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## SHEEP AND GOAT PRODUCTION PRACTICE IN AGROFORESTRY SYSTEMS OF GEDIO ZONE, ETHIOPIA

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### Abstract

The study was conducted to describe sheep and goat production practice in three Agro-ecological Woredas of Gedio zone, southern Ethiopia. A set of semi-structured questionnaire was used to collect information from 120 sheep and goat owners based on single-visit-interviews. 32.6% of them participate in crop production, 56.5% of them involved in both animal and crop production and 5% of them involved in crop production, animal production and off farm activity. Sheep flock in the study sites were significantly different; and were 5.63, 6.97 and 3.4 in Wenago, Dilla and Kochera sites, respectively. Major feed resources were grazing (33.5%). The highest mortality rate occurred in suckling flock (16.24% lambs; 16.3% kids), young flock (9.64% lambs; 13.24% kids) and breeding females (ewes 12.06% and does 14.1%) in all study sites. Sheep and goat production in the studied areas was constrained by different problems; where the major ones are availability and cost of feeds, limitation of land for the expansion of production and poor extension services. Sheep and goats are very important smallholder producers due to their biological factors such as short generation interval, twinning, have short growth periods and do not require much space.

Keywords: grazing, mortality, feeding, fattening and marketing

## **Introduction**

Ethiopia has a diverse indigenous sheep and goat populations, numbering 25 million and 22 million heads, respectively (CSA 2009). The total annual meat production (in %) are cattle (63%), sheep (25%) and goats (12%). At the national level, sheep and goat account for about 90% of the live animal/meat and 92% of skin and hide export trade value. Sheep and goats represent an important component of the farming system by providing about 12% of the value of livestock products consumed and 48% of the cash income generated at the farm level (FAO, 2004).

Sheep and goats are owned by smallholder farmers as an integral part of the livestock sub-sector and contribute to both subsistence and cash income generation (Ehuis et al., 2000). Sheep and goat are rear in various agro-ecological condition of the country. The suitability of an area for either animal or crop production, and the type of animal or crop to be produced depends on the agro-ecological conditions of the area. The feasibility of cropping and the type of crops to be produced depend on climatic, edaphic and biotic factors. The extent of cropping and the type of crop, in turn, determine the quantity, quality and distribution of animal feed resources throughout the year (Tolera and Abebe, 2007). On the other hand, the feed resource base and disease challenge determine the animal production system.

Integration of crop livestock production in general and small ruminant in particular plays an important role in food security and food self-sufficiency. A diversified production system is important to maintain food security in sustainable pattern. Income from the sale of goats and sheep's have been used to improve housing, purchase livestock, pay school fees, begin a small business, and improve family nutrition. In addition to that, it also served as a buffer and resource for use in drought conditions, lessening the need for food aid for participating families (Tolera and Abebe, 2007).

Sheep and goat are an integral part of mixed-farming systems throughout Ethiopia. Assessment of the existing sheep and goat production systems is an important tool to inform researchers about the actual problems farmers face and the opportunities that exist within the systems. Gedio zone are geographically located in Southern, Nation, Nationalities and Peoples of Regional State (SNNPRS), Ethiopia. Even though the study area is rich in sheep and goat still there is a long way to go to identifying and document the existing production system of the region. The overall objective of this study is therefore to asses sheep and goat production practices and reproduction performances in the study area.

## **Material and methods**

### **Area description**

This study was conducted in three Agro-ecological Woredas of Gedio zone (Wenago, Kochra and Dilla) of SNNPRS of Ethiopia. The Gedeo live between 5 and 7 degrees North latitude and 38 and 40 degrees East longitude in the escarpments of the south eastern Ethiopian highlands overlooking the Rift Valley, in the narrow strip of land running from North (Sidama zone) to South (Oromiya region). In altitude the area ranges from 1200 meter above

sea level in the vicinity of Lake Abaya to 2993 meter above sea level at Haro Wolabu Pond, Bule woreda. The climate of Gedeo is characterized as warm humid temperate. Mean annual temperature ranges between 17 ° C and 22.4° C and mean annual rainfall between 1200 and 1800 mm. The Gedeo zone is thus endowed with two rainy seasons, from March to May and from July to December, with interruptions of 3 to 4 dry months. However, the truly dry months are only January and February; others count with intermittent rain showers. The climate is suitable for abundant forest cover. The highlands, constituting about 30% of the total surface, are the dwelling of most sedentary agriculture with perennial crops such as *ensete*, coffee and chat and annual *teff*, maize, barley, and wheat. The dry, sub-humid zone covers 12% of the area and supports drought-tolerant crops like sorghum. The semi-arid and arid zones cover about 41% of the area and are currently used as pasture and range lands (Tadess, 2002).

## **Methods**

Assessment was conducted from April to July 2013 in the selected Woreda of Gedio zone (Wenago, Kochera and Dilla) based on their different agro ecology (humid, sub-humid and dry), from each Woredas one kebele was selected based on their potential (Wenago, Kochera and Dilla). Then, an average of forty households was purposively selected only from each locality, totaling 120 households were interviewed. A structured questionnaire was used to collect data on productive and socioeconomic aspects which were later validated by group discussions and flock monitoring. From the survey, production constraint and opportunity, available feed resource, purpose of keeping sheep and goat and important disease reduce the production potential of sheep and goat in the study area were assed. Furthermore focus group discussions were held with elder people, experts who have been actively engaged with animal production development agent from each site.

### **Flock monitoring**

From the interviewed households, ten farmers from each kebele (thirty in total) were selected randomly and participated in the flock monitoring study on a continuous basis for a period of six months (July to December, 2013). Data on health and disease situations, production and reproductive performances, disposal of sheep and goats (death, transfer and slaughter), labor utilization and other traditional husbandry practices were collected during the monitoring period using trained enumerators that was assigned to each selected study site. Furthermore, the researchers were supervised the data collection on monthly basis.

All data collected were analyzed by using statistical package for social science (SPSS) version 16.0 for windows. Descriptive statistics and analysis of variance were used.

## **Result and Discussions**

### **Source of income of interviewed household**

From the total of sample households, 32.6% of them participate in crop production, 56.5% of them involved in both animal and crop production and 5% of them involved in crop

production, animal production and off farm activity (Table 1). The chi-square test shows that there was a significant difference between the three groups and the majority of the farming community generates income from both crop and animal production. The main reason of keeping sheep and goat is for income generation of the family which is mainly used as a saving during crop failure and off harvesting. This result is in line with those of Gatenby (2002), Chipman (2003), Tolera and Abebe (2007) and Belete, (2009). In this study, small ruminants are sheep and goats and would interchangeably be used to refer to both species.

**Table 1: Source of income by sample household characteristics in three selected woredas of Gedio zone, Ethiopia**

Variables	No	%	Chi-Squire	P-Value.
Crop production	39	32.6	14.39	0.001
Animal and Crop Production	68	56.5		
Crop, Animal Production and Off-Farm activity	13	10.9		
Total	120	100.0		

### **Livestock holding**

Sheep flock in the study sites were significantly different; and are 5.63 in Dilla, 6.97 Wenago and 3.4 in Kochera (Table 2). The average holding of sheep in the study sites is higher than an average holding of sheep 0.96 (0.19) in Dira Dawa town (Tesfu, 2006). The average holding of goat in the study area 3.46 (0.35) lower than average holding of goat 5.03 (0.48) in Dira Dawa town (Tesfu, 2006). Moreover average cattle, is sheep and goat holding in Wenago area were different from the other study sites. Across the three study sites household keep mixed species composition and according to ILCA (1990), this decrease competition for feed, reduces risk by lessening the dependency on one species for meat and milk and increases the likelihood of meeting basic consumption needs.

The reasons for the variations could be due to the natural wealth base such as feed availability and capital wealth base of the respective communities. The extent of cropping and the type of crop, in turn, determine the quantity, quality and distribution of animal feed resources throughout the year; on the other hand, the feed resource base and disease challenge determine the animal production system (Tolera and Abebe 2007). Moreover the area having different agro ecology which determined availability of feed for sheep and goat and diversify source of income.

**Table 2: Livestock composition across the three selected woredas of Gedio zone, Ethiopia**

Livestock composition				Test		
	Dilla Mean (SE)	Wenago Mean (SE)	Kochera Mean (SE)	Overall mean (SE)	F- value	P-value
Cattle	2.12 (0.5) <sup>a</sup>	3.13 (0.5) <sup>b</sup>	2 (0.5) <sup>a</sup>	2.42 (2.8)	2.95	0.06
Sheep	5.63 (0.8) <sup>a</sup>	6.97 (0.8) <sup>a</sup>	3.4 (0.8) <sup>b</sup>	5.33 (0.32)	12.28	0.00
Goat	2.63 (0.61) <sup>a</sup>	4.27 (0.68) <sup>a</sup>	3.8 (0.47) <sup>a</sup>	3.46 (.35)	1.99	0.14
Chicken	2.3 (0.37) <sup>a</sup>	3.43 (0.48) <sup>a</sup>	2.9 (0.39) <sup>a</sup>	2.9 (.24)	1.86	0.16

\*\*different subscripts indicates significant differences at  $p < 0.05$  between means with in rows  
SE means standard error

#### **Selection criteria for fattening of sheep and goat**

Sixty three percent of the household practices fattening for targeted market (specific holidays) and the rest depend on target market season. Selection criteria for sheep and goat and sheep fattening were shown in table 3. 27% of respondents select animals for fattening based on body conformation (27%), age (27%) and local ecotypes (25%). Young fattened animals fetch higher prices due to tenderness of their meat.

**Table 3 Fattening of sheep and goat in three selected woredas of Gedio zone, Ethiopia**

Criteria	Percentage
Conformation (height, length and appearance)	27
Physical characteristics (color, horn, tail length and width, ear etc.)	12.7
Age	27
Breed (known local ecotypes)	25
Others	8.3

The survey result indicate that fattening was reported as one farming activity in the area using homemade concentrates using the human food grains so provision of supplementary feeds at affordable price

#### **Feed and water sources of the area**

According to respondents, feeding whatever available in their surrounding was common. Availability of different feed sources vary depending on the area where the households were located in references to market, cafeterias, miller house and grazing land which is either private or open area and type of crop cultivated. Major feed resources were grazing (33.5%), which includes road and fence side grazing, private or government land area grazing, free roaming on waste disposal and purchase grass from different sources is common (Table 4).

The non-conventional feeds used by smallholder sheep and goat holders include the traditional brewery and liquor residue (Atella), chat, vegetables and fruit wastes, and leftover foods.

**Table 4: Feed resource in in three selected woredas of Gedio zone, Ethiopia**

Feed types			Kochera(%)	Overall (%)
Feed types	Dilla(%)	Wenago(%)	Kochera(%)	Overall (%)
Grazing	26.8	28.6	45.2	33.5
Wheat bran	21.8	20	20.7	20.8
Local brewery by product	13.1	11.2	9.9	11.4
Enset leaves	5.8	6.4	9.9	7.4
Banana leaves	5.5	6.4	6.9	6.3
Chat left over	8.6	7.8	4.4	6.9
Grain and legume	-	15	1.5	1
Others <sup>a</sup>	18.4	18.1	1.5	12.7

Others <sup>a</sup> = Sugar cane top, Fruit peels, Kitchen left over and Grinding by products

#### Feeding systems of sheep and goat

The type of feeding systems practices were free grazing (58.82% dry; 54.4% wet season) and fully tethering (3.9% dry; 5 % wet season) which is practices in Wenago and Kochera sites and confine (3.9 % dry; 7.2 in wet season). According to Rischkowsky *et al.* (2005), the four sheep feeding system identified in West Africa; free grazing, scavenging in the roads and tethering, semi-intensive and confine both in dry and wet season.

**Table 5: Feeding systems practices in three selected woredas of Gedio zone, Ethiopia**

	Dilla		Wenago		Kochera		Over all	
	N	%	N	%	N	%	N	%
Dry season feeding practices								
Free grazing	26	43.3	33	55	47	78.3	106	58.9
Partly tethered	30	50	22	36.7	8	13.3	60	33.3
Fully tethered	–	–	3	5	4	6.7	7	3.9
Confined	4	6	2	3.3	1	1.7	7	3.9
Wet season feeding practices								
Free grazing	27	45	34	56.7	37	61.7	98	54.4
Partly tethered	27	45	19	31.7	14	23.3	60	33.3
Fully tethered	–	–	3	5	6	10	9	5
Confined	6	10	4	6.7	3	5	13	7.2

Tether grazing is practiced to decrease labor requirement, especially in the Wenago area of urban sites. During group discussions they mentioned that in Wenago and Kochera area complete tethered grazing was practiced to avoid theft, predators and car accident. Theft and predator is common and predators were big challenges for goat and sheep owner.

### **Productive and reproductive performances of sheep and goat**

Small ruminant reproduction and production a performance variation occur due to genetic as well as environmental factors which include breed, health, nutrition and climate. Age at first parturition of does observed in this study was 12.9 months (table 6), which is less than the indigenous goat age at first kidding was 16 months (Mamabolo and Webb, 2002). Ewe age at first lambing (13.0 months) was greater than age at first lambing (8.4 months) of Menz sheep in Ethiopian highlands (Mukasa-Mugerwa and Kassi, 1995). Early age at first parturition observed in this study agree with finding of Wilson (1989).

Litter size in the area was 1.78 ewes and 1.7 does. The most frequent litter size was twins flocks constituting 67.4% in goat and 70.12 % in sheep and this could attribute to the present litter sizes. Litter size observed in this study are comparable to observations in African flocks ranging between 1.08 and 1.75 for does but slightly higher than reports for ewes ranging between 1.02 and 1.43 (Wilson, 1989). Litter size of Menz sheep in Ethiopia highland of Ethiopia was 1.12 (Mukasa-Mugerwa and Kassi, 1995) and most estimates of litter size in tropical sheep ranges from 1 to 1.5 (Ibrahim, 1998). Litter size was differ significantly at  $p < 0.05$  across three experimental sites for both species.

**Table 6: Productive and Reproductive Performances of the flock in three selected woredas of Gedio zone, Ethiopia**

Location	Age at first parturition per months	
	Ewe	Goat
	Mean(SE)	Mean(SE)
Dilla	13.8(0.5)a	13.3(0.8)b
Wenago	12.1(0.41)b	11.9(0.4)a
Kochera	13.0(0.3)a	13.5(0.4)b
Over all(SD)	13.0(3.1)	12.94(2.6)
	Parturition interval	
Dilla	8.1(0.24)a	7.9(0.2)a
Wenago	6.5(0.23)b	7.5(0.2)a
Kochera	10.1(0.29)c	8.9(0.4)b
Over all(SD)	8.01(2.2)	8.3(1.6)
	Litter size	
Dilla	1.7(0.07)a	1.87(0.2)a
Wenago	2.0(0.07)b	1.85(0.1)a
Kochera	1.51(0.08)c	1.49(0.1)b

Overall(SD)	1.78(0.5)	1.7(0.63)
	Lambing/Kidding rate (%)	
Dilla	167.8(8.3)a	188.7(16.3)a
Wenago	193.6(7.6)b	180(14)a
Kochera	150.9(7.6)a	147.5(8.2)b
overall(SD)	173(57)	168(63.5)

\*Different subscripts indicates significant differences at  $p < 0.05$  between means with in rows  
SE: means standard error

Lambing and kidding rate significantly ( $P < 0.05$ ) varied in the three study sites as shown in Table 6. Lambing rate is a product of fertility and prolificacy is a good measure of ewe reproduction as cited in Mukasaa- Mugerwa *et al.*, (2002) and the present 173% lambing and 168% kidding rates are falls within the 65-200% values reported for tropical hairy sheep as cited in Mukasaa-Mugerwa *et al.*, (2002). Based on FAO report that lambing rate ranges between 108.2 and 119.1 and kidding rates between 120.1 and 133.6 for sub-Saharan Africa flocks.

### Sheep and goat health management

Out of the total interviewed households, 53.9% declared that sheep and goat death occurred in the year 2012/2013. Overall mortality rate of sheep and goat in study area were 12.93% and 14.04% (Table 7) respectively. The highest mortality rate occurred in suckling flock (16.24% lambs; 16.3 kids %), young flock (9.64 % lambs; 13.24% kids) and breeding females ( ewes 12.06% and does 14.1%) in all study sites. Reports of Denksew and Girma (2000) studies at Hawassa showed higher results for lambs < 3 months and lambs 3-6 months (3-6 months). For the most part of breeding females died due to car accident, kicked by person and swallowing of plastic. According to Otte and Chilonda (2002) authors reported that the mean lamb and kids' mortality are 26.7 and 27.8 percent in the traditional system of Sub Sahara Africa (SSA), respectively which is extreme result.

**Table 7: Mortality of sheep and goat flocks**

Flock structure	Sheep		Goat	
	Mean(SD)	Rate (%)	Mean(SD)	Rate (%)
Suckling flock	0.18 (0.5)	16.24	0.13 (0.4)	16.3
Young flock (3-6 months)	0.16 (0.5)	9.64	0.15 (0.5)	13.24
Breeding female	0.23 (0.5)	12.06	0.17 (0.53)	14.1
Intact/breeding male/	0.11 (0.33)	18.5	0.05 (0.2)	13.43
Castrated/fattening	0.12 (0.2)	16.7	–	–
Overall mortality	12.93%		14.04%	

Different sheep and goat disease which caused mortality of sheep and goats were Pneumonias, Pasteurellosis, and sheep pox, bloating and ingestion of plastics materials, car accidents and predators. Kochera kebele, a predator is the most prominent for the death of their flocks. Most frequently, the predators (hyena) enter in to barn and attack their flock.

### Sheep and goat production constraints

Small ruminant production in the studied areas was constrained by different problems. Small ruminant production in area prioritized the major constraints as; availability and cost of feeds, limitation of land for the expansion of production and poor extension services.

In Dilla area, lack of grazing area is first ranked problem. Whereas Wenago and Kochera area feed shortage is first ranked constraint (Table 8). Both problems are directly related to each other; as the population/urbanization increase land allocate for constriction which decreases the land available for livestock grazing.

There is a problem of availability and price of feeds. Usually sugarcane tops and grass is sold in the market as animal feed. Additionally, prices of concentrate feeds were among the major problems in small ruminant production. Following to feed related problems, availability of land for small ruminant production is the next important constraint in the studied area. According to Berhanu *et al.*, (2007) livestock health is the second important problem followed by feed shortage which is the first critical problems for Ethiopian livestock productions.

Though small ruminant producers are interested to expand the production, the land available for production cannot let them to do so. This is in line with Denksew and Girma (2000) that showed the main problems which hamper the expansions of sheep flock at Hawassa were shortage of feed and land for grazing.

**Table 8: Constraint of sheep and goat production in three selected woredas of Gedio zone, Ethiopia**

Location of study area	Constraints	1 <sup>st</sup> ranked	2 <sup>nd</sup> ranked	3 <sup>rd</sup> ranked	4 <sup>th</sup> ranked	Index <sup>a</sup>
Dilla	lack of grazing area	27	11	15	0	0.33
	Feed shortage	10	33	11	1	0.31
	lack of land for production	16	7	15	2	0.23
	Health problem	2	5	11	21	0.13
Wenago	Feed shortage	10	38	9	0	0.33
	lack of grazing area	11	11	31	0	0.26
	lack of land for production	25	3	12	0	0.25

		Health problem	11	3	2	25	0.16
Kochera		Feed shortage	30	15	6	0	0.40
		lack of grazing area	7	34	4	2	0.32
		lack of land for production	7	6	8	0	0.14
		Health problem	2	5	14	9	0.14

### Opportunities for sheep and goat production

There is a high demand of meat from small ruminants. According to Ehui *et al.* (2000), income, number of family and employment increased the purchasing potential of live sheep and goats increase. Most of the households want to buy live sheep and goat Ehui *et al.*, (2000) during Ethiopian New Year; eastern fall (August-October and May-July). This is also similar with study area, which is a better opportunity for sheep and goat owner to sell fattened animals at specific season and it also attracts commercial and small fatteners.

Some of the interviewed households usually practice fattening for specific season. Although, there are many constraints that may hinder the development of small ruminants identified in the area, majority of the respondents (92%) willing to expand production of sheep and goat in future; the producers are aware the of current demand of sheep and goats. Sheep and goats are very important especially for urban producers due to their biological factors such as short generation interval, twinning, have short growth periods and do not require much space.

Sheep and goats have high demand and incentive prices in the area. Because of the rapid urbanization, substantial population growth and change in the life standard by urban societies in the area, these increase the demand for meat. Considering these emerging and existing opportunities, the extension system needs to organize and guide to focus on sheep and goats production and marketing in order to improve income and enhance smallholder livelihoods, by minimizing flock loss through diseases and parasites control, protection against predators and proper feeding. The local feeding management system entirely depended on grass, local brewery by products, kitchen left over from home, hotel and cafeteria. In addition to this, in the market and around miller house, there are considerable amount of feed which minimize the feed cost and seasonality of the feed.

### Conclusion

In the study area the majority of the flock is composed of young (lambs and kids) and breeding females (ewes and does). Main purpose/reason of keeping sheep and goats were as source of income and saving. Sale of sheep and goat to fulfill immediate household cash needs accounted the main flock exit route for which sheep and goats are at immediate disposal. Major feed resources were grazing which includes road and fence side grazing, private or government land area grazing, free roaming on waste disposal and purchase grass from different sources is common. Small ruminant production in the studied areas was

constrained by different problems; prioritized as the major constraints; availability and cost of feeds, limitation of land for the expansion of production and poor extension services. Sheep and goats are very important especially due to their biological factors such as short generation interval, twinning, have short growth periods and do not require much space.

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