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Research article

MANAGEMENT PRACTICE AND CONSTRAINTS OF SHEEP PRODUCTION IN SOUTHERN, SOUTH EASTERN AND EASTERN ZONES OF TIGRAY, NORTHERN ETHIOPIA.

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ABSTRACT

The study was carried out in Atsibi wonberta, Wukro kilteawlaeo, Ofla, Alamata, Enderta and Degua Temben woreda (district) of Tigray Regional State of Ethiopia. The objective of this study was to characterize the management practice and major constraints of sheep production. A total of 180 household 30 from each district were selected randomly for the interview. Data were gathered through semi-structured questionnaire, focus group discussions and field observations. Data collected through questionnaire were described by descriptive statistics. The primary reason for keeping ewes was to generate income (32%), meat (20%), manure (15%) and ceremonies (14%) respectively. However, the primary reason of keeping male sheep was for the purpose of income (35%), meat (17%), ceremonies (15%), and breeding (11%). The major feed resources were natural pasture (100%); crop residues (68.33%) and source of water were from rivers, wells, natural ponds. The majority of the respondents (86.67%) trek their animals 1 to 5 km in search of water during the dry season, but during the wet season 96.11% of respondents was reduced to < 1 km and about 38.89 % of the respondents watered their animals in their home. In the study area there was no separate house for young, male and female sheep. About 49.5% (n=89) of respondents had their own rams, while the remaining sheep owners get rams service from their neighbors or in communal grazing areas. Only 20.56 % respondents castrate their ram. But, the remaining 79.44 percent of the respondents did not practice castration. The major production constraints that need to be tackled in order to increase the performance level of sheep flocks in the surveyed districts include: recurrent drought, diseases prevalence, inadequate feed supply associated with the shortage of land throughout the year especially during the rainy and dry season for most farmers. Predators like fox and hyena are also the problems of sheep production especially in Enderta woreda. A total of 1155 head of sheep had died in the six study districts during the year of 2009/2010. In the last 12 months, 45 and 20 heads of sheep died per family in Atsib-wonberta district and Ofla and Degua-Tembien districts, respectively. Both

highest (43.75%) and lowest (6.25%) mortality for male and female lambs was reported in Enderta district. In general the management practices of sheep observed in this study was similar to other traditional sectors in Ethiopia. Therefore, government and development agencies of the study districts should give due attention in all aspects of sheep management practice and their constraints to assist smallholder farmers to help themselves to extricate from chronic hunger and under line poverty.

Key words: Diseases, feeding, sheep production, watering, district (s)

INTRODUCTION

Ethiopia has diverse indigenous sheep populations, numbering 26.1 million heads (CSA, 2009). In addition to this the country also has diverse ecology, production systems and ethnic communities. According to (FAO, 2004), the total annual meat production from sheep is only 25%. At the national level, small ruminants account for about 90% of the live animal/meat and 92% of skin and hide export trade value. In the lowlands, sheep with other livestock are the mainstay of the pastoral livelihoods. The current levels of contributions of the livestock sector in Ethiopia, at either the macro or micro level is below potential. The levels of livestock and livestock products are also much lower than would be expected, given the size of the livestock population (Gizaw *et al*., 2010). In order to alleviate the multi-faceted problems that limit productivity and off-take rates and improve marketing success of farmers and pastoralists, characterization of the production and marketing systems is essential.

In Ethiopia, sheep are reared mainly by smallholder farmers and graze in small flocks on communal open natural pastures. Ethiopia's diverse sheep population estimated at 26.1 million heads (CSA, 2009), is the third largest in Africa (FAO, 2004). This diverse sheep genetic resource is distributed from the cool alpine climate of the mountainous highlands to the arid pastoral areas of the lowlands (DAGRIS, 2006; Markos, 2006). As compared to large ruminants, sheep and goats require small investments, have shorter production cycles, faster growth rates and greater environmental adaptability; and hence have a unique niche in smallholder agriculture. In Ethiopia, sheep and goats provide 25% of the domestic meat consumption with production surplus, which is exported mainly as live animals (Markos, 2006). In order to meet the increasing demands for food of animal origin, a livestock revolution has to take place. Animals and production systems must, therefore, be adapted to local environment, socio-economic and cultural conditions, and adequate genetic diversity for the unknown future needs to be ensured (ILRI, 2006; Solomon, 2007).

Small ruminants are widely distributed and are of great importance as major source of livelihood for smallholder farmers and the landless in rural communities in developing countries (Tembely, 1998). Small ruminants represent an important component of the Ethiopian livestock production system, providing 12% of the value of livestock products consumed at the farm level and 48% of the cash income generated, but accounting for only 7% of the capital invested in the livestock sector by farmers (Kassahun *et al*., 1991; Tembley, 1998).

Small ruminants are an integral part of mixed-farming systems throughout Ethiopia. Animals in this type of production system are considered as low producers because of several factors such as insufficient feed availability confounded with the prevalence of disease and parasitic pests (Zinash and Seyum, 1991). Assessment of the existing sheep production systems (socio- economic aspects of the household, sheep management and husbandry practices, constraints and their interaction with other farming activities) is an important tool to inform researchers about the actual problems farmers face and the opportunities that exist within the systems. Therefore, this research work was conducted with the following objectives:

- To characterize the management practice of sheep in the study area.
- To assess the major constraints of sheep production in the study area

3. MATERIALS AND METHODS

3.1. Description of the study area

The study was conducted in six districts namely, Atsbi-Wonberta, Wukro-Kilteawlaelo, Ofla, Alamata, Enderta and Degua-Temben. Atsbi-Wonberta and Wukro-Kilteawlaelo districts are found in Eastern zone of Tigray; while Ofla and Alamata are in Southern Zone of Tigray Regional State. The remaining two districts viz, Enderta and Degua-Temben are part of South Eastern of Tigray Region (figure 1). The mean annual temperature of the study areas varies from 14^{o}c to 22^{o}c. The mean annual rainfall ranges from about 400 mm to around 969 mm. The altitudes of districts were situated at 1500- 3200 masl. The farming system in all of the surveyed districts is a crop livestock mixed farming system. The major crops grown in Southern; South Eastern and Eastern zones of Tigray Regional state are sorghum, Teff (Eragrostis tef), maize in Alamata, Enderta and Wukro-Kilteawlaelo districts. Whereas, wheat, bean, barley, pea, lentil, grass pea, chick pea, rarely linseed wheat and other highland crops in Ofla, Atsibi-Wonberta, Degua-Tembien districts. Cattle, goat, sheep, equines, poultry and honey bees also reared in these woredas. Detail description of the above six districts was made as follows (Table 1).

3.2. Selection of the study site

Study sites were selected based on their suitability for sheep production, sheep distribution patterns, agro-ecology, and access to infrastructures like road and public transport. A rapid reconnaissance survey was done before the main survey to know the distribution and sampling framework from which sampling of district was taken. Two districts from each of three Zones (Eastern Tegray, South Eastern Tigray and Southern Tigray) were purposively selected. The selections of districts from the Zones were made to include one dominantly highland and one dominantly lowland district. The districts included in the study are (Atsbi-Wonberta, Wukro-Kilteawlaelo, Ofla, Alamata, Enderta and Degua-Tembien). A total of 12 peasant associations **(**Felege wein, Golgolnaele, Genfel, Aynalem, Menkere, Wonberet, Timuga, Limat, Debri, Maitsedo, Mahibere-silassie and Hagereselam), 2 from each district were selected randomly. A total of 180 households 30 from each district and 15 from each peasant associations were selected randomly for the interview.

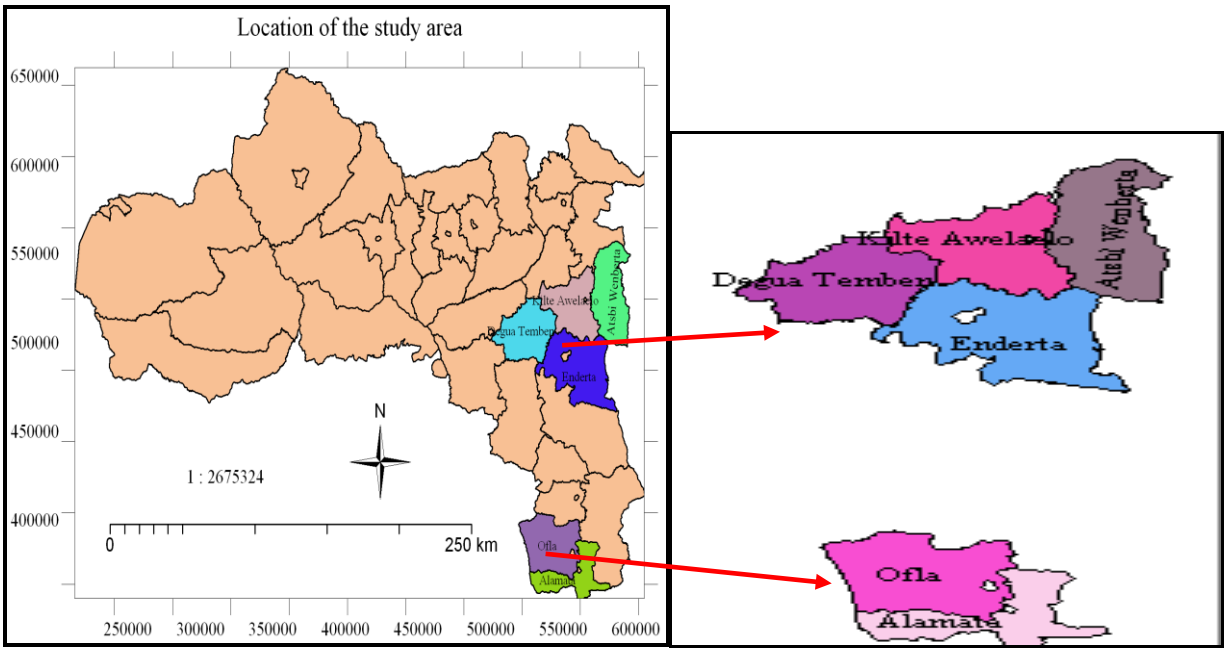

Figure 1. Location of the study districts in Tigray Region.

3.3. Procedures and Methods of Data Collection

Data from primary (observation, questionnaire and interview) and secondary sources (different offices) were collected. Data were generated through use of structured questionnaires, field observation and group discussions and from secondary sources**.** To collect primary and secondary data formal and informal survey was employed. Secondary data was collected from different offices such as Regional, Zonal and district offices of agricultural bureaus and related offices, from various relevant documents and sources. A set of detailed structured and pre-tested questionnaire were designed to collect information on farming activity, production system, main uses and reasons for keeping sheep; breeding management; major feed resources, source of water; sheep husbandry practices in the area.

A modified questionnaire was prepared by adopting a questionnaire prepared by International Livestock Research Institute (ILRI) and Oromiya Agricultural Development Bureau (OADB) for survey of livestock breeds in Oromiya (Workneh and Rowlands, 2004). The questionnaires were pre-tested by discussing with the development agents and farmers found in the study districts prior to beginning of interview and necessary rearrangements were made to make sure that farmers easily understand it. The survey materials were prepared in a way and language that are understood by the enumerators and farmers during the completion of a questionnaire. The pre-tested questionnaires were administered to 180 households by the researcher and development agents. The questionnaires consist of open-ended and close-ended questions.

To verify the information collected through individual farmer interview, focus group discussions were held with village leaders, youth, elders, women and socially respected individuals. Since it is believed that, such individuals would have better information about the overall production system of sheep as well as the major production constraints. Besides secondary data on human and livestock population, agro-ecology, topography and climate were gathered from regional, districts and Agriculture and Rural Development offices as well as central statistical authority (CSA, 2008).

3.4. Data management and analysis

Data collected through questionnaire were described by descriptive statistics using (JMP, 2002). Index was calculated to provide ranking of the reasons of keeping sheep by sex and reasons for death of sheep. Therefore, index was calculated as Index = Sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) given for an individual reason divided by the sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) for overall reasons according to Musa et al. (2006).

4. RESULT AND DISCUSSION

4.1. Farming system and farm size

All of the interviewed farmers keeping sheep indicated that they practiced both crop and livestock production. With the exception of Wukro-Kilteawlaelo and Alamata districts, the remaining districts had used less than a quarter of the total land for grazing (Table 2). In all of these six districts no improved forage crops were sown. However, the grazing lands were covered by natural vegetation. Wukro-Kilteawlaelo and Alamata districts had larger arable land (1.42 and 1.4 ha) as compared with the other study districts whereas, Degua-Tembien district had the smallest land holding (0.56 ha (Table 2). Though larger land as compared with grazing land was allocated for the production of crops, the yield obtained from crops like wheat, barley, Teff (Eragrostis tef), maize, sorghum, pea, and bean is not enough for family income (by sale their grains) and food source (Table 2). Therefore, additional income was generated from their livestock production. There was no communal grazing land in Atsibi-Wenberta, Wukro-kilteawlaelo, and Degua-Tembien districts. But, in Ofla, Alamata and some parts of Enderta district communal grazing areas are available (Table 2).

4.2. Composition of the livestock species and flock structure of sheep

The major livestock species in the study area were cattle, sheep, goats, poultry and equines. Number and percentage of respondents' who had different livestock compositions in the study districts is summarized in (Table 3). Across all the different districts studied, sheep were kept together with other livestock species. All the households considered in the study had sheep. The average flock size of sheep among the study districts considered, Alamata had the largest (16.39) sheep flock size, followed by Degua-Tembien (16.09) and Ofla distirct (15.72) (Table 4). Except that of Atsibi-Wonberta district the maximum flock size of sheep per family was similar in the other districts.

Previous study on sheep flock size other than the two extreme environments (cool highland and arid lowland) of the country is in a range from 2.9 to 9.6 (Solomon, 2007; Mengistie, 2008). In the lowlands, larger flock size of 16.0 for Gumuz sheep, 23 for Afar sheep and 19.2 for Blackhead Somali sheep were reported (Solomon, 2007; Tesfaye, 2008; Fekerte, 2008). Similarly larger flock size of 31.45 was reported for Menz sheep in the cool highlands of Ethiopian (Tesfaye, 2008). The relatively larger sheep flock size, compared with other parts of the country, obtained in this study indicated that the area favors sheep and shows higher dependency of farmers on sheep implying the higher chance of success and acceptance of village level sheep breeding strategy if planned carefully.

4.3. Purpose of keeping sheep

The purpose of keeping sheep include regular cash income, meat for home consumption, manure for farm use, insurance against emergency, skin for home use and sale, and different gifts, ceremonies or celebrations (Table 5). Respondents from all sampled woredas ranked income source from sales of live animals and their products as a first purpose of keeping sheep. The primary reason for keeping ewes was to generate income followed by meat, manure and ceremonies, as means of savings, skin and blood (as a food when slaughtered and for religious purposes) in that order with an index of 0.32, 0.2, 0.15, 0.14, 0.03 and 0.01, respectively (Table 5). However, the primary reason of keeping male sheep (ram and growing lambs) was for the purpose of income, meat, ceremonies (socio-cultural), breeding, manure, saving and skin with an index of 0.35, 0.17, 0.15, 0.12, 0.11, 0.07 and 0.02 respectively (Table 5). The present study was in contrast with the previous study reported by Kosgey *et al.,* 2008. While other categorically stated that keeping animals is a prerequisite for deriving operational breeding goals (Jaitner *et al*., 2001).

In all of the aforementioned districts farmers reported that female sheep are not used for milk production purpose. The contribution of sheep in the study area for the family income obtained in this study was much higher (35%) than a previous report (Solomon *et al.,* 2005), which reported that sheep and goat contributed 29% of the farm cash income in East Wellega and West Shewa.

4.4. Livestock feed resource and feeding practice

In the study districts crop residues from bean, peas and Teff (Eragrostis tef) and *atela (by product of crops)* (50%) were important feed sources especially during the dry season when availability of grazing pasture is low. Provision of salt (mineral supplementation) was a recognized practice (Table 6). Large number of the respondents (43.33%) provides salt during the wet season. Sheep feeding practice during supplementation of *atella* (crop by-product) in Ofla and Degua-Temben was at a time for all age groups and sometimes with cattle. Private grazing land was common in the Atsibi-Wonberta district, Wukro-kiltawlaelo, Degua-Temben only. Whereas in the other three districts (Alamata, Ofla and some part of Enderta) communal grazing land was common. It was observed that natural pasture was the major feed resource in the study area and feed shortage was reported as the major production constraints by the farmers. The different feed resources reported in the area were natural pasture, crop residue and crop after math and hay (Table 6). Generally in Ethiopia the main feed resource for livestock includes natural pasture, fallow land, and stubble grazing and crop residues (Solomon, 2007).

According to 95% of the respondents, seasonal shortage of feed in the area was severe for a period of five to six months every year (January to June) in the study districts. To solve this problem the farmers give supplemented feeds (crop residues and crop by-products) for their sheep. The present study is in agreement with previous study (Abebe, 1999; Aden 2003; Samuel, 2005). The authors reported that feed shortage is the major constraint of sheep production in different areas of Ethiopia.

4. 5. Water source and watering frequencies

In the areas studied the main sources of water for livestock and human beings was from stream, rivers, natural ponds, water holes etc. The amount of these water sources decline in the dry season. The distances to watering points varied during the dry and wet seasons. The majority of the respondents (86.67%) trek their animals 1 to 5 km per day in search of water during the dry season, but during the wet season distance for 96.11% of respondents is reduced to < 1 km and about 38.89 % of the respondents watered their animals in their home. Fekerte (2008) in Shinile and Erer districts of Somalia Region of Ethiopia reported that majority of the respondents search water up to 10 km for their animals during the dry season, but during the wet season distance is reduced to five km. In the study area lambs are watered with adults.

During the wet season, only 3.3% of the farmers watered their animals freely, while 52.2% watered once in two days (Table 7). In dry season, however, only 8.8% of the respondents' water once in 2 days and about 91.1% watered once a day (Table 7). Majority (91.67%) of the respondents' reported that the quality of water that uses for their animals and home consumption was clean. The remaining 8.33 percent reported unclean water for their animal especially during the dry season. Higher watering frequency was reported in this study as compared to similar studies in other areas. Watering once in 2-3 days was common in the lowlands of Dire Dawa area (Aden, 2003). The more frequent watering in the study area might be related to the availability of water in the study woredas especially in Wukro-kilteawlaelo, Ofla, Degua-Tembien and some parts of Enderta and Atsibi-wonberta.

4.6. Sheep housing

In the study area sheep housing varies from one district to another disrict. Good housing can determine productivity by reducing stress, disease hazards and making management easier. In Atsib-Wonberta, Wukro-Kilteawlaelo, Ofla Degua-Tembien and most parts of Enderta districts sheep are housed separately from the family house. Whereas, in Alamata (50%) and Enderta (10 %) districts; the farmers housed their sheep within family house. But where the number of animals is large (greater than 15), a separate pen is built for them. Females, males and young animals are kept in the same house. In contrast to this (Fikrte, 2008) reported that the males of black head Somali sheep are kept separately from the female to control breeding.

Sheep houses are made up of iron sheet, wood, bushes/grass, stone/bricks and earth/mud (Table 8). Abebe (1999) reported that Menz sheep in general were housed in corrals (84.4%) throughout the year and a few farmers provide shelter in-houses (15.6%) usually underground floor separately from other species. During the rainy season from the sheep sheltered in corrals, pregnant, recently lambed, new-born lambs, emaciated and sick ewes were given priority for in-house. The farmers are skillful in constructing these enclosures which are kept closed with thorny branches during each night to prevent predator attacks. There are different types of sheep house in the study woredas.

4.7. Breeding practice

In the study districts there are different indigenous breeds of sheep (Afar, common highland and mixed of them). However, those breeds were not fully characterized and identified. In these districts, there was no practice of controlled mating. Thus, showed that about 100 % of the mating system was uncontrolled (Table 9). The rams run with ewes throughout the year. Kosgey *et al.* (2006) also reported predominance of uncontrolled mating within households flock. In the other categories 78 percent of the respondents in Shinille and Errer Districts of Somali Region practiced partial controlled mating system as reported by Fekerte (2008).

About 49.4% (n=89) of respondents had their own rams, while the remaining sheep owners get rams serviced from their neighbors or in communal grazing areas, respectively (Table 9). Availability of ram in the system considerably affects all biological and financial performances of the flock (Galal *et al.,* 1996). Among the 180 respondents' only 37 (20.56 %) castrate their lambs. But, the remaining 79.44 percent of the respondents' did not practice castration (Table 9). This might be due to the reason that most of the respondents' sold the male sheep in the early age for the source of income and slaughtered during holidays. Majority (94.59%) of the respondents' castrated their sheep after 6 months of age (Table 9).

In the study area age of castration was not practiced less than 3 months (Table 9). All of the respondents' reported that the reason for castration is for the purpose of fattening and then to get better market price. The productive life of ram was reported up to 2 years. This is because the farmers sold their ram at early age. The type of flock management where there is no separate herding of sex and age groups lead to indiscriminate and uncontrolled breeding in the study flock. The main consideration in the management appears access to the basic needs such as pasture and water.

4.8. Sheep production constraints in the study area

In all the districts covered by the current study the major problems of sheep production were persistent drought, shortage of feed and disease. In addition to these predators like fox and hyena are also the problems of sheep production especially in Enderta district. As the respondents said, recurrent drought was the worst problem of sheep and other livestock production especially in the dry season. Atsibi Wenberta, Wukro-kilteawlaelo, Alamata and Ofla districts were among the nine districts in Tigray most affected by drought during 2008, requiring emergency food supplies requested for an estimated 600,000 people in the first woreda only (Kahsay, 2008). According to BoANRD

(1997) and UNECA (1997) grazing lands in Tigray are supporting livestock beyond their carrying capacity, consequently, feed shortage is the chronic problem to livestock productivity in the region and the situation is worsened especially during drought periods. Kahsay (2008) also reported that, drought was the worst problem in Atsibi-Wonberta district.

From the description of the symptoms, it was obvious that many farmers were able to identify diseases and parasites such as *Ovine Pasturulosis, Ovine Pleuropneumonia, Fasciolosis* and Menge mites are mentioned as major contributors to high mortality before weaning. The most common diseases noted from the description of symptoms of diseases in all surveyed areas are Ovine Pasturulosis, anthrax *(Tagtagta/Mieta),* Ovine Pleuropneumonia *(samba),* Bloat *(kofa),* Coenuruses (*Zarit*) and Cowdriosis (*Magerem*), Enteritis *(Tsetseh*), skin diseases like scabies (*Abek*/*shihor*), internal parasites such as *Haemonchus, Hydatid cyst and Fasciola*. The most common external parasites were Menge mites, ticks, fleas and lice. Coenuruses was believed to be the most economically important disease in Atsibi-wonberta, Wukro-kilteawlaelo, Ofla and Degua-Tembien districts. Whereas, in Alamata district; the most economically important disease was scabies.

Most of the respondents indicated that they spray anti external parasite chemicals on their sheep and goat. The animals are vaccinated against few of the diseases only. It was clear from this study that there is occasional use of veterinary drugs and traditional medicines prepared from local medicinal plants. The traditional medicines are generally used to cure the animal but sometimes they cause serious problems due to higher dose and adverse effects.

Most farmers (59.5%) treated sheep against liver fluke and *ovine pluronumenia*. Drugs were purchased from open markets (45%) or district bureau of agriculture (55%). The respondents reported that random use of modern drugs especially those purchased from open markets for the treatment of parasites was a common practice with most of the farmers in the study area. In some cases vaccinations against pasteurolosis and anthrax were provided by district or PA bureau of agriculture if reported by the farmers during an outbreak. Moreover, the decision to treat sick animals depended on the availability of cash with the farmer. Even when the cash was available it was observed that distance from clinics, unavailability of drugs in the district or PA bureau of agriculture clinics, inadequacy of service offered by organizations and cost implications were obstacles to get veterinary service in the study area. Smoke *(fumigation)* from plastic materials, eucalyptus tree leaves, cattle dung and cotton-made closings was used to fumigate the animal in treating sheep with Coenurus in Atsibi-Wonberta district. Fumigation is also considered to prevent external parasites like tick infestation. Similarly, treating with smoke from eucalyptus tree leaves, tobacco, coffee bean shells, cattle dung, birds' nest and cotton-made closings is used to fumigate in treating Issa goats with Coenurus and tick infestation was reported by Girum (2010) around DireDawa.

Mortality of sheep during the last 12 months was assessed as remembered by owners. Mortality rates for different sexes and age groups of sheep according to the respondents are different within the study districts (Table 10). A total of 1155 heads of sheep died in the six study districts during the year 2009/2010 (Table 10). In the last 12 months, 45 and 20 heads of sheep died per family in Atsib-wonberta district and Ofla and Degua-Tembien districts, respectively. However, the number of sheep (7) died in Enderta district was small (Table 10). It can be observed

that mortality rate was higher for females compared to their male counterparts across all the study districts. Higher mortality rate was also computed for the lambs less than one year of age than the adults in Wukro-kilteawlaelo, Ofla, Alamata, Enderta and Degua-Tembien districts in male. This result is in agreement with earlier reports on pre-weaning lamb mortality (Gatenby and Humbert 1991; Njau *et al*., 1988).

The high mortality of 10 to 50 percent was recorded to be common in young lambs up to weaning (Gatenby and Humbert, 1991; Ibrahim, 1998) in all type of traditional management system. In contrast to this female sheep mortality was higher in the age of greater than one year in the above mentioned districts except Enderta and Degua-Tembien. Both highest (43.75%) and lowest (6.25%) mortality for male and female lambs was reported in Enderta districts (Table10). This result might be due to the shortage of feed, prevalence of diseases and predators in this district. The report of (ILCA, 1990) which stated that annual mortality rate of between 25 to 35 was common in small ruminants.

According to the respondents the reasons for death of sheep in the study area was drought, disease, predators, accident and unknown reasons. Recurrent drought, disease and predators were ranked as first, second and third most important reasons of mortality in the last 12 months with an index value of 0.49, 0.44 and 0.05, respectively (Table 11). This result agreed with previous reports of Sinishaw (2004) in Abergelle district, where the major problems of sheep production were recurrent drought and disease. Disease, predator and drought were the major reasons for reduction of number of sheep in the Errer and Shinille Districts of Somai Region (Fekerte, 2008). In the rural areas of Dire Dawa, it was reported that diseases, predators, accidents and mis-mothering were the common causes of mortality of sheep (Aden, 2003; ILCA, 1990; Mukasa-Mugerwa, 1996; Ibrahim, 1998). Njau *et al*. (1988) also reported that 55.3% of the mortality occurred in Menz sheep kept under on-station conditions was due to disease factors.

5. Conclusions and recommendations

In general it was conclude that the management practices of sheep observed in this study was similar to other traditional sectors in Ethiopia. It was noticed that there was usual feed shortage problem during the short rainy season compared with similar agro-ecological zones. It was mainly due to the small size of land holding. The major production constraints that need to be tackled in order to increase the performance level of sheep flocks in the surveyed districts include: diseases prevalence, inadequate feed supply associated with the shortage of land throughout the year especially during the rainy and dry season for most farmers.

Feed shortage especially from January to June and considering small ruminants as secondary to large livestock hence not properly supplemented them with additional feed than grazing or browsing are critical problems in the production system. To alleviate feed shortage, there is a need to take feed inventory and introduce improved forages and some tree legumes in the cropping system without leading to a serious competition with cropping land. Therefore, this should be considered as a major critical point and requires intensive work.

The other problem is the prevalence of diseases and pests. Hence, controlled treatment and awareness of farmers is vital. There is also a need to provide adequate veterinary services and proper management practices. Government

agencies are responsible to provide facilities for surveillance and diagnosis of diseases and should able to maintain adequate vaccine supply to prevent endemic and epidemic diseases. Therefore, government and development agencies should give due attention in all aspects of small ruminant production system to assist smallholder farmers to help themselves to extricate from chronic hunger and under line poverty.

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Table 1. Description of the Study Area

Name of Woreda	Distance (Km) from Adiss Ababa & Mekelle respectively	Attitude (masl)	Mean annual temperature (^{o}C)	Mean annual rainfall (mm)	Total human population (CSA,2008)
Atsbi-Wonberta	843N & 65NE	918-3069	19	400	112,234
Wukro-Kilteawlaelo	823 N & 45 N	1977	19.7	400	129,896
Ofla	620 N & 158 S	2300-3200	14	942	142,803
Alamata	600 NE & 180 S	< 1500	22	693	118,557
Enderta	766 N & 12 S	1185-2169	22	500	114,277
Degua-Temben	828 NW & 50 N	1595-2760	18	969	113,526

**masl= meter above sea level*

Table 2. Land holding per hectar (mean ± SD) and land use pattern in the study woredas

Variables	Land use	Atsibi-wenberta	Wukro-kilteawlaelo	Ofla	Alamata	Enderta	Degua-Tembien
Own-land	Cropping	0.57± 0.33	0.76± 0.43	0.37±0.22	1.08 ± 0.52	0.61 ± 0.35	0.52± 0.21
	Grazing	0.16±0.12	0.025± 0.10	-	-	-	-
Rented land	Cropping	0.27± 0.33	0.16 ± 0.3	0.23± 0.27	0.32 ± 0.46	0.03 ± 0.08	0.04± 0.11
	Grazing	-	0.025± 0.07	-	-	-	-
Total land		1	1.42	0.6	1.4	0.64	0.56

Table 3. Number and percent of respondents who had livestock composition in the study districts.

Species name		Atsibi-Wonberta	Wukro-Kilteawlaelo	Ofla	Alamata	Enderta	Degua-Tembien	Total
Cattle	N	19	21	26	30	13	17	126
	%	63.3	70	86.9	100	43.3	56.7	70
Sheep	N	30	30	30	30	30	30	180
	%	100	100	100	100	100	100	100
Goat	N	5	6	1	0	0	0	12
	%	16.7	20	3.3	0	0	0	6.7
Poultry	N	30	28	25	30	15	26	154
	%	100	93.3	83.3	100	50	53.3	85.6
Donkey	N	21	25	18	18	30	11	123
	%	70	83.3	58.1	58.1	100	36.7	68.3

**N= number of respondents, %= percent of respondents*

Table 4. Average, minimum and maximum number of sheep flock size per family in the districts.

Name of districts	Flock Size per Family		
	Average	Minimum	Maximum
Atsbi-wonberta	13.97	7	22
Wukro-kilteawlaelo	14.58	7	27
Ofla	15.72	10	22
Alamata	16.39	11	22
Enderta	13.76	7	23
Dega Tembien	16.09	9	21

Table 5. Purpose of keeping sheep as ranked by the respondents in the study districts

	Male sheep				Female sheep			
Purpose	R1	R2	R3	I	R1	R2	R3	I
Meat	35	12	53	0.17	35	24	66	0.2
Breeding	15	41	-	0.12	-	-	-	-
Manure	11	22	47	0.11	8	51	38	0.15
Blood	-	-	-	-	-	-	5	0.01
Skin	-	5	15	0.02	5	6	5	0.03
Saving	-	27	26	0.07	21	27	37	0.14
Ceremonies	6	58	27	0.15	4	33	25	0.15
Income	113	15	12	0.35	107	9	4	0.32

***** *R1, R2 and R3 = rank 1, 2 and 3 respectively. I= index* **:** *Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual purpose divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall purposes.*

Table 6. Major feed resources reported in the study area

Feed resource	N	%
➢ Natural pasture	180	100.0
➢ Crop residue	123	68.33
➢ Concentrate	65	36.11
➢ Hay	25	13.89
➢ Crop by products (*atella*)	90	50
➢ Provision of salt (mineral supplementation)	78	43.33

**N= Number of respondents, %= percent of respondents*

Table 7. Seasonal watering frequency and availability of water in the study area

Watering frequency	Season	
	DS	WS

	N	%	N	%
➢ Freely	-	-	6	3.33
➢ Once a day	164	91.11	70	38.89
➢ Once in two days	16	8.89	94	52.22
➢ Once in three days	-	-	10	5.56

**N= number of respondents, DS= dry season, WS= wet season and %= percent of respondents.*

Table 8. Types and percent of sheep housing material in the study area

	Housing material	Astibi-wonberta	Wukro-kilteawlaelo	Ofla	Alamata	Enderta	Degua-Tembien
Roof	Iron sheets	-	43.33	50	60	13.33	83.33
	Grass/Bushes	-	23.33	46.67	40	6.67	13.33
	wood	100	33.33	3.33	-	80	3.33
Wall	Wood	-	36.67	50	100	-	86.67
	Stone/bricks with mud	100	63.33	50	-	100	13.33
Floor	Earth/mud	100	100	100	100	100	100

Table 9. Castration and Breeding practice of sheep in the study area

Variables	N	%
Castration practice		
➢ Yes	37	20.56
➢ No	143	79.44
Age of castration		
➢ < 3 months	0	0
➢ 3-6 months	2	5.41
➢ >6 months	35	94.59
Breeding		
➢ Controlled	0	0
➢ Uncontrolled	180	100
Source of ram in the last 12 months		
➢ Own ram	89	49.45

➢ From neighbors	31	17.22
➢ From communal grazing	60	33.33

**N= Number of respondents, %= percent of respondents*

Table 10. Total number of sheep died and percentile of mortality in the last 12 months of 2009/10 per woreda in the study area.

		Male		Female		
Name of Woreda		young < 1yr	adult ≥ 1yr	young < 1 yr	adult ≥ 1yr	Total
Atsbi-wonberta	N	79	81	82	139	381
	%	20.73	21.26	21.52	36.48	100
Wukro-kilteawlaelo	N	62	55 35	43	43195	195
	%	31.79	28.21	17.95	22.05	100
Ofla	N	39	29	42	110	220
	%	17.73	13.18	19.09	50	100
Alamata	N	25	24	22	43	114
	%	21.93	21.05	19.3	37.72	100
Enderta	N	28	5	27	4	64
	%	43.75	7.8	42.2	6.25	100
Degua Tembien	N	63	30	53	35	181
	%	34.81	16.57	29.28	19.34	100

** N= number of died animal, %= percent of died animal*

Table 11. Reasons for death and ranking of their importance

Reasons	R1	R2	R3	I
Predators	3	7	11	0.05
Diseases	55	57	-	0.44
Accident	-	-	8	0.01
Unknown	-	1	4	0.01
Drought	76	44	-	0.49

**R1= rank 1, R2= rank2, R3= rank and I= Index*