

Evaluating the effect of certain management practices on the production performance of goat farmers in selected districts of KwaZulu-Natal: agricultural extension can make a difference

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ABSTRACT

Goat farming holds great importance in the KwaZulu Natal province, it offers means to generate income specially to sustain rural households. Employment and food security are accounted for. Proper management of goats play a prime role in improving the productivity of herds. 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, lambing percentage, mortality rate and weaning percentage was investigated. 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 was present. A statistically significant higher lambing 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

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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 are a source of income and ensure food security through aiding seasonal food variability and availability (Dube, 2015:2). According to 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 a goat enterprise is the production rate, which is largely a function of pregnancy rate, lambing 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. LITERATURE REVIEW

2.1 Managing for a productive goat herd

In many parts of rural Africa sheep and goats wander freely around the villages and communal veld, scavenging for food. This often leads to over grazing, poor condition of livestock and poor production standards (Maree & Casey 1993). A healthy animal is able to resist diseases and can recover more easily when it gets sick. A sick animal cost a farmer money and time (DARD, 2015:11). The nutrition of goats is the most important factor affecting performance. Poor nutrition results in lower rates of production (Senthilkumar & Purushothaman, 2017:13). Davila (2017:95) points out that factors that affect conception rate include nutritional management and body condition of goats. 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).

Buck fertility is just as important as doe fertility when it comes to breeding season (Elliot, 2021). 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 chance of conceiving. To address management factors, it is recommended that a certain breeding season is practised to allow for improved, controlled management of the flock. Furthermore, this is only possible if bucks can be prevented from mating the does (DARD, 2015: 86). Determining

pregnancy status early on is arguably the most important factor in determining reproductive efficiency, early identification of open does provides a better evaluation of conception rate (Evermann & DeAvila, 2019:1).

Poor production results mainly from kid mortality which are mainly due to poor management (including poor nutrition) (DARD, 2015:64). 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 (Mwuso, 2019:12). Increased reproduction in any type of goat would contribute to improved efficiency (Shelton, 1978:994).

2.1 Internal parasites

Internal parasites are a major health problem in the livestock industry, they cause retarded growth, poor reproductive performance, condemnation of goat carcasses 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.

2.2 Provision of supplementary feed during winter and summer

It has been well-known that supplementary feeding (flushing) before mating and during lactation affects reproductive performance positively (Snyman, 2010:46). Ewes 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.

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. 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, Hamudikwanda, Ndlovu & Muzanenhamo, 2001:283).

2.3 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.

2.4 Flush feeding

When ewes 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 ewes to be in a good condition for mating. Acero-Camelo (2008:5) stated that flushing improved the body condition in all ewes, not only at mating but also during their post-partum period (Titi, Alnimer, Tabbaa & Lubbadah, 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).

2.5 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 ewes, this gives time to address any problems or replace the rams that are not healthy and fertile (Molecare, 2017). Seaman (2004:1) stated that in all breeding flocks there are rams that either have physical abnormalities or poor serving abilities which is likely to interfere with semen quality, these rams must be identified and removed so that the ewes have a better chance of conceiving.

2.6 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). 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 (Van Tonder, 2020;1). A controlled breeding season can ensure efficient conception rate and kidding percentage (Prinsloo, 2015).

2.7 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).

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 ewes might reduce reproductive and production losses in the form of abortions, still births and production of weak lambs (Wani, Wani, Mufti & Khan 1998:239; Karen, Kovacs, Beckers & Szenci, 2001:9).

3. 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 70 respondents. This district was chosen to assess current management practices, thereby the effect on production of goats. The results of this study will play a role in improving goat farming in the uMgungundlovu district. A well-designed questionnaire was used to gather data from respondents individually. Farmers were selected using the simple random sampling method (every farmer had an equal chance of being selected) and they participated voluntarily in the survey. All the farmers were visited while the questionnaires were completed.

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. Before conducting a t-test to compare the various groups of respondents based on various management practises, the assumptions that must be met before conducting a t-test was investigated. If the sample data did not meet the assumptions for performing a t-test, the Mann-Whitney U test (the non-parametric equivalent of the independent samples t-test) was conducted. According to Maverick (2018), the following assumptions must be met before a T-Test can be conducted. The first assumption made regarding t-tests concerns the scale of measurement. The assumption for a t-test is that the scale of measurement applied to the data collected follows a continuous or ordinal scale, such as the scores for an IQ test. The second assumption made is that of a simple random sample, that the data is collected from a representative, randomly selected portion of the total population. The third assumption is the data, when plotted, results in a normal distribution, bell-shaped distribution curve. The fourth assumption is a reasonably large sample size is used. A larger sample size means the distribution of results should approach a normal bell-shaped curve. The final assumption is homogeneity of variance. Homogeneous, or equal, variance exists when the standard deviations of samples are approximately equal. Analysis was completed using Statistical Package for Social Science SPSS Software.

3.1 Respondents

3.1.1 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

Level of education	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

3.1.2. Herd particulars

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 & 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).

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

Herd combination	Bucks	Does	Kids	Weaners
Mean±SD	3.37±3.47	49.96±73.89	15.59±22.15	10.96±20.38

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).

3.1.3 Breeds

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 3) shows the goat breeds of the assessed farmers.

Table 3: 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

3.14 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%. 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.

3.1.5 Farm infrastructure

(Figure 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.

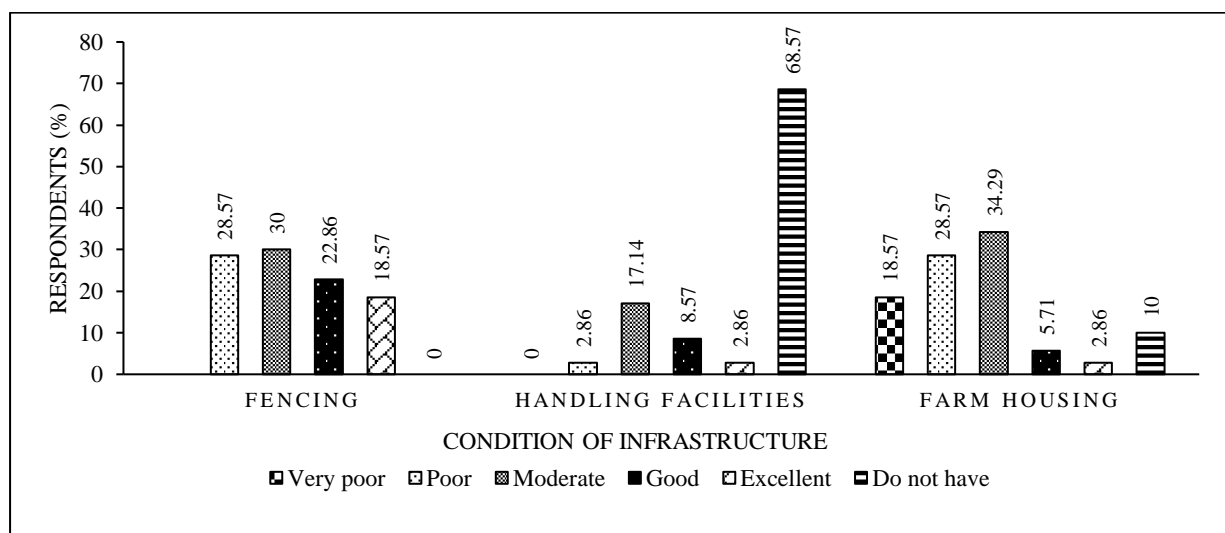


Figure 1: Farm infrastructure and condition in the uMgungundlovu district

3.1.6 Animal health

a. Internal parasites

Sixty-six respondents control parasites, 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.

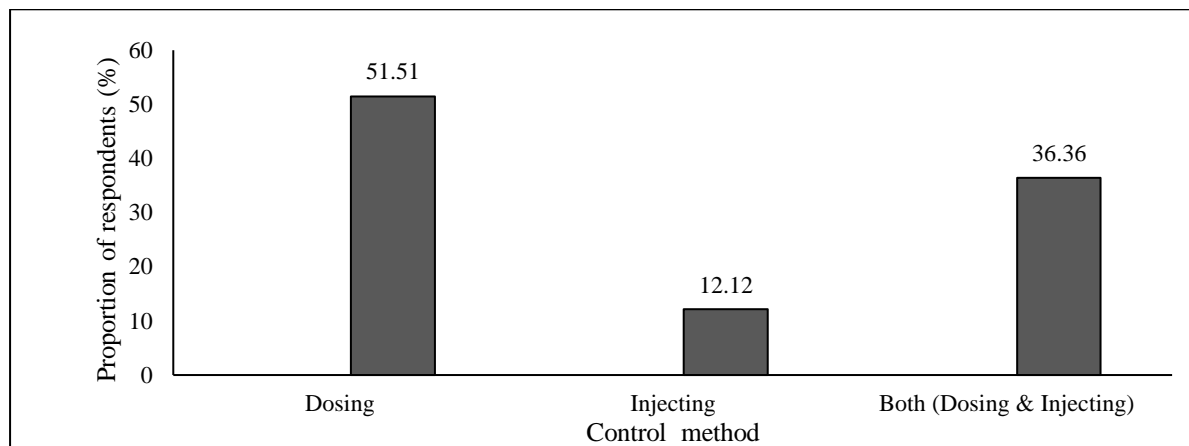


Figure 2: Respondents' method of controlling internal parasite

b. External parasites

A considerable proportion of respondents (95.71%) were controlling external parasites while 4.29% were not (Table 4). 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).

Table 4: 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

Respondents use different methods of controlling external parasites, with most farmers using 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.

c. 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.

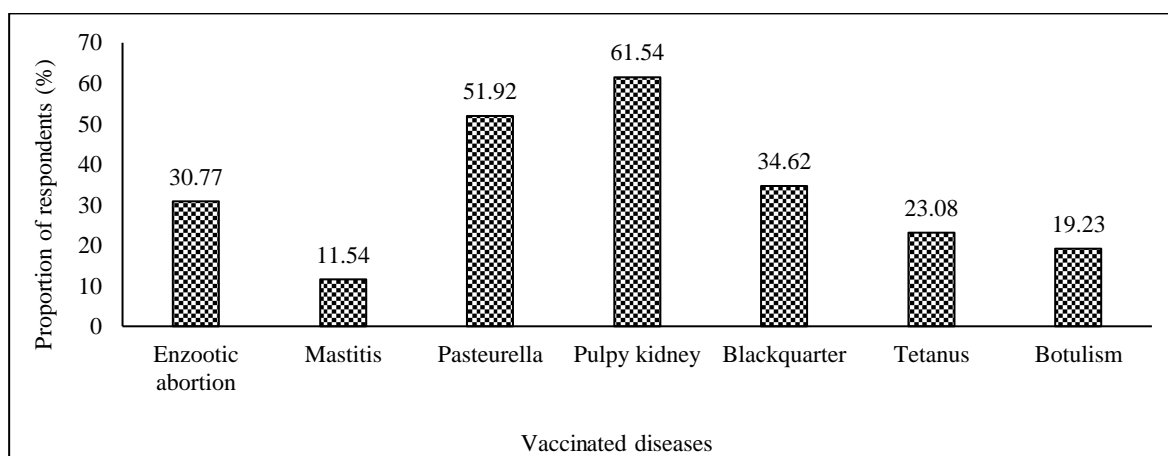


Figure 3: Vaccinated diseases by respondents

3.1.7 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 deteriorates, 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.

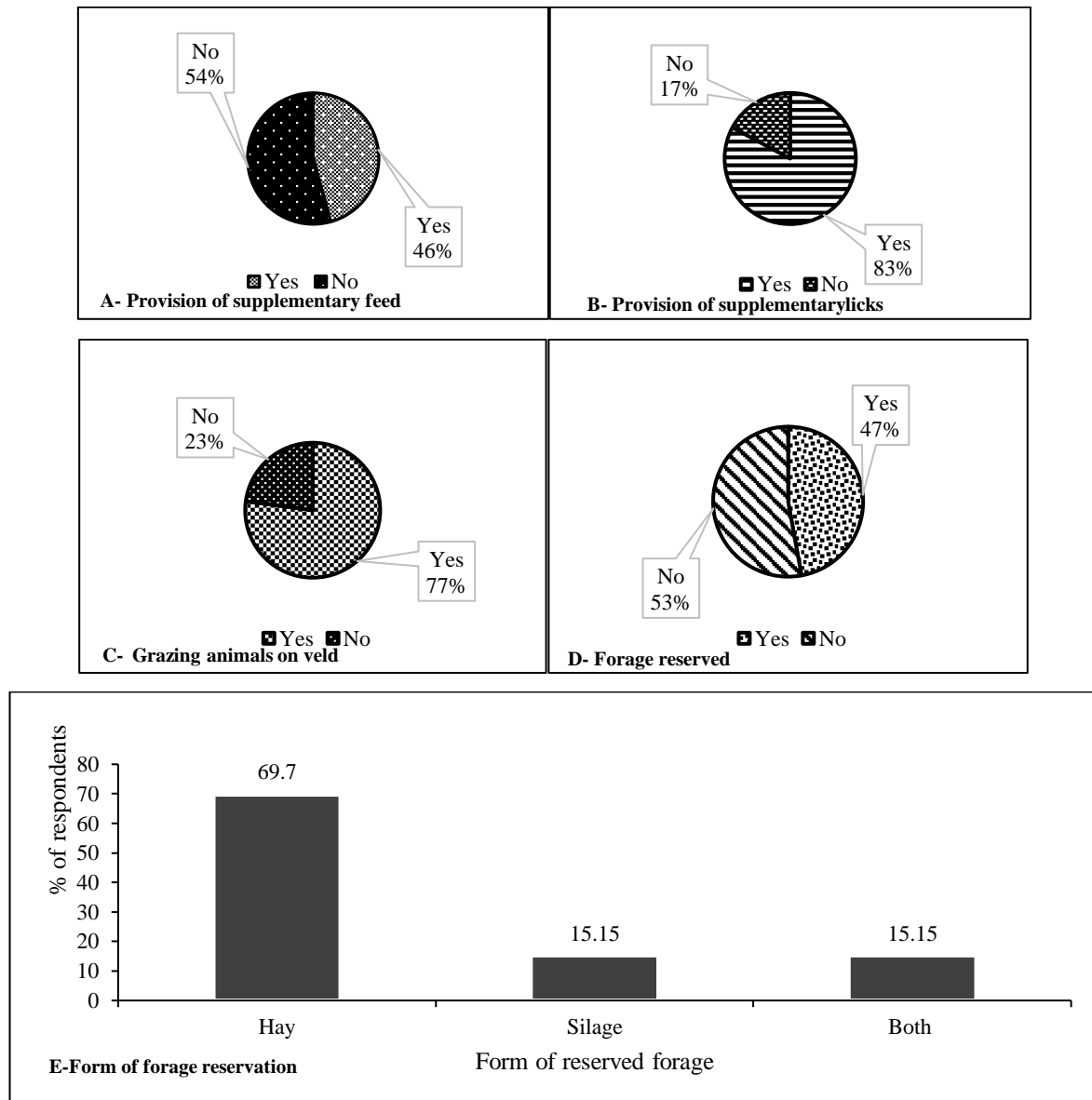


Figure 4: A- Provision of supplementary feed (Winter/Summer) by respondents'; B- Provision of supplementary lick by respondents; C- Grazing animals on veld; D- Forage reservation by respondents; E- Form of forage reservation by farmers.

Most of the farmers (83%) figure 4-B, provided supplementary licks. 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%).

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%

Table 5: General management practices by respondents (Castration, animal identification and hoof trimming)

3.1.8 General management

a. Castration

Table 5 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, according to Yami (2009:12), it has the greatest potential of infection and fly infestation. This is another example where extension services can not only educate farmers in using more effective methods but also reduce possible losses.

b. Animal identification

Stuart (2016:1) stated that being able to identify individual animals on the farm is critical to good farm management. Table 5 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.

c. Hoof trimming

Table 5 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 (2014:1) 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.

3.1.9 Veld management

a. Veld division

A single farm may have veld types differing with regard to nature of the vegetation, the palatability of plants and accessibility of certain parts of veld (Roux & Skinner, 2012), 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 dividing 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.

b. 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 farmers were cultivating *Medicago sativa* (Alfalfa). One farmer had Mooi mix.

3.1.10 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).

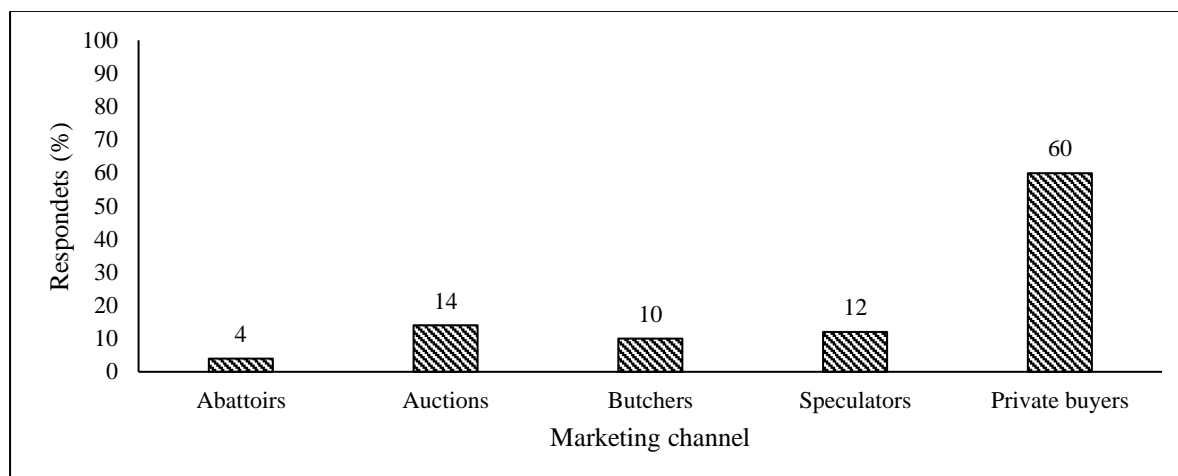


Figure 5: Marketing channels

4. RESULTS AND DISCUSSION

Table 6: Number of farmers in the uMgungundlovu district employing the different management practices

Management practice	No. of farmers employing each management practice (n=70)	Percentage of farmers employing each practice
Internal parasite control	66	94%
Provision of supplementary feeds	32	46%
Provision of supplementary lick	58	83%
Flush feeding	13	18.6%
Buck fertility testing	4	5.7%
Presence of a specific breeding season	17	24.3%
Pregnancy diagnosis	8	11.4%

4.1 Internal parasites

In the study, 94% of the farmers were controlling internal parasites, 51.5 % use the oral dosing method, (12.1%) injecting and those who use both the dosing and injection method accounts to 36.4%. The only statistically significant difference was for the lambing percentage variable, $P<0.05$ (Table 4. 1). Respondents who controlled internal parasites had a statistically significant ($P<0.05$) higher lambing percentage than respondents that did not control internal parasites. A ewes' body condition can be affected by internal parasites (Prinsloo, 2015). On the other hand, Van der Vyver, (2014) indicated that the ewe flock's condition and lambing 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. Agricultural extension officers have a crucial role the play by firstly assisting farmers to acquire the equipment and secondly to train farmers how to use the equipment. There are companies that supply livestock medicine that play an active role in educating local farmers about internal parasites and available remedies. Companies such as *Virbac* and *Afrivet* are actively playing a role in educating farmers through arranged meetings with farmers and handing out booklets. These booklets are available in all languages which makes it easier for the farmers to read.

Table 7: The effect of internal parasite control on conception rate, lambing percentage, mortality rate and weaning percentage

Conception rate %		Lambing %		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 $P<0.05$

Table 7 shows that where internal parasites were not controlled, the conception rate was 94.4% and where they were controlled, the conception rate was 77.6%, therefore no statistically significant difference ($P>0.05$). In a similar manner, there was no statistically significant difference where internal parasites were controlled for both weaning and mortality rate

respectively. Respondents who had controlled internal parasites had a statistically significant ($P < 0.05$) higher lambing percentage than respondents that did not control internal parasites.

4.2 Provision of supplementary feed during winter

In this study, (Table 8) there is a statistically significant ($P < 0.05$) difference in the lambing percentage where supplementary feed was provided as a lambing percentage (97.4%) with the provision of supplementary feed was obtained. In a similar fashion, there was a statistically ($P < 0.05$) higher weaning percentage (83.4%) with the provision of supplementary feed.

Table 8: The effect of provision of supplementary feed during winter and summer on conception rate, lambing percentage, mortality rate and weaning percentage.

Conception rate %		Lambing %		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 $P < 0.05$

4.3 Provision of a supplementary lick

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. Again, the extension officer is well positioned to act as a link between various feed companies and the farmer ensuring that farmers are well educated in the application of licks. Louw (1979:133) stated that when dealing with lick supplementation, there are basic principles that should be adhered to, namely: The objective of supplying 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 9). The extension officer should rather introduce farmers to the concept and use of licks and allow them to make their own decisions.

Table 9: The effect of lick supplementation on conception rate, lambing percentage, mortality rate and weaning percentage

Conception rate %		Lambing %		Mortality rate %		Weaning %		P Value
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		

*Significant at $P < 0.05$

4.4 Flush feeding

There was also a significant difference ($P < 0.05$) in the lambing percentage (113.9%) variable where flush feeding was provided. Flushing can increase lambing and kidding rates by 10 to 20% (Metzger, 2018). The study done by Rafiq, Khan & Aujla (2003:115) showed that lambs born to ewes supplemented and flushed excelled (high birth weight and weaning weight). This study showed high statistical significance in the weaning percentage variable.

Table 10: The effect of flush feeding on conception rate, lambing percentage, mortality rate and weaning percentage

Conception rate %		Lambing %		Mortality rate %		Weaning %		P Value
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		

*Significant at $P < 0.05$

4.5 Buck fertility testing

In this study, four (5.71%) respondents were testing their breeding rams for fertility. In commercial flocks semen examination is only worthwhile if there is doubt as to ram fertility (Seaman, 2004:3). This study showed no statistically significant ($P>0.05$) difference in the conception rate and lambing percentage when ram fertility testing was conducted (Table 4.5). However, the conception rate (92.7%) and lambing percentage (113.6%) were high where rams were tested for fertility. The majority of the farmers (75.71%) had rams and ewes running together throughout the year.

Table 11: The effect of ram fertility testing on conception rate and lambing percentage

Conception rate %		Lambing %		
Buck not tested	Buck tested	Buck not tested	Buck tested	
77,4%	92,7%	91,5%	113,6%	
0.134		0.080		P Value

*Significant at $P < 0.05$

4.6 Presence of a specific breeding season

Only 17 (rather use numbers of farmers who employed a specific breeding season, or almost a quarter of farmers) 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. With knowledge of controlled breeding season, grazing can be utilised at its peak production period, the best camps can allocated to the breeding herd which may result in high conception rate and does can be mated at optimal condition (weight) (Bergh, 2004).

Table 12 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 lambing percentage (107.8%). A controlled breeding season can ensure efficient conception rate and lambing percentage (Prinsloo, 2015).

Table 12: The effect of breeding season on conception rate, lambing percentage, mortality rate and weaning percentage

Conception rate %		Lambing %		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 $P < 0.05$

4.7 Pregnancy diagnosis

In this study however, there was a statistically significant ($P < 0.05$) difference in the weaning percentage (Table 13). 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 ewes might reduce reproductive and production losses in the form of abortions, still births and production of weak lambs (Wani, Wani, Mufti & Khan 1998:239; Karen, Kovacs, Beckers & Szenci, 2001:9).

Table 13: The effect of pregnancy diagnosis on conception rate, lambing percentage, mortality rate and weaning percentage

Conception rate %		Lambing %		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 $P < 0.05$

5. 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 were enhanced where good management was practiced.

Furthermore, there was an improvement in lambing 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 lambing and weaning percentage. In a similar fashion, the provision of supplementary feeding increased conception rate, lambing percentage and weaning percentage. There was a statistically significant higher conception rate, lambing percentage and weaning percentage where a specific breeding season existed although only 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.

6. 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, ram 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 Show, NAMPO and International Agricultural Technology Conference & Exhibition (Agritech Africa). Farmers can obtain formal training through short courses offered at universities and colleges of agriculture.

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