

EFFECT OF SUPPLEMENTS OF CROP RESIDUES OR AGRO-INDUSTRIAL BY-PRODUCTS ON THE PERFORMANCE OF SMALLHOLDER GOAT PRODUCTION IN SWAZILAND

1. INTRODUCTION

Agriculture plays a major role in Swaziland's economy. In 1990/91 it was estimated that direct production accounted for 14% of GDP. A much larger part of the GDP, however, is directly related to agriculture as much of the value added in the manufacturing sector arises from processing agricultural and forestry products. Agriculture accounts for about half of the country's export earnings.

The agriculture sector is sharply differentiated between the communal tenure-based Swazi Nation Land (SNL) and Title Deed Land (TDL). SNL has been characterized as semi-subsistence, with communal grazing, low productivity and frequent vulnerability to droughts. It supplies most of the food and is a source of socio-economic security for the majority of the Swazi population of about 900,000 people. TDL on the other hand, is based on more commercially developed, large scale, capital intensive enterprises with high employment generation costs, export oriented production and a very considerable dependence on foreign private capital and management. It is also the major source of export earnings. Almost all of the commercial agriculture comes from the 800 or so farms in the TDL. The principal enterprises include sugar, citrus, pineapples, cotton, maize and cattle ranching. The study reported here is based on goat production systems on SNL.

Land Use

SNL accounts for about 60% of the total 17,000 km² area of the country. Of this total, about 9% is cropped, 65% is classified as rangeland and 14% as commercial forests. There is a wide range of ecological conditions with a varied climate, natural resource distribution and developmental potential. Conventionally, the agro-ecological zones are identified as the Highveld, Middleveld, Lowveld and Lubombo.

The Highveld, with high rainfall (about 1250 mm), high altitudes (1100-1400 m) and temperatures ranging from 5-25^oC, is characterized by open, fairly poor quality grasslands that lose their palatability in winter and are unsuitable for grazing year round. There are patches of extensive forest plantations in the north west and west central areas. Only 3% of the total area constitutes good arable land.

The Middleveld accounts for for about 25% of the total land area, and has an average elevation ranging from 600-900 metres above sea level. The region is generally undulating. It is warmer and drier than the Highveld with annual rainfall

ranging between 750 and 1000 mm. Almost 20% of the upper Middleveld has good to fair arable soils, while in the lower Middleveld the proportion is about 10%. The gentler slopes are good arable lands making the region the most densely populated part of the country. The predominant vegetation is tall sour grasses and mixed bush. In terms of grazing, the grasses are of moderate quality. Overgrazing, cultivation and veld fires have eliminated forests in this region and contribute significantly to the soil erosion problem.

The Lowveld, with the lowest annual rainfall (500-600 mm) and the highest mean temperatures (10⁰C to 30⁰c) and altitudes of 200-500 metres is characterized by open savanna woodlands with Acacias and very palatable grasses which are suitable for year round grazing. The occurrence of sweet grasses has encouraged the development of large livestock ranches in the region.

The Lubombo region rises abruptly from the Lowveld to around 700 metres above sea level. The climatic characteristics of the region are similar to those of the Middleveld. The steep slopes of the Lubombo mountains are formed of volcanic debris. About 12 percent of the region has good to fair arable soils. The vegetation of the Lubombo region is mainly wooded bushland. Pockets of "moist" semi-deciduous forest and "dry" forests occur along with sweet grasses.

About 80-90% of Swazi people live on SNL in some 88,000 scattered homesteads under traditional chieftainship authorities. Average land holding per homestead is about 3.5 ha with about half being cultivated at any one time while the other half is left fallow. Agricultural production accounts for less than half of an average homestead's income (both cash and kind). There is considerable dependency on wage earnings with 60% of the working male and 30% of the working female homestead members occupied in paid employment in plantations, manufacturing, trading and service industries. Most of the agricultural labour for SNL farms is therefore provided by women, older men and children.

Production Patterns

Crop Production.

Table 1 sets out the estimated national production of various crops both on TDL and on SNL. The largest acreage comes from maize followed by sugar cane and cotton. Most of the TDL areas are irrigated especially for sugar and citrus production on large estates that include processing facilities.

Table 1 Production of major crops on TDL and SNL 1990/91

	Area ha (‘000)	Production m. tons	Yield ton/ha	Value E. (‘000)
TDL				
Sugar cane	36.6	3841.8	105.0	192,090
Pineapples	1.5	32.9	21.9	3,419
Cotton	9.7	13.5	1.4	16,463
Citrus	2.7	56.6	21.0	41,883
SNL				
Cotton	17.3	13.5	0.8	16,463
Maize	98.9	153.0	1.5	76,500

Source: Table 19, Development Plan 1989/90-1995/96
Ministry of Economic Planning, 1993.

Average crop production figures for individual homesteads on SNL are presented in Table 2.

Table 2. Area of major crops grown per homestead on SNL

Crop grown	Area (ha)	% of total area
Maize	1.90	65
Cotton	0.62	21
Beans	0.24	8
Sweet Potatoes	0.02	1
Fallow	0.14	5
Others	0.03	
Total	2.92	100

Source: Annual Survey of SNL, 1989

Table 2 shows that maize, which is the staple food in Swaziland, occupies the bulk of the total cropped area compared to the next important crop, cotton, which occupies a relatively smaller area and is confined almost exclusively to the Lowveld. Commercially oriented homesteads tend to have higher hectares of maize and cotton and larger farm sizes than do non-commercial oriented farmers (Curry, 1988). Maize yields on SNL average 1.5 tons/ha (Table 1), with a range between 0.6 and 2.5 tons depending on rainfall and soils. Hybrid seeds are widely used by farmers and so are inorganic fertilizers although at low application rates (probably less than 20 kg N/ha). Tractors are the preferred method of land preparation but there is a continuing dependence on ox cultivation because of limited access and high costs of most mechanical services.

Livestock production

Livestock production has an important economic and social role in Swaziland. It accounts for 5% of GDP, 20% of agricultural output and about 3% of total export earnings. According to CSO, livestock earnings between 1972 and 1981 varied between 2-6% (average 4%) of the nation's exports. For all these years however, the beef cattle sub-sector contribution varied from 94 to 99% of the total export earnings from the livestock sector while sheep and goats combined contribution varied between 0.02-1.19% between 1973-1977 (Table3). Thus compared to beef cattle, small ruminants have made little contribution to the export earnings. There is no evidence that the pattern has changed significantly in the 90's.

Table 3. Livestock sector exports(1973-1981)

	1973	1974	1975
Total domestic export (E'000)	72,824	119,619	143,686
Livestock sector (E'000)	4712	5187	3190
Cattle and cattle products	4711	5186	3184
Sheep and goats	1	1	6
Chickens	-	-	-
Livestock/Total exports (%)	6	4	2
Cattle & cattle products/Livestock (%)	99.98	99.98	99.81
Sheep & goats/Livestock	0.02	0.02	0.19

Source: Adapted from Hunting Technical Services Report (1983)

E. Emalangeni 1 US \$ = 1.8 E

Though not a major contributor to the nation's foreign exchange earnings, The SNL stock-owners obtain a wide range of productive values from their animals. They represent a symbol of security, affluence and status and the exchange of cattle is an important factor in family life. They also provide meat, milk, manure as well as draught power.

Small Ruminant Population

The evolution of small ruminant (sheep and goats) populations and those of other livestock types are shown in Table 4.

Table 4. National livestock population ('000), 1987-1991

	1987	1988	1989	1990	1991	Average growth
Cattle	641	640	679	716	740	3.7%
Goats	312	280	294	416	334	1.8%
Sheep	28	20	23	20	14	-16.1%
Poultry	844	870	1200	1113	1086	6.5%
Pigs	21	18	19	24	28	7.0%

Source: Table 19, Development Plan 1993/94-1995/96
Ministry of Economic Planning, 1993

During the five year period, the goat population showed a gradual increase of 1.8% per year. However the sheep population declined by 50% during this period. According to the 1984 livestock census, about 29% and 3.4% of the total human population kept goats and sheep respectively. After studying 1150 rural homesteads on SNL, de Vletter et al (1983) observed that 32.7% of the homesteads owned goats with an average herd size of 20 heads. From the 1984 livestock census, about 90% of the people keeping small ruminants kept goats. This is a clear indication that, relatively, goats are more popular and cherished among Swazis than sheep.

The small ruminant population is largely made up of the indigenous Nguni stock. In 1985, about 99% of the goat population and about 81% of the sheep population were indigenous stock. The rest of the goat population consisted of Boer, Saanen, Angora and their crosses. Trek Merino and Dorper sheep brought to Swaziland from South Africa made up the rest of the sheep population. Pigs are becoming more popular in Swazi society and poultry is a common species in the homestead. They are kept mainly for home consumption.

Small Ruminant Management and Production

As shown in Table 2, small ruminants are largely in the hands of farmers on SNL who use only native breeds and production systems that are essentially traditional and characterized by little or no inputs and low productivity (Lebbie and Matsapha 1985). Meat yields are low, averaging about 10-12 kg per animal at 2 years of age. A fertility level of 67% and a prolificacy of 1.16 goats per birth have been reported for goats in the Middleveld of Swaziland (Lebbie and Matsapha, 1985). The same study observed a relatively high multiple birth rate (22%) among goats in the area, but also recorded high death rates especially among young stock. The authors attributed this sub-standard performance to poor nutrition, especially in the dry season when quality and quantity of feed from the natural rangeland are very low. The improvement of feed availability and quality during this period could significantly increase the productivity of the indigenous goats.

2. OBJECTIVES

The objectives of the study reported here were:

1. To compile an inventory of the availability and quality of maize stover, cotton seeds, sugar cane tops, pineapple waste and citrus waste.
2. To measure the growth response in young male goats, grazed on natural pastures, to supplementation with resources identified as being available at critical times of the year.
3. To determine if supplementation of the indigenous goats is economically viable, acceptable and sustainable for smallholder farms in Swaziland.

STUDY CONCEPT AND METHODOLOGY

The main concept of the study hinges on obtaining data to construct a productive baseline which would allow identification of the main variables affecting goat production. This identification would allow the researchers to pinpoint areas where future attention should be focussed from a technical standpoint in order to raise productivity above present levels and in the process increase net revenues to producers on SNL.

Three main methods were used in data collection:

1. Questionnaires for collection of socio-economic information on producers.
2. Monitoring of crop and animal productivity 3 times during a calendar year.
3. Conducting a feeding trial with the indigenous goats using selected crop residues and agro-industrial by-products.

Sampling of farmers for the study

Livestock practices on SNL are relatively homogeneous throughout Swaziland hence 120 farmers were randomly selected from the Highveld, Middleveld and Lowveld (40 farmers per zone). The number and distribution of farmers were dictated by available operational resources.

Socio-economic questionnaire:

During the first visit, an interview was carried out for each farmer to obtain demographic and economic information against which livestock production could be structured and compared with alternative uses of capital, land and labour (annex 1). The questionnaire was designed to obtain information on:

Family, age and sex structure

Farm labour availability and demand from its various activities
Land acquisition and general land issues
Production decisions
Production and marketing of animals and animal products
Disease occurrence
Use of draught animals

Crop and Livestock monitoring

The selected farmers were visited 3 more times during the year and more information was obtained from them using 3 slightly different questionnaires (Annexes 2, 3 and 4). The following information was obtained from the processing of these data:

Type of crops grown
Crop yields
Seasonal labour demands for crop production
Use of inputs
An inventory of crop residues for livestock feeding
Seasonal availability of the crop residues
Age and sex structure of the livestock
Births and mortalities
Cullings
Livestock sales and purchases
Livestock husbandry practices
Marketing of livestock

Evaluation of the feeding value of selected crop residues and agro-industrial by-products utilized by goats

Growth study

The response of the indigenous Swazi goats, grazed on natural rangeland, to supplements of maize stover, sugar cane tops and dried pineapple pulp were assessed at Luyengo University farm from August to November 1994.

At the start of the study, 63 indigenous male goats were bought from local farmers and assembled for acclimitization at the University farm. Housing was constructed of brick walls and wire mesh fencing under a galvanized iron roof. No special bedding was provided on the concrete floor. The goats were castrated after one week. Eleven goats died of heartwater and worm infestations within a three week period. The remaining goats were subsequently treated on a monthly basis with Deadline to control heartwater and Panacur to control worms and diarrhoea. No deaths occurred thereafter.

Out of the remaining 52 goats, 48 were selected for the experiment based on age and weight. The age range, based on dentition, was from 14 to 23 months. Individual goat weights varied from 12 to 29 kg at the start of the feeding period. The goats were grouped according to age and weight from which they were randomly assigned to the treatments as indicated in Table 6. A protein supplement was included in the study in order to improve the utilization of the crop by-products. The supplement was prepared by mixing a commercial concentrate with yellow maize to give a concentrate mixture containing 26% protein.

Table 5. Assignment of goats (in groups of 4) to the different feeds

Feed	Levels of protein supplementation		
	0	80g	160g
Grazing only	(4)	(4)	(4)
Grazing + maize stover	(4)	(4)	(4)
Grazing + sugar cane tops	(4)	(4)	(4)
Grazing + pineapple pulp	(4)	(4)	(4)

The goats were grazed on natural pasture from 11.00 a.m. to 4.00 p.m. after which they were kraaled in individual pens measuring 1.8 x 0.5 metres. They were then given the crop by-products ad lib in plastic buckets overnight. The protein supplement was given at 8.00 a.m. every morning before going out for grazing. The goats were allowed two weeks to adjust to their respective diets before data began to be collected. Data collection lasted 77 days. During this period, leftover feeds were weighed every morning to obtain daily feed intakes. The goats were weighed at 2 week intervals.

Intake and digestibility study

Sixteen male indigenous goats of an average weight of 27.5 kg were used for the digestibility and intake study. All the animals were dewormed before the trial began. The animals were randomly allotted to four dietary treatments in a completely randomized design. The feed treatments were: grass hay, grass hay + maize stover, grass hay + sugar cane tops, grass hay + pineapple pulp. Rations were offered ad libitum so as to allow for a minimum of 20% refusals. The animals were weighed before and after the experimental period which consisted of a 10-day preliminary period followed by a 7-day collection period. During the preliminary period, the animals were allowed to attain the highest DM intake. All the refusals were collected and weighed daily to determine daily intake.

The volume of urine was recorded daily, and 10% aliquots were combined for each goat during the study period for analysis. Daily faecal samples were dried

at 80°C, samples from goats on the same treatment were composited for analysis.

Chemical and data analysis

The chemical composition of the herbage and those of maize stover, sugar cane tops and dried pineapple pulp, refusals and faeces were milled a 1-mm Wiley mill screen before they were analyzed. Analyses for dry matter (DM), organic matter (OM), crude protein (CP) and fibre (CF), ash and ether extract were conducted according to the standard procedures (AOAC, 1980). The urine samples were analyzed for nitrogen by the routine Kjeldahl method (AOAC, 1980)

Data from the growth, digestibility and intake studies were analyzed in a completely randomized design as described by Snedecor and Cochran (1980) and the means were compared by Duncan's Multiple Range test.

3. RESULTS

Socio-economic characterization

The sample was constituted by 120 homesteads in three agro-ecological zones Highveld (humid), Middleveld (subhumid) and Lowveld (semi-arid). In each of the three zones, 40 homesteads were selected for study and have been analyzed. The results are presented with respect to the total sample as well as of the three zones, in order to detect the main differences that can be observed from one agro-ecological zone to the other.

THE MAIN CHARACTERISTICS OF THE "FAMILY"

The size of the family

The "family" was defined as the group formed by the husband, the wife (or wives) and the children. The average size of the family was around 9 members (precisely 8.9) with quite an important difference between the Lowveld (8.3 members) and the other two zones (9.4 members for the Middleveld and 9.1 for the Highveld). Generally we could then assume that the size of the family is relatively smaller in the semi-arid zone, the maximum is 16 members against 23 or 24 in the other two zones (Table 6).

Table 6. Relative family size by ecological zone

Zone	Average number of members per family	Minimum	Maximum
Lowveld	8.3	2	16
Middleveld	9.4	4	24
Highveld	9.1	4	23
Total sample	8.9	2	24

Concerning the number of wives, there was no significant difference from one zone to the other (average = 1.25). In 80% of the cases, the farmer had one wife while 17.5% of the farmers have two wives and 2.5% have 3 or 4 wives. The differences observed in the size of the family appears to be related to the number of children in the family and Table 7 below shows that the average number of kids is higher in the Middleveld and Highveld. Overall, the percentage of school kids is roughly 50% of the total number of kids per family.

Table 7. Number of children per family

Zone	Average number of kids per family	School kids	Non school kids
Lowveld	6.1	2.8	3.3
Middleveld	7.1	4.0	3.1
Highveld	6.8	3.5	3.3
Total sample	6.7	3.4	3.3

While the family size seems to be smaller in the Lowveld, the average number of farm workers is higher than in the other two zones (Table 8).

Table 8. Number of farm workers per family

Zone	Average number of farm workers	Minimum	Maximum
Lowveld	3.6	1	12
Middleveld	3.0	1	8
Highveld	3.3	1	7
Total sample	3.3	1	12

Regarding the number of off-farm workers in each homestead, the distribution by zone is as follows:

Table 9. Number of off-farm workers per family

Zone	Average number of off-farm workers		
	0	1	2+
Lowveld	27 (67.5%)	9 (22.5%)	4 (10.0%)
Middleveld	23 (57.5%)	14 (35.0%)	3 (7.5%)
Highveld	20 (50.0%)	13 (32.5%)	7 (17.5%)
Total	70 (58.3%)	36 (30.0%)	14 (11.7%)

The main source of income

From the 8 main sources of income possible, it is clear that the first one is the wages and remittances, because in more than 50% of the homesteads, this source is considered as the greatest by the farmer (Table 10). This is followed followed by sales of crops (46.6%) and sales of cattle (30.0%). In very few cases are sale of goats important as a source of income (first source of income = 0.8% and second source of income = 10.0%) and only 59.1% of the homesteads had any income (important or not) from the sale of goats, a percentage which is similar to that for the sale of cattle.

Table 10. The importance and the rank of the different sources of income

Rank for each source	Wages and remittances	sales of crops	sales of cattle	sales of goats	traditional medicine	beer brewing	handicraft	others
1	52.5%	23.3%	5.8%	0.8%	5.0%	2.5%	3.3%	5.8%
2	14.2%	23.3%	24.2%	10.0%	6.7%	5.0%	8.3%	8.3%
3	8.3%	11.7%	17.5%	23.3%	4.2%	5.8%	15.8%	12.5%
4	8.3%	7.5%	10.8%	17.5%	3.3%	3.3%	5.8%	5.8%
5	-	2.5%	1.7%	6.7%	1.7%	6.7%	8.3%	5.0%
6	-	1.7%	-	0.8%	-	0.8%	-	-
Total	83.3%	70.0%	60.0%	59.1%	20.9%	24.1%	41.5%	37.4%

In terms of regional differences, the percent of homesteads that have wages and remittances is much more important in the Highveld (92.5%) than in the Middleveld (87.5%) and in the Lowveld (70.0%). Concerning the sales of goats, only 32.5% of the families in the Lowveld received some income from this kind of activity, while in the highveld 67.5% of the homesteads obtained some income from this kind of sales.

MAIN CROP PRODUCTION

Area cultivated and production

Four main crops are produced by the farmers in the 3 zones namely: maize, beans, groundnuts and cotton. The number of producers for each of these crops is given in Table 11.

Table 11. Proportion of farmers growing the major crops on SNL

Zone	Maize		Beans		Groundnuts		Cotton	
	Number	%	Number	%	Number	%	Number	%
Lowveld	40	100.0	8	20.0	14	35.0	23	57.5
Middleveld	40	100.0	23	57.5	17	42.5	5	12.5
Highveld	40	100.0	15	37.5	10	25.0	1	2.5
Total	120	100.0	46	38.3	41	34.2	29	24.2

As anticipated, all farmers in the three zones produce maize which is the staple food in Swaziland. Regarding the other crops, beans and groundnuts are important in the Middleveld (57.5% and 42.5% of the homesteads respectively) while cotton is more important in the Lowveld (57.5% of the farmers). Production and consumption levels for these crops are given in Tables 13, 14 and 15.

Table 12. Average area, production and consumption of maize

Zone	Area (ha)	Amount produced (kg)	Amount consumed (kg)	Amount sold (kg)
Lowveld	1.2	1400	1169	238
Middleveld	1.9	3318	2485	833
Highveld	2.3	3654	2177	1477
Total	1.8	2791	1944	849

Apart from differences in consumption patterns, there are also differences in the average maize yields by zone: 1167 kg/ha in the Lowveld against 1746 and 1589 kg/ha in Middleveld and Highveld, respectively. For the total sample, the average yield is around 1550 kg/ha. Similarly, production and consumption for beans are presented in Table 13.

Table 13. Average area, production and consumption of beans

Zone	Area (ha)	Amount produced (kg)	Amount consumed (kg)	Amount sold (kg)
Lowveld	0.4	121	121	0
Middleveld	0.6	228	215	13
Highveld	0.3	175	175	0
Total	0.6	175	170	449

The average yields of groundnuts by zone are: 303 kg/ha in the Lowveld, 380 in the Middleveld and 583 kg/ha in the highveld. For the total sample, the average yield is 292 kg/ha. Similarly, production and consumption for groundnuts is as follows:

Table 14. Average area, production and consumption of groundnuts

Zone	Area (ha)	Amount produced (kg)	Amount consumed (kg)	Amount sold (kg)
Lowveld	0.5	188	188	0
Middleveld	0.5	242	228	14
Highveld	0.3	188	188	0
Total	0.6	206	201	5

Average production of cotton is given in Table 15.

Table 15. Average area and production of cotton

Zone	Area (ha)	Amount produced (bales)
Lowveld	4.3	14.3
Middleveld	2.0	9.0
Highveld	1.0	6.0
Total	4.1	9.8

Table 15 shows that cotton yields vary from zone to zone; 3.3 bales per ha in the Lowveld as against 4.5 in the Middleveld and 6 bales in the humid zone. These differences are not surprising as regards differences in the agro-ecological conditions of each zone.

Methods of cultivation

The majority of farmers use tractors, 53.3% exclusively and 12.5% conjointly with oxen (Table 16). Hence around 66% of farmers are using tractors although only 12.7% are owners (Table 17).

Table 16. Method of cultivation (% of farmers)

Method	Lowveld	Middleveld	Highveld	Total
Tractor only	57.5	55.0	47.5	53.3
Oxen only	32.5	32.5	37.5	34.2
Both	10.0	12.5	15.0	12.5
Total	100	100	100	100

Table 17. Possession of tractors and oxen

	Lowveld	Middleveld	Highveld	Total
Tractor				
Owned	18.5	7.4	12.0	12.7
Hired	81.5	92.6	88.0	87.3
Oxen				
Owned	70.6	88.9	100	87.5
Hired	29.4	11.1	0	12.5

LIVESTOCK STRUCTURE

Number of animals at the 1st visit

From the first visit, it is possible to determine the average number of animals by farm. Generally, the number of animals is more important in the Highveld while goats are more important in the Lowveld. The other significant difference concerns the number of sheep, which is very small (average less than 1) throughout the three zones. Pigs seem to be more developed in the Middleveld.

Table 18. Average number of animals by farm

Zone	Cattle	Goats	Sheep	Pigs
Lowveld	13.6	12.6	0	0.1
Middleveld	13.0	7.8	0.9	1.4
Highveld	17.3	11.9	0.6	1.0
Total	14.6	10.7	0.5	0.8

The distribution of goats by zone is given in Table 19. The most important difference is that the percent of farmers with more than 10 goats is higher in the Lowveld than in the other 2 zones. There are 50.0% in the Lowveld against only 32.5% in the Middleveld and 35.0% in the Highveld. Goats are therefore generally more important in the Lowveld.

Table 19. The distribution of farms by number of goats and by zone

Classes	Lowveld	Middleveld	Highveld	Total
0-2	10.0%	45.0%	5.0%	20.0%
3-5	35.0%	7.5%	37.5%	26.7%
6-10	5.0%	15.0%	22.5%	14.2%
11-20	30.0%	27.5%	12.5%	23.4%
21-30	12.5%	5.0%	15.0%	10.8%
31 +	7.5%	-	7.5%	5.0%
Total	100.0%	100.0%	100.0%	100.0%

For cattle and goats, it is possible to observe the variation of the average size of flock or herd from one visit to the other. The highest variations are observed between the second and third visits for both cattle and goats.

Table 20. Average number of cattle and goats by farm at each of the 3 visits

Visits	Cattle			Goats		
	1st	2nd	3rd	1st	2nd	3rd
Lowveld	13.6	13.5	14.8	12.6	12.5	14.8
Middleveld	13.0	13.9	10.6	7.8	7.7	10.6
Highveld	17.3	18.2	14.5	11.9	12.1	14.5
Total	14.6	15.2	13.3	10.7	11.3	13.3

Table 20 shows that, from one visit to the other, the percent of farms with a decreasing number of cattle and goats is quite small. Generally the number of cattle and goats is unchanged or slightly increased. These trends are presented in detail in Tables 21 and 22 for cattle and goats respectively.

Table 21. Number of farms that have decreased, not changed or increased in the number of cattle

Zone	Between 1st and 2nd visits			Between 2nd and 3rd visits			Between 1st and 3rd visits		
	decrease	no change	increase	decrease	no change	increase	decrease	no change	increase
Lowveld	8	27	5	7	17	16	5	17	18
Middleveld	3	31	6	6	16	18	7	14	19
Highveld	9	18	13	3	8	29	4	6	30
Total	20	76	24	16	41	63	16	37	67

Table 22. The number of farms that have decreased, not changed or increased in the number of goats

Zone	Between 1st and 2nd visits			Between 2nd and 3rd visits			Between 1st and 3rd visits		
	decrease	no change	increase	decrease	no change	increase	decrease	no change	increase
Lowveld	10	22	8	6	15	19	7	14	19
Middleveld	9	25	6	3	19	18	3	21	16
Highveld	12	20	8	1	12	27	4	12	24
Total	31	67	22	10	46	64	14	47	59

ORIGINAL SOURCE OF GOATS

Concerning the original source of goats, we can observe that in 14 cases, the farmers did not give a response and all these farmers are located in the Lowveld. The other important difference concerns the number of responses given by each of the farmers. While in the Highveld and Middleveld, it is quite frequent that the farmer gives more than one source, it is less frequent in the Lowveld (Table 25).

Table 23. Number of sources of goats

	Lowveld	Middleveld	Highveld	Total
Only one source	19	16	17	52
Two sources	7	20	10	37
Three sources	0	4	13	17
No response	14	0	0	14
Total	40	40	40	120

It is relatively frequent to have a combination of purchase and birth as the main sources for goats especially in the Middleveld. There were 6 cases in the Middleveld with a combination of 3 sources: purchase, birth and inheritance.

The two main sources of goats are purchase and birth. In the Highveld, we can see that births are for a very large majority of cases, a source of increase (87.5%). In the Middleveld, purchase is the first source followed by births. If inheritance and dowry are not so frequent, their percentages are relatively high 22.5% in humid zone for inheritance, and 20.0% in the Middleveld for dowry, while in the Lowveld, these two sources are not significant.

OWNERSHIP OF ANIMALS

Ownership of cattle

Generally, only one member of the family is the owner and in most cases, the “head” of the family is the owner. It is interesting to note that the “head” of the family is the exclusive owner in 23 cases in the Lowveld (57.5), 31 cases in the Middleveld (77.5) and 26 cases in the Highveld (65%). Concerning the ownership of goats, the image is not very different from the situation observed in the case of cattle. Generally, the husband is the main owner. However, in the Lowveld, women are more frequently owners than in the other two zones (Table 24). It seems also that children are more frequently owners of goats than cattle, a result which is not surprising. Concerning wives, 50% of them are exclusive owners of cattle as against 68% for goats.

Table 24. Ownership of goats

Ownership	Percent of Homesteads			
	Lowveld	Middleveld	Highveld	Mean
Husband	57.5	80.0	75.0	70.8
Wife	32.5	15.0	15.0	20.8
Children	15.0	17.5	12.5	15.0
Others	2.5	2.5	5.0	3.3

MANAGEMENT DECISIONS

Herding the flock

In general, children are the ones who frequently herd the animals, especially in the humid zone where 65% of the flocks are herded by children (Table 25). The role of women is relatively more important in the Lowveld than in the two other zones (30% as against 7.5% and 10.0%). The other significant difference concerns the hired persons. In the Highveld, only the family's members are herding the animals, while hired persons are employed in 20% of the farms in the arid zone, and in 22.5% in the Middleveld.

Table 25. Who herds animals?

Who herds?	Percent of Homesteads			
	Lowveld	Middleveld	Highveld	Mean
Husband	12.5	32.5	22.5	22.5
Wife	30.0	7.5	10.0	15.8
Children	45.0	35.0	65.0	48.3
Others	0.0	2.5	2.5	1.7
Hired	20.0	22.5	0.0	14.2
Nobody	2.5	0.0	0.0	0.8

Are the animals herded separately?

Generally animals are not herded separately (Table 26). But it is important to note that in the Lowveld, it is more frequent to herd cattle and goats separately. This point has to be connected with the lack of grazing land and/or the quality of pasture under the semi-arid conditions.

Table 26. Are animals herded separately?

	Percent of Homesteads			
	Lowveld	Middleveld	Highveld	Mean
Animals herded separately	45.0	15.0	22.5	27.5
Animals not herded separately	50.0	85.0	77.5	70.8
No response	5.0	0.0	0.0	1.7