

ASSESSING SOCIO-ECONOMIC FACTORS INFLUENCING WOOL PRODUCTION IN KOLOMANA VILLAGES OF EASTERN CAPE, SOUTH AFRICA

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ABSTRACT

Despite considerable investment by government and non-governmental organisations (NGOs) to support wool production amongst farmers in parts of the Eastern Cape Province, the sub-sector continues to feature low production and productivity while the small-scale farmers continue to wallow in poverty. There is therefore genuine interest to gain a deeper understanding of the reasons for this situation and identify elements for a strategy to remedy the situation. This study looks specifically at socio-economic constraints/factors affecting wool production in the rural Kolomana area. A structured questionnaire was used to collect information on demographic parameters and socio-economic factors affecting wool production in Kolomana villages of the Eastern Cape Province in South Africa. Descriptive statistics were generated using the Statistical Package for Social Sciences (SPSS, version 20). Observed major infrastructural constraints to sheep farmers in Kolomana were shortage of shearing sheds, dip tanks, fences and re-fencing of camps and technical resources such as availability of animal health technicians. A linear regression model was used to test how independent variables relate or affect the dependent variables, which were defined in value and quantitative terms. Age of the household head, marital status of household head, number of sheep owned by households, division of rangeland into camps, state of fencing on rangeland, visits by animal health technicians, and availability of colostrum to lambs were found to be influential. Without doubt, removing constraints faced by rural wool sheep farmers and implementing correct managerial practices when necessary could improve efficiency in wool production for the rural poor. Thus, the study seeks to acknowledge different practices that rural farmers employ in sheep production, which includes but is not limited to indigenous knowledge used to enhance maximum wool production.

Keywords: Linear regression model, Rural wool farmers, Smallholders, Socio-economic factors, wool production

1. INTRODUCTION

Sheep are important to farmers in many economies. They provide milk (and its derivative products such as cheese and butter), wool, sheep skin (used for making clothes, footwear and rugs), and meat. The contribution of sheep to the economies of many countries in Southern Africa has however declined in the last decades (Bot *et al*, 2004; Lupton *et al*, 2007). South Africa produces mainly apparel wool (Bot *et al*, 2004; Lupton *et al*, 2007). The South African wool clip is predominantly a Merino clip, but coarse and coloured types are also produced and

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marketed on a limited scale. Historically, wool produced in the neighbouring states of Namibia and Lesotho was considered part of South African production and has always been sold in South Africa (Department of Agriculture, Forestry and Fisheries (DAFF), 2010).

South Africa is also rich in mutton production and mutton sheep such as South African mutton merino is mostly found in the semi-arid areas of the Northern Cape, Western Cape, Free State and Mpumalanga provinces (Grootfontein, 2014). The most popular mutton breed in South Africa, which is locally developed, hardy and highly reproductive is a Dorper. Limited numbers of indigenous fat-tailed sheep and Karakul sheep are still found (Agriculture and Land Affairs, 2007). Mutton contribution in the growth rate of Southern Africa economies was 3% per annum in 1960-1970 and 1.4% per annum in 1970-1980 (Tangermann & Krostitz, 1982). Sheep possess an exceptional ability to convert a wide variety of non-competitive feedstuffs (forage and crop residues) into high quality meat and fibre products for human use (Agriculture and Land Affairs, 2007). They are efficient converters of forage to meat and fibre and are capable of producing good carcasses from forage alone (Umberger, 1996).

Sheep feed on a forage that is found freely on the rangelands and convert it to meat and fibre. Sheep mostly eat grass, clover, and other pasture plants. They especially love forbs (a broad-leaf plant other than grass); it is usually their first choice of food in a pasture. Therefore, sheep produce high income generating products (meat and fibre) using low cost vegetation found on the rangelands. Sheep also contribute to income through its wool while it is still alive. This makes them choice elements of poverty reduction strategies especially for previously disadvantaged groups unable to raise the critical mass of capital to invest in income generating activities (DAFF, 2010). South Africa is ranked number five after Australia, New Zealand, Uruguay and Argentina amongst wool exporting countries (DAFF, 2010).

Over half of the sheep in South Africa are fine-woolled Merinos. Other breeds used include the locally developed Afrino, a woolled mutton breed adapted to arid conditions, the South African Mutton Merino, the Dohne and the Merino Landrace. The Eastern Cape is well known for its wool production and good quality wool that farmers produce every year. The sheep breed with the highest wool production per head in South Africa is the South African Merino (Safari, Fogarty & Gilmour, 2005).

The other high producing breeds are the dual purpose Merino breeds, of which the Dohne Merino, the South African Mutton Merino, the Afrino and the Lettele are the most popular (Safari *et al*, 2005). Dual-purpose breeds are bred with the specific aim of maximising wool and mutton income, since they have a better body conformation than the Merino, but produce slightly less wool per kilogram of body weight (Bot *et al*, 2004). The gross value of production for wool is dependent on the quantity produced and prices received by producers. Average Merino fleece weights vary from 4 kg to 5 kg per year in the semi-arid regions, to up to 8 kg per year from sheep grazing on cultivated pastures. DAFF (2010) stated that the gross value of wool production started to increase in 2000 to 2002 until a decline was experienced in 2003 to 2005. Between 2006 and 2007, the gross value of wool production increased until a decline in 2009. In 2007, the gross value of wool production reached a peak at approximately R1.3 million and the lowest attained was in 2000 at approximately R600 000. The recorded gross value of wool sold at first point of sale for the season 2009/10 came to R1 505 million, compared to R1 154 million in 2008/09 – an increase of 30.5%. In South Africa, wool production increased by 0.8% from 47.9 million kg in 2008/09 to 48.3 million kg in 2009/10, mainly because of improved production conditions in most areas (DAFF, 2010). Marked dramatic improvements

in productivity and quality of wool are possible and are already experienced in other parts of the country where improvement programmes are put into place. For example, de Lange *et al* (2004) reported that pilot programmes under cooperation arrangements between the National Wool Growers Association (NWGA) and the Department of Agriculture, with the active engagement of communal developing farmers, led to an increase in the annual income from R15 per sheep per annum to more than R65.

The NWGA is running a scheme to improve the quality of wool sheep in underdeveloped areas. The project is aimed to produce good quality and environmentally adapted sheep in these areas through the use of improved technology such as artificial insemination and embryo transfer. The improved ewes and rams will provide a sufficiently large infusion of appropriately high quality animals into the communal areas that will catalyse production practices and catapult rural wool production and income levels ten times (de Lange *et al*, 2004). These quality wool sheep are distributed to farmers by NWGA through the exchange system, where a farmer will take an old sheep to NWGA and get a good quality ram to improve his/ her flock. One of the requirements for the success of the project is proper veld and flock management systems (de Lange *et al*, 2004).

The emergent and traditional stock-keepers in particular in the rural areas of South Africa are faced with problems or constraints in increasing their production and productivity and thus their incomes from wool is alarming. The principal constraints are technical in nature, especially genetic (stock quality) improvement, better herd and health management (to increase reproduction and reduce mortality rates), and improvements in shearing, grading and sorting standards as well as the fenced camps. However, most of the technical solutions are known and capable of being addressed (Bot *et al*, 2004). There are more than 27 000 wool producers (mostly Merino) in South Africa producing a total of just over 100 million kg of wool. Commercial growers are producing more than 80% of the entire wool clip. The average production per sheep is roughly 4,5 kg. The number of annual slaughtering comprises about one-third of the total sheep population giving a meat yield of just over 6 kg per sheep (Grootfontein Agricultural Development Institute (GADI), 2012).

Over 70% of the resource poor rural farmers in the Eastern Cape Province of South Africa reside in the harsh agro-ecological zones where cropping is unsuitable and therefore, they rely on livestock for their livelihoods (Bester *et al*, 2003). Wool sheep contributes to subsistence farming and enhances the sustainability of smallholder farming systems. Although sheep provide diverse functions to farmers in Africa, their productivity is generally low. There are various factors that reduce wool production (Abeyratne, 2001). This led to the introduction of several initiatives by the government and NWGA such as the Ram Project which is introducing superior rams to wool farming communities in the former Transkei and Ciskei regions. These constraints have a negative impact on wool production. Therefore, there is a need to carry out a study at Kolomana villages in the Nkonkobe Local Municipality and Amathole District Municipality of the Eastern Cape to determine constraints faced by rural wool farmers and management practices being used.

1.1 Problem statement

Kolomana sheep farmers have large numbers of different wool sheep breeds such as Merino and Dohne Merino, availability of suitable vegetation for feeding their sheep, availability of clean water for the stock to drink, veterinary services, as well as the undivided support from

the Eastern Cape government structures such as extension services from the provincial Department of Rural Development and Agrarian Reform (DRDAR), previously known as the Department of Agriculture and Land Affairs. The National Wool Growers Association (NWGA) and the Agricultural Research Council (ARC) collaborated in 1996 to establish and provide an advisory service to the woolgrowers in the former Transkei and Ciskei areas to improve the quality of life of rural sheep farmers.

Under the scheme, sheep farmers exchange old sheep for superior ram to improve the quality of their breeding stock. Kolomana sheep farmers have benefited from the project. Even though these farmers have been supported over the years and are still being supported, the quality of their wool is still poor; producers still suffer low incomes and poverty remains high. Both the DRDAR and the NWGA are concerned about this state of affairs.

Over the years, several studies have been undertaken to explore the reasons for this situation as a basis for designing optimal solutions. However, these studies have focused on general animal production questions, trying to find out which types of livestock were suitable to be reared in Kolomana. Cattle, sheep and goat were the livestock that have received the most attention. Studies on wool production constraints, opportunities and management practices have either been rare or never been carried out. Types of sheep which are mostly reared in Kolomana are Merino and Dohne Merino, which are the wool breeds. Ideally, these farmers are supposed to produce good quality wool. In the view of experienced white farmers in the area, it is contrary to common sense that wool production would be as severely constrained among these farmers as is the case at present.

These views were again very strongly expressed during the rural sheep farmers mini flock show held in September, 2010 in Kolomana and again in September, 2011 by the DRDAR and NWGA in trying to motivate farmers to take wool production seriously. It is also true that neighbouring farms (white-owned) have consistently produced good quality wool when compared to what the local farmers produce. It is for this reason that the present research is designed to assess the management practices such as feeding, breeding, lambing and health issues that are employed or practised in seven villages of Kolomana. More specifically, the study aims to describe the sheep production system in the study area, assess opportunities and constraints for wool sheep producers in Kolomana, assess availability of resources such as feed, water and grazing land, determine infrastructure needed for wool sheep production such as fencing, dip tanks and shearing sheds in Kolomana, as well as to identify the sheep management practices (feeding, health issues, breeding and lambing) that are being employed in Kolomana and how they influence the performance of the wool sheep production systems.

2. LITERATURE REVIEW

This section reviews the literature on economic and social importance of livestock production in rural development and poverty alleviation.

2.1 Livestock production - The tool for rural development and poverty alleviation

Ngqulana (2017) states that livestock plays an important role in poverty reduction in rural areas, however, it is also opposed by a number of constraints which exist globally and locally. These constraints are the obstacles to the development of livestock production and for it to be able to reach a level where the people in rural areas are able to reap the benefits of keeping livestock.

Livestock production accounts for about one-fourth of the total food produced by households rearing livestock in the Eastern Highlands of Ethiopia. These results lead one to hypothesise that if livestock are so critical in the densely populated Eastern Highlands with small land holdings, their contribution might be even greater in the Central and Western Highlands of Ethiopia where population density is lower and the average land and livestock holding per farm is larger (van Averbek & Khosa, 2007). Ainslie (2002) found that the number of livestock marketed from the small-scale sector of the Eastern Cape Province is well under 10% of the total herd. Jooste (1996) states that this is low compared to the commercial sector that ranges between 23% and 25% of the total herd. Jordaan (2012) states that small stock does play a valuable role in all rural communities because of their low cost, which makes accumulating herds easier for the poorer groups. Their small size means that they are easily disposed of when slaughtered and they can be easily marketed to meet minor cash demands.

Ainslie (2002) stated that communal area livestock production contributes insignificantly to formal agricultural output and confined to the eastern and northern parts of the country. However, herd sizes vary considerably between and within regions and livestock. Ownership is skewed with a small number of people owning large herds and the majority owning few animals or none at all. Stock numbers tend to be less evenly distributed in communal than in commercial areas. There is a tendency for high concentrations of people and livestock near to access roads, towns, infrastructures (schools, clinics, supply stores), and permanent water. Portions of the landscape that are inaccessible or far from permanent water remain underutilised. The areas designated as homelands were caught up in an age-old tradition of communal livestock farming among Africans in which there were very poorly defined individual rights with respect to access to grazing resources, except for national or tribal boundaries. This led to problems such as landlessness and little available land, which were in fact unavoidable (Bayer, Alcock & Gilles, 2004).

2.2 Economic importance of livestock production in rural development and poverty alleviation

In the Eastern Cape Province of South Africa, the communal grazing areas occur mostly in the former homeland areas such as Transkei and Ciskei which constitute about 25% of the surface area but are carrying high livestock numbers. These areas carry about 1.7 million out of 2.3 million cattle, 2.9 million sheep out of 7.3 million, and 2 million goats out of the 2.7 million in the Province (Food and Agriculture Organization (FAO), 2001). These figures are an equivalent of more than 60% of the cattle and 70% of the goat populations of the entire province (Ainslie, 2002). The combined livestock sector contributes about 75% of total agricultural output (National Department of Agriculture, 2009).

Comparison between crop and livestock incomes reveals that while livestock accounted for 49% of total net income, crop production contributed a mere 6%. Within the livestock sector, cattle contributed the highest (33%). Nevertheless, the contribution of small ruminants is substantial, amounting to 15%. This exceeds the contribution from crops by 58%.

This finding provides enough evidence for the smallholder farmers to reallocate some resources from crop production to small ruminant production if only they view profitability and efficient utilisation of resources as their main goals. Smallholder farmers in the area should, therefore, exploit the potential benefits of small ruminant production to increase their household income

by allocating more resources to its improvement. Furthermore, policy makers, researchers and farmers should be made aware of the economic viability of small ruminant production in the country and elsewhere in Africa.

According to Hendricks and Fraser (2003), about 65% of all the cattle in the province are held in the former Ciskei and Transkei and this in itself illustrates the importance of the cattle for very reserve dwellers. Livestock contributes about 70% of gross agricultural income in the province as a whole (NWGA, 2008). There is an overwhelming catalogue of evidence about the skew distribution of cattle holding and ownership in the former reserves with fewer households owning large herds and the majority holding smaller herds.

Hendricks and Fraser (2003) argue that conventional wisdom has merely repeated the view that cattle holdings in the reserves are manifestly irrational, that low off-take has led to overgrazing and land erosion with little attention to animal health. From an economic point of view, the large cattle holdings in the communal areas is rational if the objectives of keeping the cattle are taken into account. If the cattle are seen as a symbol of status or wealth, the owners are being perfectly rational by maximising their wealth by increasing the number of cattle they own.

Livestock produce food (e.g. meat, milk) and non-food commodities (e.g. hides, wool), and provide draught power and manure for food and cash crop production, thereby helping to generate income for livestock owners and their employees. Since livestock grow in number and in individual size, they also constitute a form of profitable investment/ savings which can be drawn on in time of need. In good years, savings invested in livestock can earn considerably higher rates of return than those obtainable from money deposited in interest-earning bank accounts. However, in times of drought or disease, such savings can be swiftly wiped out.

According to Eastern Cape Business (ECB), the Eastern Cape Province provides approximately a quarter of South Africa's milk, and the industry is further expanding as producers tend to favour high-rainfall coastal areas such as the Eastern Cape. The province's farmers mostly sell raw milk to three major processors, namely Parmalat, Clover and Dairy Belle. With the growth of the dairy subsector in recent years, a few independent processors have emerged. Small-scale dairy farming presents an opportunity to develop the industry in the former homeland areas. The livestock subsector accounts for about 5% of the total gross domestic product (GDP) in sub-Saharan Africa. Its contribution to the GDP excludes draught power and manure. In South Africa, the livestock sector contributes up to 49% of agricultural output (van Niekert, 2012).

3. METHODOLOGY

3.1 Area of study

This study has been conducted in the eight villages of Kolomana, namely Phathikhala, Dunedin, Ngqikana, Cairns, Votyiwe, Marais, Edika, and Grafton. Kolomana is located in the Raymond Mhlaba Local Municipality, which is situated in the Winterland of the Eastern Cape under the jurisdiction of the Amathole District. It is approximately 200 km from Port Elizabeth. It is the largest municipality of the six in the district, making up a third of its geographical area (Raymond Mhlaba Local Municipality, 2019).

Raymond Mhlaba Local Municipality has a landscape that has a character of a flat, regular topography. The northern part of the municipality is structured by high mountain ranges,

having the highest peak being the Hogsback Region, which has a height level of 1700 m – 2000 m above sea level. Towards the southern region, the topography starts to have a relatively flat surface and evens out, having some of the southern parts with the heights of less than 200 m above sea level. The topography has influenced the distribution of human activities in the area, with most of the settlements occurring at heights of 200 m – 400 m above sea level (Raymond Mhlaba Local Municipality, 2019).

Ortmann (2005) states that people in rural areas rely on poorly developed road networks for connecting with the surrounding towns and cities. The poor road conditions of Kolomana prevent development in the area in terms of job opportunity creations. Ortmann (2005) further insisted that the main occupation held by rural residents is skilled agricultural (farming) workers. This means that rural households of Kolomana are capable of producing their own food by combining indigenous knowledge and skills they have acquired.

3.2 Data collection

There are eight villages in Kolomana and each village has approximately 11 to 23 families or households. All these villages are represented in the study. A total of 100 structured questionnaires were administered to wool sheep farmers in all of the eight villages..

Both primary and secondary data were used in this study. Primary data were collected using interviewer administered questionnaires which included household characteristics such as demographic questions (age, sex, education, marital status, family size, and employment status), availability and characteristics of resources or infrastructure found in the area (dip tanks and materials, shearing facilities, fencing), and sheep management practices that are taking place in Kolomana.

The questionnaires were interviewer administered to alleviate the problem of misinterpretations or misunderstandings of words or questions by respondents. The respondents were presented with a series of questions that they responded directly to on the questionnaire form itself with the aid of an interviewer. This questionnaire method of data collection is much quicker in terms of saving time. The interviewer read questions to respondents and recorded their answers on the questionnaire.

The advantage of this data collection method is that an interviewer was in a position to probe for more information from respondents. These questionnaires could also ensure that all questions had been considered and respondents did not omit difficult questions. By having the questionnaires administered by the interviewer, it also meant that information could be obtained from respondents who could neither read nor write (Levy & Lemeshow, 2013).

The questionnaire consisted of both open-ended and closed-ended questions. Open-ended questions allowed respondents to express their views freely, but these types of questions were minimised for easy data analysis as well as to focus on issues relating to the research. Most of the questions were structured as closed-ended questions for the benefit of obtaining information from respondents without consuming much of their time as well as for easy coding of responses. Secondary data were collected from published and unpublished documents. It was collected from books, articles, journals and the internet.

3.3 Data analysis

For the purpose of this study, the unit of analysis was rural households of Kolomana locations and for each household, the head of the household was interviewed. The study has used tables, graphs and descriptive statistics (frequency and percentages) to analyse data. Descriptive statistics are brief descriptive coefficients that summarise a given data set, which can be either a representation of the entire population or a sample of a population (Investopedia, 2018). They provide simple summaries about the sample and the demographic measures of the households and household heads. Together with simple graphics analysis, they form the basis of virtually every quantitative analysis of data (Emathzone, 2011).

A linear regression model was used to predict direct relationships between a vast array of sheep management practices as well as the characteristics of household heads and the total income generated from wool sales. It is therefore possible to fit a simple linear model of the form:

$$Y = f(x_1, x_2, \dots, x_n) \dots \dots \dots (1)$$

Where:

Y is the dependent variable representing total income that has been generated from the sales of wool, while the x 's are the explanatory variables representing age of the household head, marital status of the household head, number of sheep owned by each household, visits by animal health technicians, division of range land into camps, state of fencing on range land, gender of household head, household size, access to arable land, production of feed for sheep, availability of technicians when needed, season to join ewes with rams, keeping of sheep on range land, and the availability of first milk to lambs. These explanatory variables were used to determine the relationship between them and the dependent variable.

Following convention, the model can be specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots \dots \dots \beta_n X_n + \mu_i \dots \dots \dots (2)$$

Where:

- β_0 = the intercept or constant term,
- $\beta_1, \beta_2, \dots, \beta_n$ = slope or regression coefficient,
- X_1, X_2, \dots, X_n = explanatory or independent variables, and
- μ_i = error or disturbance term.

The model was estimated to identify factors affecting the total income generated from the sales of wool. As previously mentioned, the explanatory variables are used to determine their effect on the dependent variable.

If the signs of their coefficients are positive, this implies a positive relationship between the dependent and explanatory variables, meaning that the dependent variable is influenced by such explanatory variables. If the signs of their coefficients are negative, this implies that they are not influential to the dependent variable.

The synthesis of qualitative data has also been done to fully cater for valuable information from key informant interviews and individual perceptions. Quantitative data was analysed using a

combination of Microsoft Excel and the Statistical Package for Social Scientists (SPSS, version 20).

4. RESULTS AND DISCUSSION

In this section, the demographic characteristics of the household heads are presented. These include gender, age, educational level, marital status, size of the household, and occupational information of the household head. Makhura (2001) stated that these aspects are important because the main household activities are coordinated by the household head and the head's decisions are most likely to be influenced by such demographic aspects. In addition, this section presents information on the number of sheep owned by each household head, visits by extension and animal health officials for technical advice, and availability of first milk (colostrum) to lambs. The information mentioned above is presented in tables and graphs below. Only factors or variables that are positively influential to the dependent variable are presented in this section.

Table 1: Summary statistics of the household demographic (continuous) variables

Variable	Minimum	Maximum	Mean
Age	31	89	59.01
Household size	3	11	6.08

Source: Field survey, 2012

Table 1 displays the personal information of the household. Demographics that are in the table include the age of the household head and household size and are referred to as continuous variables. The minimum and maximum statistics are shown in Table 1 and the minimum age is 31 while the maximum age is 89. The mean age of the households is 59.01 and household size is 6.08.

Table 2: Summary statistics of the household demographic and socio-economic situation (categorical) variables

Variable	Category	Frequency	Percentage
Gender	Male	59	59.0
	Female	41	41.0
Marital status	Single	10	10.0
	Married	57	57.0
	Divorced	3	3.0
	Widowed	30	30.0
Employment status	Employed	26	26.0
	Unemployed	34	34.0
	Pensioner	40	40.0
Educational level	No education	17	17.0
	Primary	38	38.0
	Secondary	41	41.0
	Tertiary	4	4.0

Source: Field survey, 2012

Table 2 shows the household demographic frequencies. These household head demographic variables include gender, marital status, educational level and employment status of the household head and are referred to as categorical variables.

Table 3: Distribution of households by sheep numbers

Number of sheep	Frequency	Percent
1-49	66	66.0
50-99	25	25.0
100-149	3	3.0
150-199	4	4.0
200-249	0	0
250-299	0	0
300-349	1	1.0
350-399	1	1.0

Source: Field survey, 2012

The majority (66%) of farmers or households in the survey own less than 49 sheep as shown in Table 3. The total number of households in the survey who were found to own between 100 and 149 sheep were only three, while those who owned between 150 and 199 sheep were only four. Those households that were found to have large numbers of sheep between 300 and 349, as well as between 350 and 399 were only two. As portrayed in Table 2, several households were headed by pensioners (40%) or were unemployed (34%). These households depend on their sheep for survival. They generate income by producing wool and selling the sheep itself in times of hardship.

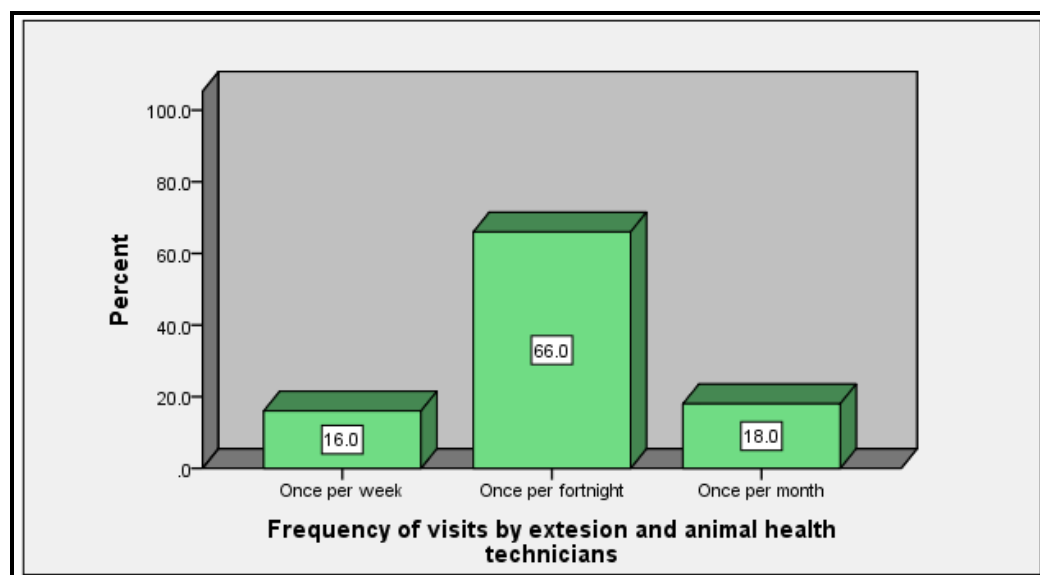


Figure 1: Distribution of households by visits of animal health and extension technicians
 Source: Field survey, 2012

In Figure 1, it is indicated that 66% of the surveyed households stated that extension and animal health technicians visit once every two weeks, while 18% stated that they visit once a month and 16% stated that they visit once a week. Figure 1 also shows that the technicians do visit

these farmers, but such visits are not enough for these farmers. They need proper visits in order for them to be productive and sustainable.

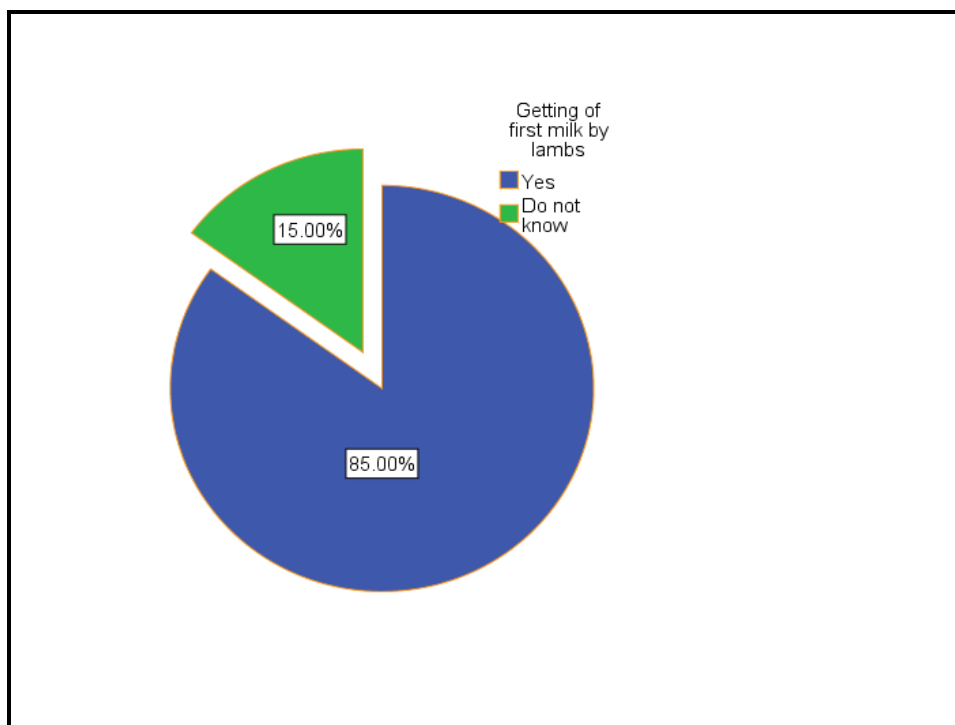


Figure 2: Distribution of households by availability of first milk for lambs

Source: Field survey, 2012

Figure 2 indicates that 85% of households who participated in the study indicated that their lambs do get the first milk, which means they are present when the ewes lamb. The other 15% of households indicated that they do not know if their lambs do get the first milk after birth.

4.1 Inferential results

A General Linear Regression Model (GLM) was used to analyse the effect of household head characteristics and the sheep management practices variables in influencing the total income generated from wool sales. In statistics, the generalised linear model is a flexible generalisation of ordinary linear regression that allows for response variables that have error distribution models other than a normal distribution. The GLM generalises linear regression by allowing the linear model to be related to the response variable via a link function and by allowing the magnitude of the variance of each measurement to be a function of its predicted value. The farmer's goal of obtaining higher income, which is the dependent variable in the model, is assumed to be influenced by many factors. It is assumed that if the farmer's goal is to get a higher income from the wool production, he or she needs to apply proper sheep management practices in his or her farm. However, if such a farmer does not do that, his or her goal will never be realised. Wool production does not begin in the shearing shed during the shearing season. It starts from making sure that the farm itself is in a proper and suitable condition for keeping the animals and to apply proper management practices in the whole farm.

Multiple variables were therefore regressed to determine their influence on the income. The independent variables include gender of household head, age of household head, household size, marital status of household head, number of sheep household head owns, access to arable

land, production of feed, visits by animal health and extension technicians, availability of animal health and extension technicians when needed, division of range land into camps, state of fencing, season to join ewes with rams, availability of first milk to lambs, and keeping of sheep on open camps. Table 4 shows the results of the model where the independent variables were tested to determine how influential they are to income (dependent variable in this study) generated from wool sales. Some independent variables were found to be influential and the findings are indicated in Table 4. The overall results show that the model for the study is highly adequate and a good fit as the R Square value is 0.947 and is higher than the Adjusted R Square value which is 0.938.

Table: 4: Factors affecting income generated from wool sales

Variable	Coefficient (B)	t-Value	Significance
(Constant)		-0.777	0.439
Gender of household head	0.033	1.204	0.232
Age of household head	0.133	3.307	0.001***
Marital status of household head	-0.099	-2.675	0.009***
Household size	-0.044	-1.405	0.164
Number of sheep owned by household	0.994	37.276	0.000***
Access to arable land	0.044	1.409	0.163
Production of feed for sheep	0.042	1.446	0.152
Visits by animal health technicians	0.119	3.650	0.000***
Availability of technicians when needed	-0.031	-1.046	0.299
Range land division into camps	-0.057	-1.873	0.065*
State of range land fence	-0.087	-2.704	0.008***
Season to join ewes with rams	-0.042	-1.341	0.183
Availability of first milk to lambs	0.066	2.231	0.028**
Keeping of sheep on the range land	0.019	.692	0.491
Model summary	R Square = 0.947; Adjusted R Square = 0.938; F Change = 108.297; Durbin-Watson = 1.703		

Note: * = Significant at 10% level; ** = Significant at 5% level; *** = Significant at 1% level.

Table 4 presents the results of the major factors influencing the income generated from sales of wool produced. These factors are the marital status of the household head, age of the household head, number of sheep owned by the household, visits by animal health technicians, division of range land into camps, state of fencing on range land, and availability of first milk to lambs. For the purposes of this study, the discussion will be focusing on the variables that are significant.

4.1.1 Age of the household head

At a 1% significance level, age of the household head has been found to be significant in influencing the income. It has a positive relationship with income as it has a positive β value (0.133). Age of the household head is found to be influential in income generated from wool production. It is assumed that the older the person participating in agricultural activity, the better the output to be realised. The reason for this is the assumption that the older people have

more experience in farming activities than younger people. However, young people are indeed needed in agricultural activities as the older people are no longer able to participate in agricultural activities, especially wool production in this case, as it requires more physical labour in terms of handling sheep during the shearing process.

4.1.2 Marital status of the household head

Table 4 shows that at a 1% significance level, marital status of the household head is significant. The β value of -0.099 for marital status of the household indicates that there is a negative relationship with income. This implies that income is not influenced by marital status of the household head.

4.1.3 Number of sheep owned by household

At a 1% significance level, the number of sheep owned by the household is highly influential to income generated from the sales of wool. With a β value of 0.994, the number of sheep owned by the household has a positive relationship with income. This implies that numbers of sheep owned by the household is influential to income. Wool that is sold is from the sheep that are shorn by farmers. Therefore, numbers of sheep owned are crucial in generating income because if a farmer owns a large number of sheep, he or she will eventually obtain a maximum amount of wool which will bring in higher income.

4.1.4 Visits by animal health technicians

It is shown in Table 4 that visits by animal health technicians are very important and has an impact on income. At a 1% significance level and at β value of 0.119, visits by animal health technicians has a positive relationship with income. This implies that visits by animal health technicians are highly influential to income. These technicians are important to farmers, especially wool farmers in this case, as they advise them on prevailing diseases and medicines to prevent or cure such diseases. Healthier sheep provide good quality wool that yield higher incomes.

4.1.5 Division of range land into camps

Table 4 indicates that the division of range land into camps has a 10% significance level at β value of -0.057. This implies that the division of range land into camps has a negative relationship with income and it does not influence income. Income can be generated without division of range land into camps. However, proper sheep management practices need to be well implemented for range land to be divided into camps. This will ease the process of feeding, mating and lambing, as those ewes which are about to lamb need to be separated from the whole flock of the farm. In addition, division of range land helps to rest certain camps so as to allow them to grow enough grass for the sheep not to starve in winter season when vegetation becomes poor.

4.1.6 State of fencing on range land

At a 1% significance level and at β value of -0.087, state of fencing on range land has a negative relationship with income. This implies that state of fencing on range land does not affect

income. Income is not influenced by state of fence on range land, it can be generated whether there is fence or not.

4.1.7 Availability of first milk to lambs

At a 5% significance level and at β value 0.066, availability of first milk to lambs has a positive relationship with income. This implies that availability of first milk to lambs is influential to income that is generated from the sale of wool. If the lambs do not get the first milk from ewes after birth, they are at risk of easily contracting diseases and starving. Once the lambs contract diseases or starve, they are at risk of dying. Decreasing sheep numbers means that the quantity of wool is also going to decrease and that will lead to decreased incomes.

5. CONCLUSION AND RECOMMENDATIONS

Studies show that small-scale farmers and rural households of South Africa have the potential to contribute to growth in rural areas and to reduce poverty as well as income disparity. Wool farmers have not yet reaped the full benefits from the potential of new technology because of employment of improper sheep management practices and illiteracy in rural areas. It is suggested that there is a need for smallholder farmers to increase adoption of improved techniques of production for them to gain improved farming production. However, it has been observed that smallholder farmers are still restricted by a number of institutional arrangements, technical factors and other factors.

With regards to sheep management practices, some farmers in rural areas still use the old traditional techniques (keeping large numbers of sheep for bragging rights, do not dip, do not vaccinate, and dose using indigenous plant medicines) of production in terms of keeping their sheep. They do understand that sheep production is very important as a medium of income generation. They only consider their sheep as a tool for generating income, but they fail to understand that the same sheep they use to generate income has to be well managed for it to continue generating income for them. Some farmers were found not to dip, vaccinate and dose their sheep until the arrival of animal health technicians to do it for them.

The farmers claim that they do not have access to facilities such as dip tanks and shearing sheds in their communities, and the medicines are expensive, therefore, the government should provide it for them. In order for farmers to stop thinking that their farming is for the government or they do it for government, the government should provide by capacitating farmers through trainings, where the training will focus in certain areas of the prevailing problem and stop implementing the top down approach where they assume and decide on the needs of the farmers without consulting the farmers or extension officers who are the ones who understand the needs of the farmers. Another pressing problem is the lack of fencing. Rangelands are not fenced, or the fencing is broken. Livestock production cannot do well if the rangeland is not properly fenced because management will be poor.

Farmers should organise themselves to form commodity groups or cooperatives. This will facilitate the process of securing funds from financial institutions or organisations. Farmers must be encouraged to be independent. They must not depend on government for the sustainability of their farming business. These were the key elements the researcher found pressing regardless of what the farmers indicated in the study.

The study focused on demographic characteristics of the household head, sheep management practices, as well as opportunities and constraints that the farmers face in terms of sheep or wool production in Kolomana. Further research is required to assess the change brought by the introduction of the improved rams to farmers through the ram exchange scheme by NWGA.

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