.K., & BLACHE, D., 2014. Review of sheep body condition score in relation to production characteristics. New Zealand Journal of Agricultural research. Vol 57 pp.38-64.

KUMAR, N., RAO, T.K.S., VARGHESE, A. & RATHOR, V.S., 2013. Internal parasite management in grazing livestock. *Journal of Parasitic Diseases*, 37(2) pp. 151-157.

LU, C.D. & POTCHOIBA, M.J., 1987. Milk feeding and weaning of goat kids- A review. American Institute for Goat Research, Langston University, U.S.A.

MITTAL, S. & MEHAR, M., 2015. Socio-economic factors affecting adoption of modern information and communication technology by farmers in India: Analysis using Multivariate Probit Model. The Journal of Agricultural Education and Extension, pp. 1-14.

NIX, J., 2014. Hoof Trimming in Goats. [Online] Retrieved from: https://www.thesheepsite.com/articles/11/hoof-trimming-in-goats Accessed: 03 October 2019

OLIVIER, W.J., 2014. Calculation of reproduction parameters. Info pack: AP 2014/032 Grootfontein Agricultural Development Institute.

PETROVIC, M., PETROVIC, C., MUSLIC, R., MASKIMOVIC, N., ILIC, Z., MILOSEVIC, B. & STOJKOVIC, J., 2012. Some important factors affecting fertility in sheep. Biotechnology in Animal Husbandry vol 28, pp.517-528.

PRINSLOO, L., 2015. Boer Goat Minifarm. Grootfontein College of Agriculture.

ROWE, A., 2016. Basic goat health management: all you need to know. [Online]

Retrieved from:

https://www.farmersweekly.co.za/animals/sheep-goats-health-management-all-you-need-to-know/

Accessed: 20 May 2019

SEHAR, M., 2018. Factors influencing market access and livestock marketing inefficiency in Mpumalanga Province, South Africa. Master of Science thesis. University of South Africa, pp. 1-93.

SENTHILKUMAR, S. & PURUSHOTHAMAN, M.R., 2017. Role of feeding in improved production and productivity of intensive goat farms. *Veterinary College and Research Institute*, pp13-20.

SIMON, M., 2013. Marketing Meat Goats. The Basic System. State Specialist for Small Farm and Part-time Farmers. Kentucky State University Cooperative Extension Programme.

SNYMAN, G., 2010.Factors affecting pre-weaning kid mortality in South African Angora goats. South African Journal of Animal Science, 40, pp. 54 -64.

STEHMAN, S. & SMITH, M., 2004. Goat Parasites: Management and Control. [Online] Retrieved from:

http://goatdocs.ansci.cornell.edu/Resources/GoatArticles/GoatHealth/GoatParasites/Parasites-SM.pdf

Accessed: 05 May 2019

STUART, B., 2016. Ear tagging livestock important for identification. The Weekly Times.

VAN DER VYVER, F., 2014. Optimum nutrition for breeding ewes. Farmer's Weekly [Online] Retrieved from:

https://www.farmersweekly.co.za/animals/sheep-goats/

Accessed: 22 June 2019

VATTA, M., DE VILLIERS, JF., GUMEDE, S., HARRISON, L.J.S., KRECEK, LETTY, B.A., MAPEYI, N. & PEARSON, R.A., 2015. Feeding goats [Online] Retrieved from: https://www.farmersweekly.co.za/farm-basics/how-to-livestock/basic-goat-management-and-feeding/ Accessed: 28 May 2019

VILLARROEL, A., 2013. Internal Parasites in Sheep and Goats. Extension Veterinarian, Oregon State University pp.1-4

YAMI, A., 2009. Castration of sheep and goats. Technical Bulletin No.18. Ethiopia Sheep and Goat productivity Improvement Program. R.C Merkel 12Pp.

YUNKER, C.E., 1996. Heartwater in sheep and goats: A review. Onderstepoort J Vet Res. 1996 Jun; 63(2): 159-170.

ZOBEL, G., NEAVE, H.W. & WEBSTER, J., 2018.Understanding natural behaviour to improve dairy goat (*Capra hircus*) management systems. *Translational Animal Science*.3:212-224.

CHAPTER SIX

Effect of various management practices on goat production

6.1 Introduction

Understanding reproduction in goats is essential to increase productivity, which is largely a function of pregnancy rate, kidding rate, weaning rates and the frequency at which kids are born (Extension, 2019). Profit in the livestock industry depends on the efficiency of production, which is determined by the optimal growth of animals (Mwosu, 2019:12). Increased reproduction in any type of goat would contribute to improved efficiency (Shelton, 1978:994).

The following four production variables were investigated: conception rate, lambing percentage, mortality rate and weaning percentage. Management practices investigated were: internal parasite control, external parasite control, provision of supplementary feed during winter and summer, provision of supplementary lick; fertility testing of bucks before mating; provision of flush feed before breeding season starts, the presence of specific breeding seasons and pregnancy diagnosis.

6.2 Internal parasites

Internal parasites are a major health problem in the livestock industry, as they cause retarded growth, poor reproductive performance, condemnation of goat carcasses in abattoirs and high kid mortality (Chikwanda *et al*., 2013:32). Dube (20015:49) reports parasites as one of the main causes of mortality in goats. Hepworth *et al*. (2006:4) state that the grazing habits of sheep and goats make them more susceptible to parasites than other species; however, rotational grazing techniques can lower the parasite problem in the herd. Grazing animals are always exposed to parasites and are constantly being re-infected in chain reaction mode (Kumar *et al*., 2013:151).

Stress (including nutritional stress) weakens immunity and does carrying multiple kids tend to have more stressed immune systems and heavier worm loads than does with single kids. Therefore, keeping does on a good plane of nutrition before and after kidding may reduce their parasite load and minimize the effects of internal parasites (Wallace, 2012:41). A total of 77% respondents grazed their goats on veld. In this study, 30% of farmers (n=21) practise rotational grazing. The main objective of pasture rotation is not to put the animals back into the same field until the risk of infestation

has diminished, which means that parasitism will decrease if rotation time is increased (Kumar *et al*., 2013:153).

The only statistically significant difference was for the kidding percentage variable (Table 6.1). Respondents who controlled internal parasites had a statistically significant ($P < 0.05$) higher kidding percentage than respondents that did not control internal parasites. A does' body condition can be affected by internal parasites (Prinsloo, 2015). On the other hand, Van der Vyver, (2014) indicated that the doe flock's condition and kidding percentage are positively correlated.

Table 6.1: The effect of internal parasite control on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No control	Control	No control	Control	No control	Control	No control	Control
94,4%	77,6%	165%	89,1%	5,8%	9,45%	105,5%	77,9%
P= 0.092		**P=** 0.013		**P=** 0.489		**P=** 0.301	

***Significant at *P* <0.05

6.3 Supplementary feed and flush feeding

A major determining factor of the reproductive success in does is the relation between their live body weight and their body shape and their body condition score (Sawyer & Narayan, 2019:10). The nutrition of a doe throughout the reproductive cycle should be adequate to ensure optimum reproduction during critical periods such as before mating, during mating and after mating (Snyman, 2010:52). Furthermore, animals with higher nutrient requirements should be prioritised in supplementation so as to maintain high goat productivity (Dube, 2015:16).

6.3.1 Provision of supplementary feed during winter and summer

It is a well-known fact that supplementary feeding (flushing) before mating and during lactation affects reproductive performance positively (Snyman, 2010:46). Does should nutritionally replenish losses from the previous kidding during the time between weaning and mating (Rathod *et al*., 2018:239). Rathod *et al*. (2018:239), further state that it is advisable to increase the level of nutrition before mating and after mating because this will result in higher ovulation and conception rates.

In this study, (Table 6.2) there was a statistically significant difference (*P* <0.05) in the kidding percentage where supplementary feed was provided. A significantly higher (*P* <0.05) kidding percentage with the provision of supplementary feed was obtained, with a kidding percentage of 97.4%. Mwuso (2019:13) explains that nutrition during conception and pregnancy in animals contributes meaningfully to the ability of an animal to conceive and complete a successful pregnancy. In a similar fashion, there was a statistically higher (*P* <0.05) weaning percentage (83.4%) with the provision of supplementary feed. High pre-weaning losses are reduced with adequate nutrition during lactation, among other factors (Sebei *et al.,* 2004:132). Nutritional deficiencies during pregnancy lower the reproductive performance of goats and in some cases result in kid mortality (Kusina *et al*., 2001:283). This is contradictory to the results in this study as it shows that there was a statistically significant difference in the mortality rate where supplementary feed was provided, these results are questionable. It may be possible that the answers given by the respondents were not accurate.

Table 6.2: The effect of provision of supplementary feed during winter and summer on conception rate, kidding percentage, mortality rate and weaning percentage.

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No suppl. Feed	Suppl. Feed	No suppl. Feed	Suppl. Feed	No suppl. feed	Suppl. Feed	No suppl. feed	Suppl. feed
75,7%	81,2%	88,8%	97,4%	7,2%	11,3%	75,3%	83,4%
P= 0.129		**P=** 0.024		**P=** 0.011		**P=** 0.033	

*****Significant at *P* <0.05

6.3.2 Provision of supplementary lick

Licks can be used to compensate for mineral deficiencies or imbalances and potentially to decrease digestive disorders and toxic plant compounds (Ayotte *et al*., 2008:1041). Feed supplementation licks provide various nutrients such as nitrogen, carbohydrates, minerals and vitamins (Makkar, 2007:17). The nutritional limitations are recognized as an important determinant of an animal condition (Ayotte et al., 2008:1047). The use of supplementary licks is of advantage as it limits excess intake (Makkar, 2007:14). A study by Herbert (1967:3) indicates that animals select certain

licks over others and select sites within a lick. Hoon (2016) points out that a farm seldomly lacks only one nutrient, therefore most farmers must combine different supplements or licks to provide their herds with balanced feed. Multi-nutrient blocks represent vast reservoirs of cheap nutrients for ruminants (Asaolu et al., 2012:263).

The provision of trace elements through licks remains one of the cheapest options, however it comes with the disadvantages of unregulated intake (Coetzee, 2013:86). In most grazing situations, trace minerals containing salt blocks cannot provide sufficient trace minerals to meet nutritional needs. A total of 83% respondents provided supplementary lick, however, the provision of supplementary licks in this study showed no significance (*P* >0.05) for any of the four production variables. Louw (1979:133) argues that when dealing with lick supplementation, there are basic principles that should be adhered to; namely, the object of supply licks is to supplement certain nutrients which are deficient in grazing to create a balance among nutrients which will ensure optimal utilization of available plant material, the lick should be supplementary and should never substitute feed in any form, and the acceptance of the lick by animals should be such that voluntary intake can be controlled and take place at a consistent basis. Any deviation from these guidelines will render the lick less effective (Louw, 1979:133). According to table 6.3, lick supplementation did not have an effect (P> 0.05) on conception rate, kidding percentage, mortality rate and weaning percentages. The listed guidelines were contravened in this study, causing the supplementary lick to be less effective on the production variables (Table 6.3).

Table 6.3: The effect of lick supplementation on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No lick	Lick	No lick	Lick	No lick	Lick	No lick	Lick
70,8%	79,6%	108,1%	91,0%	10,1%	9,1%	86,9%	78,3%
P= 0.073		**P=** 0.392		**P=** 0.693		**P=** 0.229	

*Significant at *P* <0.05

6.3.3 Flush feeding

When does have low body condition scores, they often have low conception rates, low twinning rates and kids with low birth weight and weaning weight (Acero-Camelo *et al*., 2008:2)? Flush feeding helps in preparing the does to be in a good condition for mating. Acero-Camelo (2008:5) state that flushing improved the body condition in all does, not only at mating, but also during their past- partum period (Titi *et al*., 2008:34). No benefit could be detected in animals with excessive body condition scores and overly thin animals which do not respond to flushing (Metzger, 2018).

The provision of flush feeding before mating showed a statistical significance ($P<0.05$) in the conception rate variable, as the conception rate was higher if flush feeding was provided (94.3%) (Table 6.4). These results are in accordance with several studies in small ruminants which have shown that nutritional flushing improves conception rates (Fitz-Rodriguez *et al*., 2009:85; Urrutia-Morales *et al*., 2013:1473). There was also a significant difference (P <0.05) in the kidding percentage (113.9%) variable where flush feeding was provided. Flushing can increase kidding rates by 10 to 20% (Metzger, 2018). The study done by Rafiq *et al*. (2003:115) showed that kids born to does which had been supplemented and flushed excelled. This study showed high statistical significance (P <0.05) in the weaning percentage variable (99.3%).

Table 6.4: The effect of flush feeding on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No flush feed	Flush feed	No flush feed	Flush feed	No flush feed	Flush feed	No flush feed	Flush feed
74,1%	94,3%	87,5%	113,9%	8,3%	12,7%	73,9%	99,3%
P= 0.002		**P=**0.001		**P=** 0.044		**P=** 0.001	

*****Significant at P <0.05

6.4 Buck fertility testing

Bucks must be in full health before the breeding season to ensure efficient kidding. All bucks should be examined at least eight weeks before they go in with the does, which will allow time to address any problems or replace the bucks that are will not be able to service the does well (Molecare, 2017). Seaman (2004:1) asserts that in all breeding flocks there are bucks that either have physical abnormalities or poor serving abilities which are likely to interfere with semen quality. These bucks must be identified and removed so that the does have a better change of conceiving.

In this study, four (5.7%) respondents tested their breeding bucks for fertility. In commercial flocks, semen examination is only worthwhile if there is doubt as to buck fertility (Seaman, 2004:3). This study showed non statistically significant (P >0.05) difference in the conception rate and kidding percentage when buck fertility testing was conducted (Table 6.5). However, the conception rate and kidding percentage were high when bucks had been tested for fertility.

Table 6.5: The effect of buck fertility testing on conception rate and kidding percentage

Conception rate %		**Kidding %**	
Bucks not tested	Bucks tested	Bucks not tested	Bucks tested
77,4%	92,7%	91,5%	113,6%
P= 0.134		**P=** 0.080	

*Significant at $P < 0.05$

6.5 Presence of a specific breeding season

Breeding season management is an important tool to optimise the reproductive performance of a breeding herd (Bergh, 2004:11), while a well-planned breeding season can increase profit (Steyn, 2015). The majority of the farmers (75.7%) had rams and does running together throughout the year and only 24.3% of farmers had a specific breeding season. Having a specific breeding season comes with preparing

the does and bucks for mating thus it has also been proved that better conception figures are obtained by mating during the period of increasing sexual activity (Tonder, 2020;1).

Table 6.6 shows there was a statistically significant higher (*P* <0.05) conception rate (90.4%) if a specific breeding season existed. There was also a statistically significant higher kidding percentage (107.8%). A controlled breeding season can ensure efficient conception rate and kidding percentage (Prinsloo, 2015).

Table 6.6: The effect of breeding season on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No breeding season	Breeding season	No breeding season	Breeding season	No breeding season	Breeding season	No breeding season	Breeding season
73,7%	90,4%	87,3%	107,8%	8,1%	12,0%	73,3%	94,6%
P= 0.005		**P=**0.003		**P=**0.029		**P=**0.002	

*Significant at *P* < 0.05

6.6 Pregnancy diagnosis

Examination of goats for pregnancy may be done as part of a reproductive herd health programme (Dawson, 2002:41); providing information about conception rates after mating (Karadaev, 2015:184). Early and accurate pregnancy diagnoses are crucial for improving efficiency of reproduction in goats (Kharche & Kouamo, 2015:331; Aban *et al*., 2017:1).

In this study however, there was a statistically significant difference (*P* <0.05) in the weaning percentage (93.4%) when pregnancy diagnoses were done (Table 6.7). A total number of 8 (11.43%) farmers performed pregnancy diagnoses. Most farmers had stated that they do not have the resources to carry out pregnancy diagnoses, while others stated that consulting veterinarians is costly. Kharche and Kouamo (2015:331) state that farmers need to be educated on getting their animals checked for pregnancy at an early date, as it was found that the earlier pregnancy diagnoses are performed, the better the production and reproduction rates. It was further stated

that separation of flocks into pregnant and non- pregnant does might reduce reproductive and production losses in the form of abortions, still births and production of weak kids s (Wani *et al*., 1998:239; Karen *et al*., 2001:9).

Table 6.7: The effect of pregnancy diagnosis on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No diagnosis	Diagnosis	No diagnosis	Diagnosis	No diagnosis	Diagnosis	No diagnosis	Diagnosis
76,8%	88,2%	91,4%	103,4%	9,3%	8,9%	77,0%	93,4%
P=0.072		**P=**0.075		**P=**0.564		**P=**0.040	

*Significant at *P*<0.05

Conclusion

The results of the study attest to the positive effect of sound management practices on most of the production parameters. The productivity and production potential of goats was enhanced if good management was practised. In this study, there was an improvement in kidding percentage if internal parasites were controlled. The majority of the farmers (94.3%) controlled internal parasites by means of different methods. The provision of supplementary feed increased the kidding and weaning percentage. In similar fashion, the provision of supplementary feeding increased conception rate, kidding percentage and weaning percentage. There was a statistically significant higher conception rate, kidding percentage and weaning percentage if a specific breeding season existed. Twenty-four percent of the farmers had a specific breeding season. Pregnancy diagnoses also improved weaning percentage in this study, although only 11.43% farmers were performing pregnancy diagnoses. Despite the positive effect of management practices on production of goats, efforts are required to minimize the technological gap with regards to improved management practices. Farmers implement management practices that they do not really have adequate knowledge of; and as a result, the execution is often not accurate and effective.

REREFENCES

ABAN, A.S., ABDELGHAFAR, R.M., BADAWI, M.E. & ALMUBARAK, A.M., 2017. Subsequent Fertility of Goats with Prenatal Mortality Diagnosed by Ultrasound and Treated by PGF_{2a} and Oxytetracycline. College of Veterinary Medicine, Sudan University of Science and Technology, Khartoum, Sudan. pp 1-5.

ACERO-CAMELO, A., VALENCIA. E., RODRIGUEZ, A. & RANDEL, P.F., 2008. Effects of flushing with two energy levels on goat reproductive performance. *Livestock Research for Rural Development*, vol 20. pp 1-8.

ASAOLU, V.O., AKINLADE, J.A., ADERINOLA, O.A., OKEWOYE, A.T. & ALALADE, J., 2012. Performance of Grazing West African Dwarf Goats on Moringa Multinutrient Block Supplementation. *Asian Journal of Animal Science*. vol 6: pp 263-277.

AYOTTE, J.B., PARKER, K.L. & GULLINGHAM, M. P., 2008. Use of natural licks by four species of Ungulates in northern British Columbia. *Journal of Mammalogy*, vol 89 (4): pp1041-1050.

BERGH, L., 2004. Breeding seasons for beef cattle in South Africa. *SA-Animal Science* vol 5 pp11-17.

CHIKWANDA, A.T., MUTISI, C., SIBANDA, S., MAKUZA, S.M., KUSINA, N.T. & CHIKWANDA, D., 2013. The effect of housing and anthelmintic treatment on pre-weaning kid death rate and infestation with gastrointestinal helminthes. *Applied Animal Husbandry and Rural Development*, vol 6. pp 32-35.

COETZEE, J., 2013. Supplementary feeding of grazing sheep in South Africa- Short comings and solutions. Merino Management, pp 86-91.

DAWSON, L., 2002. Pregnancy diagnosis in goats. Goat Field Day. Langston University, Langston, OK. pp 41-44.

DUBE, K., 2015. Characterisation of goat production systems in selected coastal areas of the Eastern Cape province, South Africa. University of Fort Hare, Alice, South Africa. pp 1-117.

EXTENSION., 2019. Goat Reproduction. *Extension*. [Online] Retrieved from: https://goats.extension.org/goat-reproduction/ Accessed: 05 November 2019

FITZ-RODRIGUEZ, G., DE SANTIAGO-MIRAMONTES, M.A., SCARAMUZZI, R.J., MALPAUX, B. & DELGADILLO, J.A., 2009. Nutritional supplementation improves ovulation and pregnancy rates in female goats managed under natural grazing conditions and exposed to the male effect. Animal Reproduction Science. vol 116 pp 85-94.

HEBERT, D.M., 1967. Natural salt licks as part of the ecology of the mountain goat. University of British Columbia. pp 1-138.

HEPWORTH, K., NEARY, M. & HUTCHENS, T., 2006. Managing Internal Parasitism in Sheep and Goats. Animal Sciences. *Purdue University Cooperative Extension Service*, pp 1-9.

HOON, J., 2016. How to supplement this winter. *Farmer's Weekly*. [Online] Retrieved from https://www.farmersweekly.co.za/ Accessed: 4 November 2019

KARADAEV, M., 2015. Pregnancy diagnosis technique in goats – A review. *Bulgarian Journal of Veterinary Medicine*. vol 18, No 3, pp.183-193.

KAREN, A., KOVACS, P., BECKERS, J. & SZENCI, O., 2001. Pregnancy diagnosis

in sheep: Review of the most practical methods. pp 8-28.

KHARCHE, S.D. & KOUAMO, J., 2015. An overview of pregnancy diagnosis in small ruminants. *Indian Journal of Animal Sciences*. 84: 331-342.

KUMAR, N., RAO, T.K.S., VARGHESE, A. & RATHOR, V.S.R., 2013. Internal parasite Management in grazing livestock. *J Parasit D* vol 37 (2): 151-157.

KUSINA, N. T., CHINUWO, T., HAMUDIKUWANDA, H., NDLOVU, L. R. & MUZANENHAMO, S., 2001. Effect of different dietary energy level intakes on efficiency of estrus synchronisation and fertility of Mashona goat does. Small Ruminant Research, 39 pp.283- 288.

LOUW, G.N., 1979. An evaluation of the application of stock licks in South Africa. *South African Journal of Animal Science* vol 9.133-144.

LUGINBUHL, J.M., 2015. Preparing Meat Goats for the Breeding Season. *NC State Extension Publications*. [Online] Retrieved from: content.ces.ncsu.edu Accessed: 20 October 2019.

MAKKAR, H.P.S., 2007. Feed Supplementation Blocks. *Food and Agriculture Organization*. pp 1-248.

MAMOON, R., 2008. Goats and their nutrition. *Manitoba Goat Association*. pp 1-4.

MARY, C. & SMITH, D.V.M., 2004. Goat Parasites: Management and Control. pp 1-9 Taken from presentations during the ECA Symposium on Goat Health, June 3 1995.

MELESSE, A., ABEBE, G., MERKEL, R., GOETSCH, A., DAWSON, L., GIPSON, T. & SAHLU, T., 2013. Effect of Body Condition Score and Nutritional Flushing on the Reproductive Performances of Spanish and Spanish x Boer Crossbred Does. *Ethiopian Journal of Agricultural Science*. vol 24 pp 141-153.

METZGER, M., 2018. Flushing small ruminants for a higher ovulation rate. Sheep and Goats. Michigan State University Extension. [Online] Retrieved from: https://www.canr.msu.edu/ Accessed: 22 October 2019.

MOLECARE, 2017. Ram fertility testing. [Online] Retrieved from: https://www.molecarevetsciences.com Accessed: 21 October 2019.

MWUSO, O., 2019. A Systematic Review of the Impact of Minerals on Pregnant Sheep and Goats and their offspring in the African Continent. University of Pretoria, South Africa. pp1-73.

RAFIQ, M., KHAN, M.F. & AUJLA, K.M., 2003. Economic Benefits of Flushing and Supplemental Feeding of Salt-range Ewes on Pothwar Ranges of Pakistan. *Pakistan Journal of Biological Sciences*. vol 6 pp 115-121.

RATHOD, P., VEERANNA, K., RAMACHANDRA, B., BIRADAR, C., & DESAI, A., 2018. Supplementary Feeding of Goats during Transition Period – A Participatory Action Research in North-Eastern Transition Zone of Karnataka State, India. *International Journal of Livestock Research*. vol 8,No 10, pp. 238-240.

SAWYER, G. & NARAYAN, E.J., 2019. A Review on the influence of Climate Change on sheep reproduction. Comparative Endocrinology of Animals. pp 1-21.

SEAMAN, J., 2004. Fertility testing of rams. Revised edition. *Flock Health NSW Department of Primary Industries*. pp 1-5.

SEBEI, P.J., MCCRINDLE, C.M.E. & WEBB, E.C., 2004. Factors influencing weaning percentages of indigenous goats on communal grazing. *South African Journal of Animal Science*. vol 34: 130–133.

SNYMAN, M.A., 2010. Influence of body weight, age and management system on reproduction of South African Angora goat does. *South African Journal of Animal Science*. vol 40 (1) pp 41-53.

SHELTON, M., 1978. Reproduction and Breeding of Goats. *Journal of Dairy Science* Vol. 61 , No7. pp 994-1010.

STEYN, J., 2015. Breeding season for goats. *Farmer's Weekly*. [Online] Retrieved from: https://www-farmersweekly-co-za.cdn.ampproject.org/v/s/ Accessed: 22 October 2019

TITI, H.H., ALNIMER, M., TABBAA, M.J. & LUBBADEH, W.F., 2008. Reproductive performance of seasonal ewes and does fed dry during their postpartum period. *Livestock Science* vol 115. pp 34 -41.

TONDER, E. M., 2012. Mating practices and their influence on reproduction. *Grootfontein College of Agriculture*. [Online] Retrieved from: http://gadi.agric.za/articles/Agric/mating.php Accessed: 20 January 2021

URRUTIA-MORALES, J., MEZA-HERRERA, C.A., TELLO-VARELA, L., DIAZ-GOMEZ, M.O. & BELTRAN-LOPEZ, S., 2012. Effect of nutritional supplementation upon pregnancy rates of goats under semiarid rangelands and exposed to the male effect. Tropical Animal Health and Production. vol 44: 1473-1477.

VAN DER VYVER, F., 2014. Optimum nutrition for breeding ewes. Farmer's Weekly [Online] Retrieved from: https://www.farmersweekly.co.za/animals/sheep-goats/ Accessed: 03 November 2019

VATTA, A.F., ABBOTT, M.A., DE VILLIERS, J.F., GUMEDE, S.A., HARRISON, L.J.S.,

KRECEK, R.C., LETTY, B.A., MAPEYI, N. & PEARSON, R.A., 2007.Goat Keepers' Animal Health Manual. *Agricultural Research Council* pp 1-52.

WALLACE, J., 2012. Managing internal parasites in sheep. *Canadian Organic Growers*, 41-43.

WANI, N.A., WANI, G.M., MUFTI, A.M. & KHAN, M.Z., 1998. Ultrasonic pregnancy diagnosis in gaddi goats. *Small Ruminant Research* vol 29. pp 239-240.

CHAPTER SEVEN

General Conclusion and Recommendations

7.1 Conclusion

There is a growing interest in goat farming in the Kwa-Zulu Natal province. The impact thereof may prove to be beneficial in the creation of employment opportunities, eradication of poverty and local food security. There is, however, very little known about goats (Stewart, 2000:134); thereby hampering progress in goat farming.

The study revealed that goat farming in the uMgungundlovu district is dominated by male farmers, with most of the farmers having acquired at least a primary level of education. The involvement of the youth in goat farming is low, as the highest number of respondents were in the age group (41-50 year). The farmers indicated that they own mostly indigenous goats, together with Boer goats and cross breeds; as also reported by Masika and Mafu (2004:161).

The control of internal parasites led to increased kidding percentage in this study, and in a similar manner, the provision of supplementary feed during summer and winter also increased kidding as well as weaning percentages. Conception rate, kidding percentage and weaning percentage were significantly improved in cases where flush feeding was provided prior to the breeding season. The presence of a specific breeding season proved to increase the conception rate, as well as the kidding and weaning percentages. Pregnancy diagnoses led to a better weaning percentage.

Management practices had a positive effect on production; however, the lack of farming expertise and low level of education in this district led to a failure to incorporate the latest agricultural farming advances into daily management. In this study, farmers were aware of certain management practices such as control of internal and external parasites, vaccination, and importance of nutrition and general management of goats., however, the execution is outdated and there seems to be a great lack of knowledge. Farmers relied on other farmers for information, in which case the information may be inaccurate, one-sided or obsolete.

Farmers used a variety of marketing channels. The majority of farmers sold their livestock privately, and subsequently often sold at substandard prices. Lack of

information and poor involvement of government services by extension workers resulted in farmers making poor marketing choices and not being profitable. Most farmers however, had other sources of income.

7.2 Recommendations

The involvement of the youth and women in goat farming should be encouraged. Farmers should improve the infrastructure, namely the construction of proper housing structures, farm fencing and handling facilities. This will reduce the effect of predation and inclement weather conditions. The use of extension workers will help farmers keep up to date with changing and evolving management practices, thus educating them on making sound marketing decisions. There is a need to utilize available feed resources to supplement goats if nutrition lacks.

Proper education and information to have a controlled breeding season should be delivered and farmers should be encouraged to seek advice on proper health management for their herds. There is a need to cull goats that are not productive and those with functional deficiencies. The culling of old bucks and does can reduce the inheritance of recessive genes. Recent and relevant knowledge will greatly improve the production of goats in the KwaZulu Natal province.

7.3 Areas to consider for further research

- Assessment of goat adaptation in the KwaZulu Natal province.
- Availability and accessibility of financial resources for emerging goat farmers.
- Assessment of available marketing channels for goat farmers.

REFERENCES

MASIKA, P.J. & MAFU, J.V., 2004. Aspects of Goat Farming in the Communal Farming Systems of the Central Eastern Cape, South Africa. *Journal of Small Ruminant Research*. Vol 52, pp. 161 -164.

STEWART, I.B., 2000. Zulu Goats in KwaZulu Natal. *South African Journal of Animal Science* vol 30, pp 134-135.

Appendix i: Questionnaire

FACULTY OF HEALTH AND ENVIRONMENTAL SCIENCES

Central University of Technology, Free State

QUESTIONNAIRE NUMBER

I, Londeka Ntuli undertaking a research on Appraisal of production practices of Goat farmers in the selected district of the KwaZulu-Natal Province for Masters in Agriculture, kindly request that you complete following questionnaire. It will only take 30 minutes of your time. Your participation is of utmost importance to me and be assured that your information will remain confidential.

Instructions and co-operation request:

1. It is requested that you answer the questionnaire to the best of your ability and honesty.
2. Please be rest assured that responses and individual data will be kept confidential.
3. Only processed data will be made available to the public.
4. Possible answers are provided for some of the questions, if none is applicable, please specify at the provided space.

Inquiries on content please contact:

Ms L Ntuli
Email address: lawndeka@gmail.com
Cell number: 083 223 4229

FARM DETAILS

1.Farm location:

1.1.City	
1.2.District	
1.3.Municipality	

2.How big is the farm? In hectares	

3.On whose land are you farming?

Communal land	
Own land	
Rented land	
Other: Specify	

HERD COMPOSITION

4.Do you farm with any other animals?

Yes	
No	

5.If yes to the above question, which animal?

Cattle	
Chickens	
Pigs	
Sheep	
Other:Specify	

6.How many goats do you have on your farm? Give in numbers

Bucks	
Does	
Kids	
Weaners	

7. Which farming system are you implementing?

Extensive farming system	
Intensive farming system	
Other:Specify	

LAND AND VEGETATION

8.How is the vegetation cover on your farm?

Dense	
Sparse	
Bare	
Other:Specify	

9. Which vegetation type is dominant on your farm?

Grasses	
Shrubs	
Bushes	
Mixed (grasses and shrubs)	
Other:Specify	

10.Do you divide your veld into camps?

Yes	
No	

11.Which grazing system do you practise?

Continuous grazing	
Rotational grazing	
Multispecies grazing	

12.Do you have cultivated pastures on your farm?

Yes	
No	

13.If yes to the above question, name them

EQUIPMENT AND INFRASTRUCTURE

14.What is your main source of water supply?

Groundwater	
Natural dam	
River	
Other:Specify	

15.Do you have a rain gauge on your farm?

Yes	
No	

16.If yes to the above question, how much rain do you receive in mm/year?

17.Is your farm fully fenced?

Yes	
No	

18.If yes to the above question, how is the condition of the fencing?

Poor	
Moderate	
Good	
Excellent	

19.Do you have handling facilities on the farm?

Yes	
No	

20.If yes to the above question, how is the condition of the handling facilities?

Very poor	
Poor	
Moderate	
Good	
Excellent	

21.Do you have housing for the animals on the farm?

Yes	
No	

22.If yes to the above question, how is the condition of the housing?

Very poor	
Poor	
Moderate	
Good	
Excellent	

23.Do you have an isolation ward for sick animals?

Yes	
No	

24.Do you have access to roads?

Yes	
No	

25.Do you have a work van?

Yes	
No	

26.Do you have drenching guns?

Yes	
No	

27. Do you have a cooler storage box to store vaccines?

Yes	
No	

28.Do you have disposable syringes?

Yes	
No	

ANIMAL HEALTH

29.Do you control internal parasites?

Yes	
No	

30.If yes to the above question, how do you control them?

Dosing	
Injection	
Other: Specify	

31.Do you control external parasites?

Yes	
No	

32. If yes to the above question, how do you control them?

Dipping	
Injection	
Other: Specify	
Spot treatment	

33.Which of the diseases do you vaccinate against?

Enzootic abortion	
Mastitis	
Pasteurella	
Other:Specify	

ANIMAL NUTRITION

34.Do you provide supplementary feed during winter and summer seasons?

Yes	
No	

35.Do you provide supplementary lick?

Yes	
No	

36.Do you graze animals on veld?

Yes	
No	

37.Do you have forage reserved?

Yes	
No	

38.If yes to the above question, how do you reserve storage?

Hay	
Silage	
Other:Specify	

GENERAL GOAT MANAGEMENT

39.Do you castrate bucks?

Yes	
No	

40.If yes to the above question, at what age do you castrate?

41.If yes to question 39, which method do you use?

Burdizzo	
Elastrator	
Knife	
Other:Specify	

42.Which method do you use to identify your animals?

Ear notch	
Ear tag	
None	
Other:Specify	

43.Do you trim hooves?

Yes	
No	

BREEDING MANAGEMENT

44.Do you test bucks for fertility before mating?

Yes	
No	

45. Do you provide flush feed before breeding season starts?

Yes	
No	

46.Do you have a specific breeding season?

Yes	
No	

47. If yes to the above question, when does it start and when does it end?

Starts	
End	

48. What is your breeding method?

Artificial insemination	
Group mating	
Other: Specify	

49.According to which criterion do you breed replacement does?

Age	
Weight	
Both	

50. If you breed them according to age, indicate the age in months

51. If you breed them according to weight, indicate the weight in kg

52. Do you separate does before breeding?

Yes	
No	

53. If yes, according to what criterion do you separate them?

Age	
Weight	
Both	

54. Do you separate does after kidding?

Yes
No

55. If yes, how do you separate them?

55.1 Pregnancy status

Does with single kids
Does with twin kids

56. Do you house kidding does?

Yes
No

57. Do you house lactating does?

Yes
No

58. If yes to either question 56 or 57 or both, what type of housing do you use?

Brick wall without roofing
Brick walls with roofing
Wooden poles with roofing
Open pen without roofing
Other: Specify

59.Do you do a pregnancy diagnosis?

Yes
No

60. Do you check for body condition score?

Yes
No

61. If yes to the above question, when do you score?

Thirty days before the start of breeding season
During pregnancy

At kidding

Other: Specify

62. How many does were mated the previous breeding season?

63. How many does kidded in the previous breeding season?

64.How many kids were born in the previous breeding season?

65.How many kids did you wean in the previous breeding season?

66. How many kids died in the previous breeding season?

67.What is usually the cause of kidmortality?

Poor mothering abilities

Predators

Diseases

Inclement weather

Other: Specify

68.Do you check the quality of colostrum?

Yes

No

69. If the answer is yes to the above question, how?

Visual

Hydrometer

Other: Specify

70.Do you provide artificial colostrum to kids that do not receive colostrum?

Yes

No

MARKETING

71.Do you have a culling programme?

Yes	
No	

72.If the answer is yes to the above question, on what grounds do you cull goats?

72.1 Reproduction	
72.1.1 Dry does	
72.1.2 Does that have lost their kids	
72.1.3 Infertile bucks	

72.2 Faulty functional traits

72.2.1 Faulty udder	
72.2.2 Faulty legs	
72.2.3 Faulty teeth	
72.2.4 Inverted eyelids	

72.3 Age (Old bucks and does)	

72.4 Other: Specify

73. What is your marketing channel?

Abattoir	
Auctions	
Butchers	
Speculators	
Private buyers	

74.How many goats did you sell the previous year? Use the table below

Class	Bucks	Does	Kids	Weaner
Quantity Price per head				
Total				

EXTERNAL EXPERTISE

75.Do you consult with a veterinarian?

Yes
No

76. Are you a member of any breeders' association?

Yes
No

77. If the answer is yes to the above question, name the association?

78. Which source/s of information do you use the most on your farm?

Agricultural magazines
Extension officer
Farmer's day
Other: Specify

OTHER

79 .Do you have farm workers?

Yes
No

80. If yes to the above question, how many workers do you have?

81. Do you keep records?

Yes
No

82. If yes to the above question, what records do you keep?

82.1 Production records
82.1.1 Conception records
82.1.2 Kidding records
82.1.3 Mortality records

83.Have you ever bought animals from outside KwaZulu-Natal for farming purposes?

Yes	
No	

PERSONAL DETAILS

84. Gender of a respondent

Female	
Male	

85. Age (Years) |

86. What is your ethnic group?

Black African	
Coloured	
Indian	
White	
Other: Specify	

87. What is the highest qualification you have obtained?

Grade 12	
Diploma in Agriculture	
Degree in Animal Science	
Master's degree in Agriculture	
Doctorate in Agriculture	
Other: Specify	

88.What breed of goats do you farm with? Name them

Appendix ii: Article 1

Appraisal of the management practices of goat farmers in selected districts of the KwaZulu-Natal Province: Can the extensionist play a role to improve?

L. Ntuli & P.J. Fourie*
Department of Agriculture, Central University of Technology, Free State.

Private Bag X20539, Bloemfontein, 9300, South Africa.

Co Author: Email address: lawndeka@gmail.com

Abstract

The study was conducted to assess management practices by goat farmers in selected districts (uMgungundlovu) of the KwaZulu-Natal province. A total of 70 farmers were interviewed using structured questionnaires. A considerable number of respondents had low level of education n= 28 (40%). Management activities performed by respondents included control of internal and external parasites which was done by 94% and 96% respectively. The most vaccinated for diseases were Pulpy kidney (61.54%) and Pasteurella (51.92%). Fifty-five respondents (78.57%) grazed their animals on veld. An insubstantial percentage of respondents had cultivated pastures (15.71%) n=11. Respondents were providing winter and summer supplementary feed (46%) and supplementary lick (83%). A total of 17 farmers (24.29%) had a specific breeding season. Breeding management activities were done by farmers, and 5.71% of respondents were testing bucks for fertility, while 18.57% were providing flush feeding and 11.43% performed pregnancy diagnosis. Most farmers who applied sound management practices reported elevated production levels.

Keywords: Management practices, goat farmers, KwaZulu-Natal

1.Introduction

Livestock contributes to food security and plays a role in the economy and social life in South Africa (Meissner, Scholtz & Palmer , 2013:282). Reynolds, Wulster-Radcliffe, Aaron & Davis (2015:1377) stated that livestock plays a major role in supplying protein to people in the form of meat and milk. South Africa has a thriving goat industry which consists of fiber, meat and dairy-producing goat breeds (Visser & Van Marle-Koster, 2017:19).

According to Stewart (2000:134) KwaZulu Natal has a goat population of one million goats, almost all of which are in the communal areas. Goats are important in the improvement of rural livelihood (Peacock, 2005:179), they also ensure food security through aiding seasonal food variability and availability (Dube, 2015:2). Goats are also relatively cheap to acquire and reproduce quickly, which is why they have a faster population recovery in an event of severe losses (Peacock, 2005:180).

Dube (2015:3) stated that although, some research has been done on goats, most of it lacked farmer participation as it was mainly researcher-driven, resulting in a lack of adoption of

technologies. The current study was carried out to appraise management practices by goat farmers, furthermore, to discover the effect of management practices on goat production. Furthermore, the contribution that agricultural extension can make in the development of these farmers will also be highlighted.

2. Materials and Methods

The study was conducted in the KwaZulu-Natal province, in the uMgungundlovu district. Seven municipalities were selected which each had ten respondents, therefore having a total of seventy respondents. Well-designed questionnaires were used to gather data from respondents individually. Factors that were probed included financial management and record keeping, health management, nutritional management, veld management, breeding management and biographical details. All raw data was captured and coded in Microsoft Office, Excel®. Analysis was completed using Statistical Package for Social Science (SPSS) Software.

3. Results and discussion

3.1 Educational level

The majority of respondents (n=28) 40%, which consists of (n=27) males and (n=1) female had low levels of education (lower than grade 12) and 1.43% (female) had a degree in Animal Science (Table 1), which is the highest level of education obtained for this study. Oduro-Ofori, Aboagye & Acquaye (2014:1951) stated that the returns on agricultural productivity increases as the educational level increases. According to Lubambo (2011:30) the level of education has an influence on the ability to make decisions and it is directly related to the success of a farm. In this study 38.57% of respondents were in the age group 51 to 70+ years. STATSSA (2011:42) reported that most elderly people in South Africa have no formal education. Katikati (2017:56) stated that this may have been influenced by the fact that old people grew up during the time when education was not easily accessed.

Table 1: Education level and gender of respondents in the uMgungundlovu district

	Female	**Male**	**Total**	**Total %**
No matric	1	27	28	40
Grade 12	2	17	19	27.14
Diploma in Agriculture	1	3	4	5.71
Degree in Animal Science	1	-	1	1.43
Masters' degree in Agriculture	-	-	-	-
Doctorate in Agriculture	-	-	-	-
Other qualifications	4	14	18	25.71
Total	**9**	**61**	**70**	**100**

3.2 Farm herd

According to Bester, Ramsay, & Scholtz (2009:9), herds in the communal sector were small, with 56.8% of keepers owning less than 10 goats as against 10% in the emerging sector. Ngqangweni and Delgado (2002:5) stated that various factors can affect the size of the herd, these include socio-economic factors such as: farm assets, access to finance or credit institution and household head characteristics, that is; age, gender, marital status and educational level. The average farm herd in this study consisted of 79.87 animals. The respondents in this district

were mainly faced with stock theft. A total of 28.57% respondents had poor fencing (figure 1), that could be a contributing factor to stock losses.

Table 2: Mean±SD of herd numbers (bucks, does, kids and weaners) in the uMgungundlovu district.

Farm herd	Bucks	Does	Kids	Weaners
Mean±SD	3.37±3.47	49.96±73.89	15.59±22.15	10.96±20.38

A total of 47 farmers were farming with other animals as well. More than 39% of farmers were farming with cattle, 50% were farming with chicken and 10.3% had sheep. The different species play important roles for food production and income generation from different animals (FAO, 2017).

3.3 Farm infrastructure

The figure below (1) illustrates infrastructure and its condition as given by the respondents, 28.57% of respondents had poor fencing; 68.57% had no handling facilities and 34.29% had farm housing in moderate condition. During the course of the study, farmers with no handling facilities stated that health management was mostly affected by this as it is a challenge to vaccinate, dose and dip animals without handling facilities. This may result in stock losses. According to Fungo, Krygsman, & Nel (2017:94) adequate infrastructure raises farm productivity and lowers farming costs. Farm infrastructure provides assurance for the supply of the agricultural inputs and facilitates delivery of farm outputs to the markets. All respondents (100%) had access to roads.

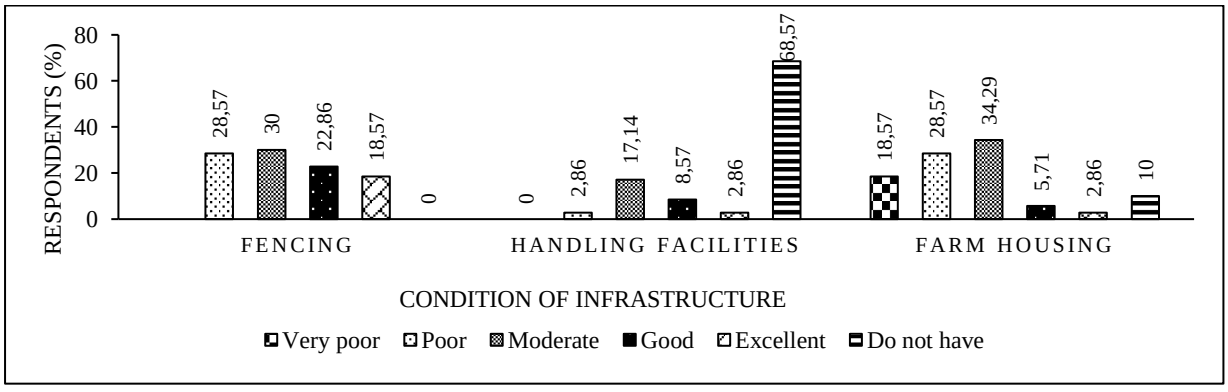


Figure 1: Farm infrastructure and condition in the uMgungundlovu district

3.4 Animal health

3.4.1 Internal parasites

Sixty-six respondents control parasite, 51.51 % use the oral dosing method, (12.12%) injecting and those who use both the dosing and injection method accounts to 36.36% (Figure 2). Villarroel (2013:4) stated that the best prevention is to reduce animals' exposure to parasites by providing a clean environment and avoid overcrowding of pens. In this study, it was

discovered that some old farmers do not buy deworming remedies, they still believe in home-made remedies.

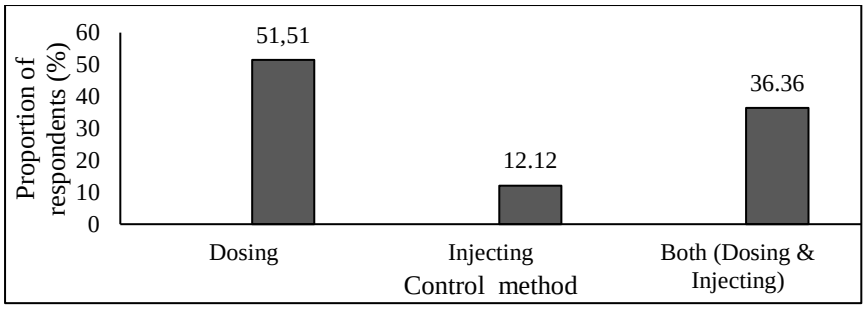


Figure 2: Respondents' method of controlling internal parasite

3.4.2 External parasites

A considerable proportion of respondents (95.71%) were controlling external parasites while 4.29% were not (Table 3). Ticks were a major problem, resulting in heartwater disease (also known as Ehrlichiosis). Heartwater disease can be fatal and usually begin with fever and may involve neurological signs and respiratory distress (Yunker, 1996:159). Respondents use different methods of controlling external parasites, with most farmers using the spot treatment method (n=31) and the least used method is the injectable method (n=12). Lack of knowledge has some farmers using wound aerosols to control ticks. Through non-formal education, extension services could facilitate these farmers on how livestock vaccination should be done based on recommended practises for KwaZulu-Natal and season of the year. In an extension approach, companies selling animal health products could be mobilised to eventually become more involved in rural communities.

Table 3: Respondents' method of controlling external parasites

Control method	No. of farmers district	Total %
Plunge/Spray dip	24	34.29
Injection	12	17.14
Spot treatment	31	44.29
Other	-	-
Do not control at all	3	4.29
Total	**70**	**100**

3.4.3 Vaccination

A total of 18 (25.71%) farmers do not vaccinate at all, while 74.29% (n=52) vaccinated at least against one disease. Pulpy kidney had the highest proportion of respondents that vaccinated for it (61.54%). According to Rowe (2016:1), prevention is better than cure and it is therefore important that any goats introduced to an existing flock be disease- free and healthy. It is important to have a strict vaccination programme to control common diseases. It was noted during this study that some farmers still rely on the government schemes to have their flock vaccinated.

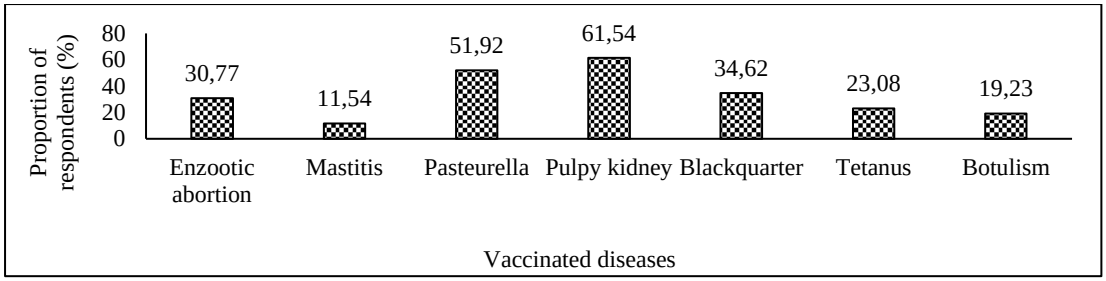
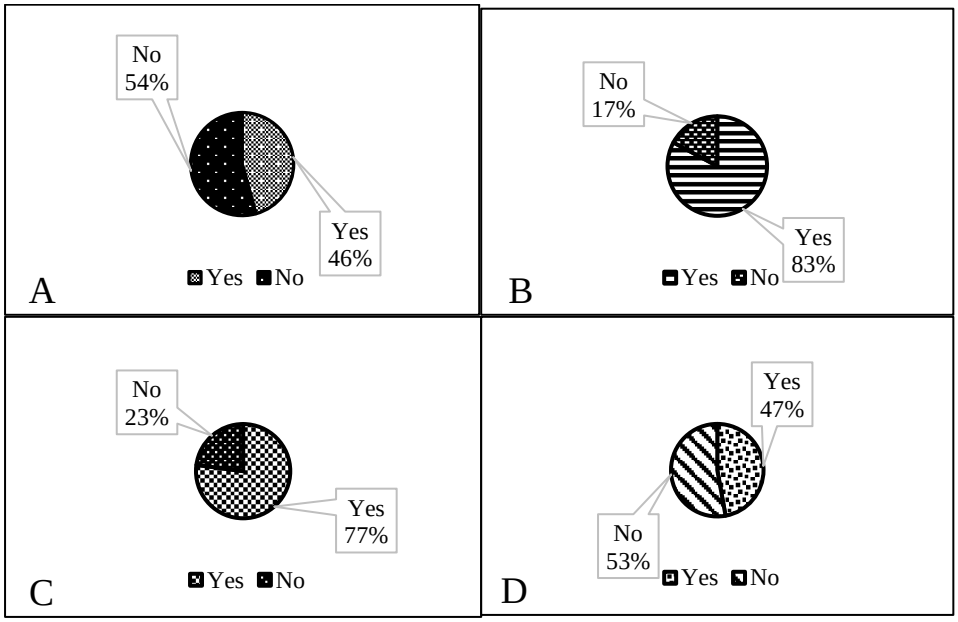


Figure 3: Vaccinated diseases by respondents

4. Animal nutrition

Vatta, Devilliers, Gumede, Harrison, Krecek, Letty, Mapeyi & Pearson (2015) stated that goats obtain most of the nutrients it needs from grazing. In the dry season, the quality of available vegetation decreases and it becomes important to provide supplementary licks or feed to the flock. However, according to Economides (1986:61) it is difficult to describe the feeding and management of the sheep and goat industry around the world because of many interacting factors such as production system and genetic potential of breeds.

Figure 4-A shows that 46% of respondents provide supplementary feed while 54% do not provide supplementary feed. Some of the respondents stated that feed is expensive, therefore they graze animals on veld without the provision of additional supplementary feed, and figure 4-C shows that 77% of the farmers graze their animals. Most of the farmers (83%) figure 4-B, provided supplementary licks. There were few reasons for that; some stated they did not have knowledge of supplementary licks and did not see the need for it as it is expensive. Figure 4-D shows that 47% of respondents had forage reserved while 53% did not reserve forage. Those that reserved forage, were reserving it in the form of hay (69.70%), silage (15.15%) and in both silage and hay form (15.15%).



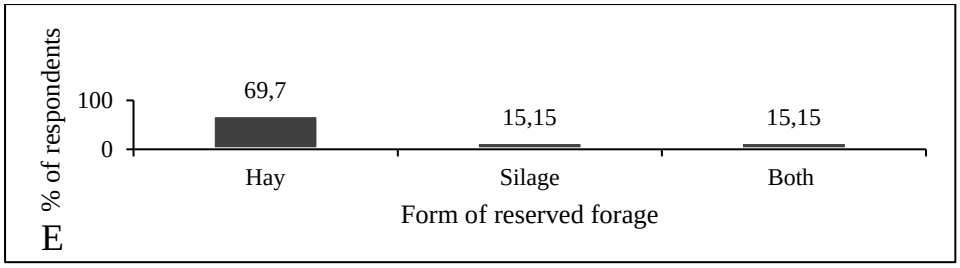


Figure 4: ***A***- Provision of supplementary feed (Winter/Summer) by respondents'; ***B***- Provision of supplementary lick by respondents; ***C***- Grazing animals on veld; ***D***- Forage reservation by respondents; ***E***- Form of forage reservation by farmers.

5. General management

Table 4: General management practices by respondents (Castration, animal identification and hoof trimming)

General management activity	Method	Number of respondents	Percentage of respondents
Castration	Burdizzo	17	24.29%
	Elastrator	19	27.14%
	Knife	6	8.57%
Animal identification	Ear notch	7	10%
	Ear tag	47	67.14%
	None	14	20%
	Other (Tattoo)	2	2.86%
Hoof trimming	Yes	27	38.57%
	No	43	61.43%

5.1 Castration

Table 4 shows general management practices by farmers; castration, tagging and hoof trimming. In this study, 58.57% of respondents castrate their bucks with most farmers (27.14%) using the elastrator method, while 24.29% were using a burdizzo. Yami (2009: 1) stated that castration is important to control and maintain the breeding programme. A percentage of 41.43 of farmers did not castrate at all. Only 8.6% of respondents were using the knife method, this could be because this method is the most painful and according to Yami (2009:12), it has the greatest potential of infection and fly infestation.

5.2 Animal identification

Stuart (2016:1) stated that being able to identify individual animals on the farm is critical to good farm management. Table 4 shows that 67.14% farmers used the ear tag application method to identify livestock while 10% used ear notching and (2.86%) ear tattooing. Most farmers in this study find the ear tag application method the quickest and easiest procedure.

5.3 Hoof trimming

Table 4 shows that 38.57% of the respondents trim hooves while 61.43% do not trim hooves. Animals with overgrown hooves are susceptible to joints and tendon problems. According to Nix (2014) the amount of time between trimmings depend on factors such as the goat's age, level of activity, nutritional level and even the type of breed.

6. Breeding management

A total of 17 farmers (24.29%) had a specific breeding season, while 75.71% (n=53) had no breeding season. All 17 farmers (24.29%) were practising the group mating system. Four (5.71%) respondents were testing their breeding bucks for fertility and 18.57% were flush feeding does prior breeding. This could be because of a lack of knowledge as some of the interviewees stated that they were not aware of this management practice. Eight farmers (11.43%) were doing a pregnancy diagnosis and 88.57% (n=62) were not doing pregnancy diagnosis. Karadaev (2015:184) stated that pregnancy diagnosis is essential for better efficacy and management of reproduction.

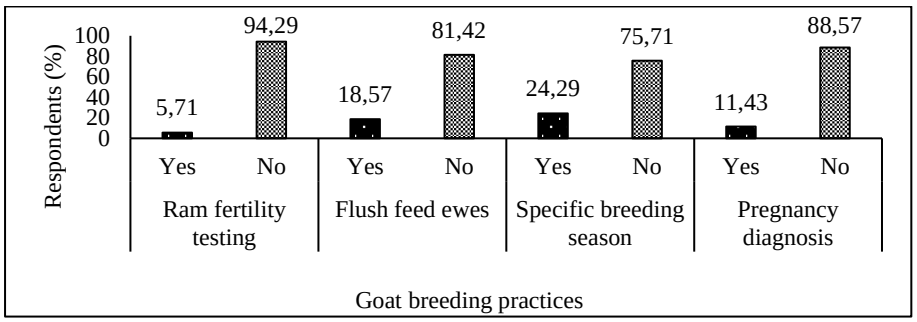


Figure 5: Goat breeding practices

7. Reproduction performance

The district had a total of 3 497 does and 63.25% (n= 2 212) of the does were bred during the years 2017/2018. The conception rate, which is used to express the proportion of does that kidded compared to the does that were mated, for this study was 71.70%. Davila (2017:95) stated that factors that affect conception rate include nutritional management and body condition of goats. Figure 4-A show that 54% of respondents did not provide winter and summer supplementary feed and only 18.57% of farmers were flush feeding their does (figure 5). In relation with this study, the conception rate could be influenced by knowledge, and thus the nutrition management. The effect of reduced fertility due to inadequate nutrition was also reported in communal goats by Chikwanda (2004:75)

The kidding rate was 84.81%. This is relatively poor for goats and this gap should be bridged by agricultural extension in collaboration with agricultural research, the breeders' society and industry. Even commercial farmers have recently become more willing to assist in the development of emerging farmers. Does with poor body condition scores will display reduced reproductive performance as opposed to those with better body condition scores (Kenyon, Maloney & Blache , 2014:45). The farmer has the ability to control or manipulate factors that influence the reproductive performance of livestock by having a strict selection of breeding animals; providing correct nutrition and having a strategic and suitable deworming and vaccination programme (Petrovic, Muslic, Maskimovic, Ilic, Milosevic, & Stojkovic,2012:519).

The weaning percentage was 77.89%. Weaning is an important parameter which assists in identifying problems during the breeding season, especially with regard to the ability of does

to successfully rear good quality kids s (Olivier, 2014:2). Mortality was 10.71%. Snyman (2010:54) reported that the most cause of death was known to be predators and small kid s abandoned by does. In this study, however, the most cause of mortality was predation (64.5%), diseases with 45.2%, inclement weather (35.5%) and poor mothering abilities (17.7%%), while twelve respondents had problems with theft.

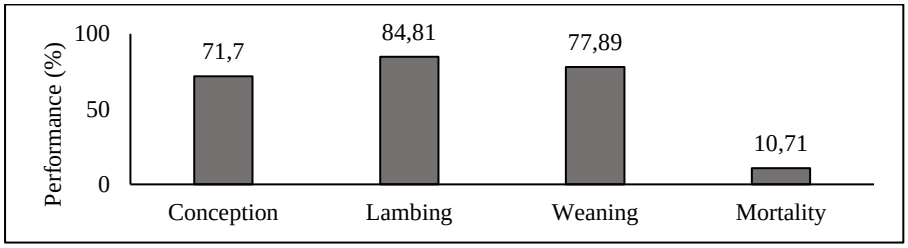


Figure 6: Reproductive performance of goat flock in the uMgungundlovu district

8. Veld management

8.1 Veld division

A single farm may have veld types differing in regard to nature of the vegetation, the palatability of plants and accessibility of certain parts of veld (Roux & Skinner, 2012:1), it is therefore important that veld should be separated by fencing off. Veld separation allows the utilisation of different plant communities (Van de Pol & Jordaan, 2008:40). Thirty one percent of farmers were dividing veld into camps, while 67% were not diving veld into camps. Hewett (2008:146) stated that the separation of different types of veld on a farm helps to keep the grazing inside each camp fairly uniform. In this study, some farmers stated that they did not have big enough land to divide into camps. Even in this situation, extension could serve as a valuable link between academic institutions and farmers as universities are frequently searching for sites where practical demonstrations and training can be presented. In this way both students and farmers can benefit.

8.2 Cultivated pastures

Eleven farmers (15.71) had cultivated pastures. Pennisetum clandestinum (Kikuyu) was listed by most farmers (n=4). Kikuyu is one of the most important dry land summer pastures species in KwaZulu-Natal (Househam, 2011:72). The major role of cultivated pastures is to satisfy the forage requirements of animals when there is low quality and quantity of forage produced by rangelands (Aucamp, 2008:22). Two farmers were cultivating Eragrostis tef (Teff) and Digitaria eriantha respectively. A number of two famers were cultivating Medicago sativa (Alfalfa). One farmer had Mooi mix.

9. Marketing channels

The marketing channel that was used the least by the farmers was abattoirs with 4%, auctions (14%), butchers (10%) and speculators (12%). The majority of meat goats marketed in South Africa are sold privately in the informal market to be slaughtered for religious or traditional purposes. The choice of marketing channel depends on a number of issues which include the availability of market, prices offered in the market and the distance to the market (Sehar, 2018:9).

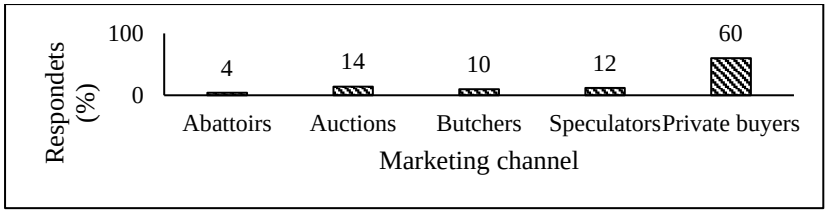


Figure 7: Marketing channels

10. Conclusion

The impact of the growing interest in goat farming in KwaZulu-Natal may prove to be beneficial in the creation of employment opportunities, eradication of poverty and local food security. Goat farming in uMgungundlovu district is dominated by males, with most of the farmers having acquired at least primary level of education. The majority of the farmers were controlling internal and external parasites, they were also vaccinating for diseases. The most vaccinated disease was Pulpy kidney, Pasteurella and Black quarter. There was a provision of supplementary feeding by some farmers. Farmers are aware of management practices such as control of internal and external parasite, vaccination, importance of nutrition and general management of goats, however, the execution is outdated and there is a great lack of knowledge. Farmers relied greatly on other farmers for information, in which case the information may be inaccurate, one-sided or obsolete.

This study reiterated that there is still a role that needs to be played by the agricultural extension services for the developing farmers. In order to improve these farmers' management practises extensionists also need to assist them through training in improved farming methods and techniques. Currently support programs to farmers are merely fragmented and needs to be well-coordinated. Agricultural extension specialists in the field of animal production, could render the much-needed momentum towards economic goat production. In addition, agricultural bodies such as the RPO, and the various goat breeders' societies in South Africa could also play a consequential role in the training of these farmers. Finally, the study recommends that focussed workshops for farmers be conducted in order to equip them with relevant knowledge.

11. Acknowledgement

The KwaZulu- Natal Indigenous Veld Goat club and financial assistance from Central University of Technology are gratefully acknowledged.

12. References

AUCAMP, A.J., 2008. Linking cultivated pastures with rangelands. Grassroots: Newsletter of the Grassland Society of Southern Africa, Vol 8.No 8, 19-25.

BESTER, J., RAMSAY, K.A. & SCHOLTZ, M.M. 2009. Goat farming in South Africa: Findings of a national livestock survey. Applied Animal Husbandry and Rural Development, Vol 2: 9–13.

CHIKWANDA, A.T. 2004. Characterisation of goat production systems and productivity in Rushinga communal area. M.Phil. Thesis, University of Zimbabwe, Harare, Zimbabwe, pp. 1-87.

DAVILA, F.S., 2017. Reproduction in Goats. Goat Science. [Online] Retrieved from:

https://www.intechopen.com/books/goat-science/reproduction in goats/ Chapter 5, pp. 87-105. Accessed: 10 October 2019

DUBE, K., 2015. Characterisation of goat production systems in selected Coastal areas of the Eastern Cape province, South Africa. Master of Science in Agriculture, University of Fort Hare, South Africa.

ECONOMIDES, S., 1986. Nutrition and Management of sheep and goats. Small ruminant production in the developing countries. Food and Agriculture Organization, pp. 61-73.

FAO-FOOD AND AGRICULTURE ORGANIZATION., 2017. Animal Production [Online] Retrieved from: http://www.fao.org/animl-production/en/ Accessed: 12 October 2019

FUNGO, E., KRYGSMAN, S & NEL, H., 2017. The Role of Road Infrastructure in Agricultural Production, Stellenbosch University, South Africa, pp.94 -108.

HEWETT, G., 2008. Veld conditions. Selecting and classifying grazing camps. *FCS Anim. Prod. L3* pp 146-150.

HOUSEHAM, S. D., 2011. Forage systems for goat production in South Africa. Master of Science in Agriculture Thesis. University of KwaZulu-Natal, South Africa.

KARADAEV, M., 2015. Pregnancy diagnosis techniques in goats. *Bulgarian J. of Vet. Med.*, vol 18, pp. 183 -193.

KATIKATI, A., 2017. Assessment of production practices of emerging cattle farmers in the selected districts of the Eastern Cape Province, South Africa. M.Tech Thesis, Central University of Technology, South Africa.

KENYON, P.R., MALONEY, S.K., & BLACHE, D., 2014. Review of sheep body condition score in relation to production characteristics. *New Zealand J. of Agric. res.*. Vol 57 pp.38-64.

LUBAMBO P.T., 2011. An appraisal of post-transfer production trends of selected land reform projects in the North-West Province, South Africa MSc Thesis, University of Pretoria.

MEISSNER, H.H., SCHOLTZ, M.M. & PALMER, A., 2013. Sustainability of the South African livestock sector towards 2050. Part 1: Worth and impact of the sector. *S. Afr. J. of Anim. Sci.*, 43(3) 282-297.

NGQANGWENI S. & C. DELGADO., 2002. Decision on livestock keeping in the

semi-arid areas of Limpopo province pp.1-8

NIX, J., 2014. Hoof Trimming in Goats. [Online] Retrieved from: https://www.thesheepsite.com/articles/11/hoof-trimming-in-goats Accessed: 03 October 2019.

OLIVIER, W.J., 2014. Calculation of reproduction parameters. Info pack: AP 2014/032 Grootfontein Agricultural Development Institute.

ODURO-OFORI, E., ABOAGYE, A. & ACQUAYE, N., 2014. Effects of Education on the Agricultural Productivity of Farmers in the Offinso Municipality. International Journal of Development Research. Vol 6, pp 1951 -1960.

PEACOCK, C., 2005. Goats: A pathway out of poverty. Small Ruminant Research, 60: 179–186.

PETROVIC, M., PETROVIC, C., MUSLIC, R., MASKIMOVIC, N., ILIC, Z., MILOSEVIC, B. & STOJKOVIC, J., 2012. Some important factors affecting fertility in sheep. *Biotech. in Anim. Husb.* vol 28, pp.517-528.

REYNOLDS, L.P., WULSTER-RADCLIFFE, M.C., AARON, D.K. & DAVIS, T.A., 2015. Importance of Animals in Agricultural Sustainability and Food Security. *J. of Nut.*, (145) 1377-1379. [Online] Retrieved from: https://academic.oup.com/jn/article-abstract/145/7/1377/4590010 Accessed: 28 February 2020.

ROUX, P.W. & SKINNER, T.E., 2012. The group camp system. Farming in South Africa 45 (10) [Online] Retrieved from: https://gdi.agric.za/articles/Agric/groupcamp.php Accessed: 18 January 2019.

ROWE, A., 2016. Basic goat health management: all you need to know. [Online] Retrieved from: https://www.farmersweekly.co.za/animals/sheep-goats-health-management-all-you-need-to-know/ Accessed: 20 May 2019.

SEHAR, M., 2018. Factors influencing market access and livestock marketing inefficiency in Mpumalanga Province, South Africa. Master of Science thesis. University of South Africa, pp. 1-93.

SNYMAN, G., 2010.Factors affecting pre-weaning kid mortality in South African Angora goats. *S. Afr. J. of Anim. Sci*., 40, pp. 54 -64.

STATSSA- Statistics South Africa., 2011. Profile of older persons in South Africa. Report-03-01-602011.pdf pp.41-48.

STEWART, I.B., 2000. Zulu Goats in KwaZulu Natal. *S. Afr. J. of Anim. Sci.*, (30) 134-135.

STUART, B., 2016. Ear tagging livestock important for identification. The Weekly Times.

VAN DE POL, R. & JORDAAN, J.J., 2008. The fodder bank system: its current place in veld management. Grassroots: Newsletter of the Grassland Society of Southern Africa. Vol 8.No1, 36-44.

VATTA, M., DEVILLIERS, JF. GUMEDE, S., HARRISON, L.J.S., KRECEK, LETTY,B.A., MAPEYI, N & PEARSON, RA., 2015. Feeding goats [Online] Retrieved from: https://www.farmersweekly.co.za/farm-basics/how-to-livestock/basic-goat-management-and-feeding/ Accessed: 28 May 2019.

VILLARROEL, A., 2013. Internal Parasites in Sheep and Goats. Extension Veterinarian, Oregon State University pp.1-4

VISSER, C. & VAN MARLE-KOSTER, E., 2017. The development and Genetic Improvement of South African Goats. Intech Open, pp 19-36. [Online] Retrieved from: http://dx.doi.org/10.5772/intechoprn.70065 Accessed: 28 February 2020.

YAMI, A., 2009. Castration of sheep and goats. Technical Bulletin No.18. Ethiopia Sheep and Goat productivity Improvement Program. R.C Merkel 12Pp.

YUNKER, C.E., 1996. Heartwater in sheep and goats: A review. *Onderstepoort J Vet Res.* 1996 Jun; 63(2): 159-170.

Appendix iii: Article 2

Evaluating effect of management practices on goat production in the selected district of KwaZulu-Natal: The role of agricultural extension

L. Ntuli & P.J. Fourie

Department of Agriculture, Central University of Technology, Free State.

Private Bag X20539, Bloemfontein, 9300, South Africa.

Co Author: Email address: lawndeka@gmail.com

Abstract

The aim of the study was to discover what influence various management practices have on the production of goats. Data was collected from seventy farmers in the uMgungundlovu district in KwaZulu-Natal province. The following four production variables were investigated: Conception Rate, Kidding Percentage, Mortality Rate and Weaning Percentage. Management practices investigated were: Internal parasite control; external parasite control; provision of supplementary feed during winter and summer; provision of supplementary lick; fertility testing of bucks before mating; provision of flush feed before breeding season starts; the presence of specific breeding seasons and pregnancy diagnosis. There was a statistical significance ($P<0.05$) in the conception rate where flush feeding was provided and specific breeding season was present. A statistically significant higher kidding percentage with the control of internal parasites, provision of supplementary feed, flush feeding and the presence of a specific breeding season was obtained. There was a statistically higher weaning percentage with the provision of supplementary feed ($P<0.05$), flush feeding, the presence of a specific breeding season and pregnancy diagnosis.

Keywords: Effect, management practices, goat production, KwaZulu-Natal

1.Introduction

According to Stewart (2000:134) KwaZulu Natal has a goat population of one million goats, almost all of which are in the communal areas. Goats are important in the improvement of rural livelihood (Peacock, 2005:179), they also ensure food security through aiding seasonal food variability and availability (Dube, 2015:2). Dube (2015:3), farmers lack access to technical, as well as market information and their management strategies are not properly defined. One of the most important factors in determining profitability of goat enterprise is production rate, which is largely a function of pregnancy rate, kidding rate, weaning rates and the frequency with which kids are born. Increased reproduction with any type of goat would contribute to improved efficiency (Shelton, 1978:994). Reproduction dictates the rate of expansion of the flock and the number of excess stocks for sale (Peacock ,1996:235).

2. Materials and Methods

The study was conducted in uMgungundlovu district, KwaZulu- Natal province. Seven municipalities were selected which each had ten respondents, therefore having a total of seventy respondents. Well-designed questionnaires were used to gather data from respondents individually. All raw data was captured and coded in Microsoft Office, Excel®. The Mann-Whitney U test was used to compare the differences between the group that performed a

specific management practice and the group that did not perform a specific management practice. Analysis was completed using Statistical Package for Social Science SPSS Software.

3. Results and discussion

3.1 Internal parasites

Internal parasites are a major health problem in the livestock industry, they cause retarded growth, poor reproductive performance, condemnation of goat carcases in abattoirs and high kid mortality (Chikwanda, Mutisi, Sibanda, Makuza, Kusina &Chikwanda, 2013:32). Dube (20015:49) reported parasites to be one of the causes of mortality in goats. Goats are sensitive to the effects of internal parasitism; the effect of parasitism is determined by the interactions between the type of parasites present in the geographic area, parasite life cycles, the environment (weather patterns) and the type of farm management (Mary & Smith, 2004:1). Dube (2015:18) stated that most parasites may be harboured in the animal dung, consequently failure to remove the dung and maintain good hygiene may lead to the transfer of the parasitic pathogens. In the study, 94% of the farmers were controlling internal parasites. There are companies that supply livestock medicine that play an active role in educating local farmers about internal parasites and available remedies.

The only statistically significant difference was for the kidding percentage variable, $P<0.05$ (Table 1). Respondents who controlled internal parasites had a statistically significant ($P<0.05$) higher kidding percentage than respondents that did not control internal parasites. A does' body condition can be affected by internal parasites (Prinsloo, 2015). On the other hand, Van der Vyver, (2014) indicated that the doe flock's condition and kidding percentage is positively correlated. It became evident that farmers who do not control internal parasites do not possess the necessary equipment like a dosing gun. The extensionist has a crucial role the play by firstly assisting farmers to acquire the equipment and secondly to train farmers how to apply the equipment.

Table 1: The effect of internal parasite control on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**		
No control	Control	No control	Control	No control	Control	No control	Control	
94,4%	77,6%	165%	89,1%	5,8%	9,45%	105,5%	77,9%	
0.092		0.013		0.489		0.301		**P Value**

*Significant at $P<0.05$

3.2 Provision of supplementary feed during winter and summer

It has been a well-known fact that supplementary feeding (flushing) before mating and during lactation affects reproductive performance positively (Snyman, 2010:46). Does should nutritionally replenish losses from the previous kidding with the time between weaning and mating (Rathod, Veeranna, Ramachandra, Biradar & Desai, 2018:239). Rathod *et al.* (2018:239) further stated that it is advisable to increase the level of nutrition before mating and after mating because this will result in higher ovulation and conception rates.

In this study, (Table 2) there is a statistically significant ($P<0.05$) difference in the kidding percentage where supplementary feed was provided as a kidding percentage (97.4%) with the

provision of supplementary feed was obtained. Mwuso (2019:13) stated that nutrition during conception and pregnancy in animals contributes meaningfully to the ability of an animal to conceive and complete a successful pregnancy. In a similar fashion, there was a statistically (P<0.05) higher weaning percentage (83.4%) with the provision of supplementary feed. High pre-weaning losses are reduced with adequate nutrition during lactation among other factors (Sebei, McCrindle & Webb, 2004:132). Nutritional deficiencies during pregnancy lower the reproductive performance of goats and in some cases result in kid mortality (Kusina, Chinuwo, Hamudikuwanda, Ndlovu & Muzanenhamo, 2001:283).

Table 2: The effect of provision of supplementary feed during winter and summer on conception rate, kidding percentage, mortality rate and weaning percentage.

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**		
No suppl. Feed	Suppl. Feed	No suppl. Feed	Suppl. feed	No suppl. Feed	Suppl. Feed	No suppl. Feed	Suppl. Feed	
75,7%	81,2%	88,8%	97,4%	7,2%	11,3%	75,3%	83,4%	
0.129		0.024		0.011		0.033		**P Value**

*Significant at P<0.05

3.3 Provision of supplementary lick

Licks can be used to compensate for mineral deficiencies or imbalances and potentially to decrease digestive disorders and toxic plant compounds (Ayotte, Parker & Gullingham, 2008:1041). The supplementation of licks provides various nutrients such as nitrogen, carbohydrates, minerals and vitamin (Makkar, 2007:17). The nutritional limitations are recognized as an important determinant of an animal condition (Ayotte et al., 2008:1047). The use of supplementary licks is of advantage as it limits excess intake (Makkar, 2007:14). A study by Herbert (1967:3) indicated that animals select certain licks over others and select sites within a lick. Hoon (2016:1) stated that a farm is seldom short of only one nutrient, therefore most farmers must combine different supplements or licks to provide them with balanced feed. Multi-nutrient blocks represent vast reservoir of cheap nutrients for ruminants (Asaolu, Akinlade, Aderinola, Okewoye & Alalade, 2012:263).

The provision of trace elements through licks remains one of the cheapest options, however it comes with the disadvantages of unregulated intake (Coetzee, 2013:86). In most grazing situations, trace minerals containing salt blocks cannot provide sufficient trace mineral to meet nutritional needs. A total of 83% respondents provided supplementary lick, however, the provision of supplementary licks in this study showed no significance (P>0.05) for any of the four production variables. It may be possible that either insufficient quantities of lick were supplied to the animals or the wrong lick combination was supplied. Agricultural extension can make a difference in educating farmers to apply licks effectively. Louw (1979:133) stated that when dealing with lick supplementation, there are basic principles that should be adhered to, namely: The object of supply licks is to supplement certain nutrients which are deficient in grazing in order to create a balance among nutrients which will ensure optimal utilization of available plant material; the lick should be supplementary and should never substitute feed in any form; The acceptance of the lick by animals should be such that voluntary intake can be controlled and take place at a consistent basis. Any deviation from these guidelines will render the lick less effective (Louw, 1979:133). The listed guidelines could have been contravened in this study, causing the supplementary lick to be less effective on the production variables

(Table 3). The extensionist can also act as the link between the farmer and industry by introducing the suppliers of lick to famers.

Table 3: The effect of lick supplementation on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**		
No lick	Lick	No lick	Lick	No lick	Lick	No lick	Lick	
70,8%	79,6%	108,1%	91,0%	10,1%	9,1%	86,9%	78,3%	
0.073		0.392		0.693		0.229		**P Value**

*Significant at $P<0.05$

3.4 Flush feeding

When does have low body condition scores, they often have low conception rates, low twinning rates and kids with low birth weight and weaning weight (Acero-Camelo, Valencia, Rodriguez & Randel, 2008:2). Flush feeding helps in preparing the does to be in a good condition for mating. Acero-Camelo (2008:5) stated that flushing improved the body condition in all does, not only at mating but also during their past- partum period (Titi, Alnimer, Tabbaa & Lubbadeh, 2008:34). No benefit can be seen in animals with excessive body condition scores and overly thin animals do not respond to flushing (Metzger, 2018:1).

The provision of flush feeding before mating showed a statistical significance ($P<0.05$) in the conception rate variable (Table 4). These results are in accordance with several studies in small ruminants which have shown that nutritional flushing improves conception rates (Fitz-Rodriguez, De Santiago-Miramontes, Scaramuzzi, Malpaux & Delgadillo, 2009:85; Urrutia-Morales, Meza-Herrera, Tello-Varela, Diaz-Gomez & Beltran-Lopez, 2013:1473). There was also a significant difference ($P<0.05$) in the kidding percentage (113.9%) variable where flush feeding was provided. Flushing can increase kidding and kidding rates by 10 to 20% (Metzger, 2018). The study done by Rafiq, Khan & Aujla (2003:115) showed that kids born to does supplemented and flushed excelled. This study showed high statistical significance in the weaning percentage variable.

Table 4: The effect of flush feeding on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**		
No flush feed	Flush feed	No flush feed	Flush feed	No flush feed	Flush feed	No flush feed	Flush feed	
74,1%	94,3%	87,5%	113,9%	8,3%	12,7%	73,9%	99,3%	
0.002		0.001		0.044		0.001		**P Value**

*Significant at $P<0.05$

3.5 Buck fertility testing

Bucks must be in full health in advance before the breeding season to ensure their fertility. All bucks should be examined at least eight weeks before they are introduced to the does, this gives time to address any problems or replace the bucks that are not healthy and fertile (Molecare, 2017). Seaman (2004:1) stated that in all breeding flocks there are bucks that either have

physical abnormalities or poor serving abilities which is likely to interfere with semen quality, these bucks must be identified and removed so that the does have a better chance of conceiving.

In this study, four (5.71%) respondents were testing their breeding bucks for fertility. In commercial flock's semen examination is only worthwhile if there is doubt as to buck fertility (Seaman, 2004:3). This study showed no statistically significant (P>0.05) difference in the conception rate and kidding percentage when buck fertility testing was conducted (Table 5). However, the conception rate (92.7%) and kidding percentage (113.6%) were high where bucks were tested for fertility. The majority of the farmers (75.71%) had bucks and does running together throughout the year.

Table 5: The effect of buck fertility testing on conception rate and kidding percentage

Conception rate %		**Kidding %**		
Bucks not tested	Bucks tested	Bucks not tested	Bucks tested	
77,4%	92,7%	91,5%	113,6%	
0.134		0.080		**P Value**

*Significant at P< 0.05

3.6 Presence of a specific breeding season

Breeding season management is an important tool to optimise the reproductive performance of a breeding herd (Bergh, 2004:11) and a well-planned breeding season can increase profit (Steyn, 2015). Only 24.29% of farmers had a specific breeding season. There is a proven need for more farmers to be educated on the importance of having a breeding season. Extension workers can serve as a link between farmers and mentors to ensure improved production.

Table 6 shows there was a statistically significant (P<0.05) higher conception rate where a specific breeding season existed. There was also a statistically significant higher kidding percentage (107.8%). A controlled breeding season can ensure efficient conception rate and kidding percentage (Prinsloo, 2015).

Table 6: The effect of breeding season on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No breeding season	Breeding season	No breeding season	Breeding season	No breeding season	Breeding season	No breeding season	Breeding season
73,7%	90,4%	87,3%	107,8%	8,1%	12,0%	73,3%	94,6%
***P*=0.005**		***P*=0.003**		***P*=0.029**		***P*=0.002**	

*Significant at P< 0.05

3.7 Pregnancy diagnosis

Examination of goats for pregnancy may be done as part of a reproductive herd health program (Dawson, 2002:41), providing information about conception rates after mating (Karadaev, 2015:184). Early and accurate pregnancy diagnosis are crucial for improving efficiency of

reproduction in goats (Kharche & Kouamo, 2015:331; Aban, Abdelghafar, Badawi & Almubarak, 2017:1).

In this study however, there was a statistically significant ($P<0.05$) difference in the weaning percentage (Table 7). A total number of 8 (11.43%) farmers performed pregnancy diagnosis. Kharche & Kouamo (2015:331) stated that farmers need to be educated on getting their animals checked for pregnancy diagnosis at an early date as it was found that the earlier the pregnancy diagnosis is performed, the better the production and reproduction. It was further stated that separation of flocks into pregnant and non- pregnant does might reduce reproductive and production losses in the form of abortions, still births and production of weak kids (Wani, Wani, Mufti & Khan 1998:239; Karen, Kovacs, Beckers & Szenci, 2001:9).

Table 7: The effect of pregnancy diagnosis on conception rate, kidding percentage, mortality rate and weaning percentage

Conception rate %		**Kidding %**		**Mortality rate %**		**Weaning %**	
No diagnosis	Diagnosis	No diagnosis	Diagnosis	No diagnosis	Diagnosis	No diagnosis	Diagnosis
76,8%	88,2%	91,4%	103,4%	9,3%	8,9%	77,0%	93,4%
***P*=0.072**		***P*=0.075**		***P*=0.564**		***P*=0.040**	

*Significant at $P<0.05$

4. Conclusion

The results of the study attest the positive effect of sound management practices on most of the production parameters. The productivity and production potential of goats was enhanced where good management was practiced. Furthermore, there was an improvement in kidding percentage where internal parasites were controlled, the majority of the farmers (94.3%) were controlling internal parasites through different methods. The provision of supplementary feed increased kidding and weaning percentage. In a similar fashion, the provision of supplementary feeding increased conception rate, kidding percentage and weaning percentage. There was a statistically significant higher conception rate, kidding percentage and weaning percentage where a specific breeding season existed. Twenty-four percent of the farmers had a specific breeding season. Pregnancy diagnosis also improved weaning percentage in this study, only 11.43% farmers were performing pregnancy diagnosis. Despite the positive effect of management practice on the production of goats, efforts are required to minimize the technological gap on improved management practices.

5. Extension implications

Extension officers can play a role in providing the knowledge and information which will enable the farmer to make sound management decisions and thereby ensure maximum production. Extensionists are better positioned to emphasize the importance of implementing better management practices, such as, but not limited to: control of parasites, provision of supplementary feed and lick, flush feeding, presence of a specific breeding season, buck fertility testing and pregnancy diagnosis. Moreover, stress how such practices has an impact on production.

Participation and attending agricultural seminars could prove beneficial to empowering farmers and extension officers, these include: The royal showground, AAII, NAMPO and International Agricultural Technology Conference & Exhibition (Agritech Africa). Farmers can obtain formal training through short courses offered at universities and colleges of agriculture.

Furthermore, it is recommended that the government implements programs where fresh graduates are also involve in sharing their knowledge with farmers.

6. Acknowledgement

The KwaZulu- Natal Indigenous Veld Goat club and financial assistance from Central University of Technology are gratefully acknowledged. All farmers who participated are greatly appreciated.

7. References

ABAN, A.S., ABDELGHAFAR, R.M., BADAWI, M.E & ALMUBARAK, A.M., 2017. Subsequent Fertility of Goats with Prenatal Mortality Diagnosed by Ultrasound and Treated by PGF_{2a} and Oxytetracycline. College of Veterinary Medicine, Sudan University of Science and Technology, Khartoum, Sudan. pp 1-5.

ACERO-CAMELO, A., VALENCIA. E., RODRIGUEZ, A. & RANDEL, P.F., 2008. Effects of flushing with two energy levels on goat reproductive performance. *Livestock Research for Rural Development*, vol 20. pp 1-8.

ASAOLU, V.O., AKINLADE, J.A., ADERINOLA, O.A., OKEWOYE, A.T. & ALALADE, J.., 2012. Performance of Grazing West African Dwarf Goats on Moringa Multinutrient Block Supplementation. *Asian J. Anim. Sci*., vol 6: 263-277.

AYOTTE, J.B., PARKER, K.L. & GULLINGHAM, M. P., 2008. Use of natural licks by four species of Ungulates in northern British Columbia. *J. Mammal*., vol 89 (4): 1041-1050.

BERGH, L., 2004. Breeding seasons for beef cattle in South Africa. *SA-Animal Science* vol 5 pp11-17.

CHIKWANDA, A.T., MUTISI, C., SIBANDA, S., MAKUZA, S.M., KUSINA, N.T. &CHIKWANDA, D., 2013. The effect of housing and anthelmintic treatment on pre-weaning kid death rate and infestation with gastrointestinal helminthes. *Applied Animal Husbandry and Rural Development*, vol 6. pp 32-35.

COETZEE, J., 2013. Supplementary feeding of grazing sheep in South Africa- Short comings and solutions. Merino Management, p 86-91.

DAWSON, L., 2002. Pregnancy diagnosis in goats. Goat Field Day. Langston University, Langston, OK. pp 41-44.

DUBE, K., 2015. Characterisation of goat production systems in selected coastal areas of the Eastern Cape province, South Africa. University of Fort Hare, Alice, South Africa. pp 1-117.

FITZ-RODRIGUEZ, G., DE SANTIAGO-MIRAMONTES, M.A., SCARAMUZZI, R.J., MALPAUX, B. & DELGADILLO, J.A., 2009. Nutritional supplementation improves ovulation and pregnancy rates in female goats managed under natural grazing conditions and exposed to the male effect. Animal Reproduction Science. vol 116 pp 85-94.

HEBERT, D.M., 1967. Natural salt licks as part of the ecology of the mountain goat. University of British Columbia. pp 1-138.

HOON, J., 2016. How to supplement this winter. *Farmer's Weekly*. [Online] Retrieved from https://www.farmersweekly.co.za/ Accessed: 4 November 2019

KARADAEV, M., 2015. Pregnancy diagnosis technique in goats – A review. *Bulgarian J. of Vet. Med*., vol 18, No 3, pp.183-193.

KAREN, A., KOVACS, P., BECKERS, J. & SZENCI, O., 2001. Pregnancy diagnosis in sheep: Review of the most practical methods. Pp 8-28.

KHARCHE, S.D. & KOUAMO, J., 2015. An overview of pregnancy diagnosis in small ruminants. *Indian J. of Anim. Sci*., 84: 331-342.

KUSINA, N. T., CHINUWO, T., HAMUDIKUWANDA, H., NDLOVU, L. R. & MUZANENHAMO, S., 2001. Effect of different dietary energy level intakes on efficiency of estrus synchronisation and fertility of Mashona goat does. Small Ruminant Research, 39 pp.283- 288.

LOUW, G.N., 1979. An evaluation of the application of stock licks in South Africa. *S. Afr. J. of Anim. Sci.,* vol 9.133-144.

MAKKAR, H.P.S., 2007. Feed Supplementation Blocks. *Food and Agriculture Organization*. Pp 1-248.

MARY, C. & SMITH, D.V.M., 2004. Goat Parasites: Management and Control. pp 1-9 Taken from presentations during the ECA Symposium on Goat Health, June 3 1995.

METZGER, M., 2018. Flushing small ruminants for a higher ovulation rate. Sheep and Goats. Michigan State University Extension. [Online] Retrieved from: https://www.canr.msu.edu/ Accessed: 22 October 2019.

MOLECARE, 2017. Ram fertility testing. [Online] Retrieved from:

https://www.molecarevetsciences.com
Accessed: 21 October 2019.

MWUSO, O., 2019. A Systematic Review of the Impact of Minerals on Pregnant Sheep and Goats and their offspring in the African Continent. University of Pretoria, South Africa. pp1-73.

PEACOCK, C.,1996. Management of reproduction. Chapter 7. Pp 235-252.

PEACOCK, C., 2005. Goats: A pathway out of poverty. Small Ruminant Research, 60: 179–186.

RAFIQ, M., KHAN, M.F. & AUJLA, K.M., 2003. Economic Benefits of Flushing and Supplemental Feeding of Salt-range Ewes on Pothwar Ranges of Pakistan. *Pakistan J. of Bio. Sci*., vol 6 pp 115-121.

RATHOD, P., VEERANNA, K., RAMACHANDRA, B., BIRADAR, C., & DESAI, A., 2018. Supplementary Feeding of Goats during Transition Period – A Participatory Action Research in North-Eastern Transition Zone of Karnataka State, India. *Int. J. of Livest. Res*., vol 8,No 10, pp. 238-240.

SEAMAN, J., 2004. Fertility testing of rams. Revised edition. *Flock Health NSW Department of Primary Industries*. pp 1-5.

SEBEI, P.J., MCCRINDLE, C.M.E. & WEBB, E.C., 2004. Factors influencing weaning percentages of indigenous goats on communal grazing. *S. Afr. J. of Anim. Sci*., vol 34: 130–133.

SHELTON, M., 1978. Reproduction and Breeding of Goats. *Int. J of Dairy Sci.,* Vol. 61 , No7. Pp 994-1010

SNYMAN, M.A., 2010. Influence of body weight, age and management system on reproduction of South African Angora goat does. *S. Afr. J. of Anim. Sci.,* vol 40 (1) pp 41-53.

STEWART, I.B., 2000. Zulu Goats in KwaZulu Natal. *S. Afr. J. of Anim. Sci*., (30) 134-135.

STEYN, J., 2015. Breeding season for goats. *Farmer's Weekly*. [Online] Retrieved from: https://www-farmersweekly-co-za.cdn.ampproject.org/v/s/
Accessed: 22 October 2019

TITI, H.H., ALNIMER, M., TABBAA, M.J. & LUBBADEH, W.F., 2008. Reproductive performance of seasonal ewes and does fed dry during their postpartum period.

Livestock Science vol 115. pp 34 -41.

URRUTIA-MORALES, J., MEZA-HERRERA, C.A., TELLO-VARELA, L., DIAZ-GOMEZ, M.O. & BELTRAN-LOPEZ, S., 2012. Effect of nutritional supplementation upon pregnancy rates of goats under semiarid rangelands and exposed to the male effect. Tropical Animal Health and Production. vol 44: 1473-1477.

VAN DE VYVER, F., 2014. Optimum nutrition for breeding ewes. Farmer's Weekly [Online] Retrieved from: https://www.farmersweekly.co.za/animals/sheep-goats/ Accessed: 03 November 2019

WANI, N.A., WANI, G.M., MUFTI, A.M. & KHAN, M.Z., 1998. Ultrasonic pregnancy diagnosis in gaddi goats. *Small Rumin. Res.*, vol 29. pp 239-240.