International Journal of Livestock Production Research
Vol. 1, No. 3, December 2013, PP: 26 - 43, ISSN: 2329 - 8634 (Online)
Available online at http://acascipub.com/Journals.php

Research article

Traditional sheep production and breeding practice in Gamogofa Zone, Southern Ethiopia

Fsahatsion Hailemariam[1], Aberra Melesse[2] and Sandip Banerjee[2]

[1]Department of Animal Production and Technology, Aksum University, Tigray, Ethiopia
[2]Hawassa University, PO Box 05, Hawassa, Ethiopia
Phone no: +251910185018

E-mail: fhialema@yahoo.com

Abstract

The study was conducted in Gamogofa zone of Southern, Nations, Nationalities and People Regional State with the objectives to describe its production systems, breeding practice and identify major constraints of sheep productivity. Purposive sampling techniques were employed to select target farmers. Structured questionnaire, focused group discussions, secondary data sources and field observations were used to generate the required data. A total of 184 households were selected from four woredas (8 rural kebele) in both weyna-dega and dega agro-ecologies. The survey results revealed that the overall total family size and land holding were 6.59 and 1.5ha, respectively and the overall mean sheep holding was 18.7sheep per households. The purpose of keeping sheep was as source of income followed by meat production and manure. The key feed resources in both agro-ecologies were communal grazing and private pastures. Most important causes of sheep mortality in the study were disease and parasite, feed shortage, lack of veterinary service and animal health professionals. The overall mean value of age at first lambing, lambing interval and litter size are 12.4, 7.34 months and 1.33heads, respectively. The constraints that delay sheep production in the study area was disease and parasite, shortage of grazing land (feed) and water, lack of extension support, predators and labor shortage were ranked as first, second, third, fourth and fifth with an index value of 0.260, 0.255, 0.240, 0.150 and 0.09, respectively. It was concluded that, indigenous sheep had a potential for multipurpose role to generate income for smallholders. Therefore, genetic improvement program should aim at farmers need to cope with trait preference and existing traditional herding and breeding practice.

Key words: Gamogofa zone; sheep production system

Introduction

Sheep population in Ethiopia is estimated to be around 25.9 million heads (CSA 2010). Majority of these animals are found in the highlands while a quarter of them are reared in the lowlands (Rege *et al* 1996). Most of the sheep population is found in the highland areas (FARM Africa 1996). Sheep have social and economic importance to the producers who keep indigenous breeds for meat, hair production and income generation (IBC 2004, Tsedeke 2007, Tesfaye 2008, Tesfaye *et al* 2011).Ethiopia is home for at least 9 breeds and 14 traditional sheep populations (Solomon *et al* 2007a). They are able to complement goat, cattle and camel in utilization of available feed resources. Furthermore, their multipurpose role as source of income, meat, skin, manure and coarse wool of long hairy fleece, as means of risk avoidance during crop failure and their cultural function during festivals too are well-documented (Jaiter *et al* 2001; Kosgey *et al* 2006b).

The tropical sheep breeds as we see today have evolved as the result of several generations of human and natural selection, predominantly for traits related to adaptation/survival under several natural challenges (FAO 2000; Markos *et al* 2004). In spite of the several constraints, they have been able to contribute significantly to the income of the small holder farmers/ pastoralists and also help in poverty alleviation schemes (Kosgey and Okeyo 2007).

The productivity of sheep as in case of most of the ruminants is markedly low due to several genetic and environmental factors besides the institutional, environmental and infrastructure constraints (Markos 2006; Kosgey *et al* 2007). Therefore, genetic improvement of the indigenous livestock through appropriate techniques or selection and breeding programme is the need of the day especially under such constraints (Yakubu 2010).

Therefore, assessing the production system, indigenous knowledge of selection, management, identification of breeding goals, describing morphological characters and productivity level of the breed/type in their habitat are prerequisites to set up a genetic improvement program at the smallholder and pastoral levels (Kosgey *et al* 2006b).

Gamogofa zone are geographically located in Southern, Nation, Nationalities and Peoples of Regional State (SNNPRS). Even though the study area is rich in livestock resources including small ruminants 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, therefore, was to describe performance characteristic and its production system of the Gamogofa zone. The objectives of this study were to describe the production system and evaluate major constraints of sheep production in the study area,

2. Material and methods

2.1. Description of the study areas

The study was conducted in Gamogofa zone of Southern, Nations, Nationalities and People Regional State (SNNPR) of Ethiopia. It is 505 km from South of Addis Ababa and 275 km from South-West of Hawassa. The predominant agricultural system of the area is mixed crop-livestock production system. Gamogofa zone has a total

area of 12,581.4 square kilometers and the general elevation ranges from 600 to 3300 meter above sea level and the location ranges from 36.40-37.90E longitude and 5.60-6.70N latitude. The topography of the land is characterized by undulating feature that favors for the existence of different climatic zones in the area. The average temperature ranges from 10.1 to 27.5^{o}c and the average annual rainfall ranges from 801 to 1800 mm.

2.2. Sampling techniques

Gamogofa zone has 15 woredas of which 4 (four) woredas were selected purposely based on their agro-ecology and flock size. From each selected woreda; two rural kebeles were selected based on the flock size, and accessibility for transportation. Twenty three households were selected from each rural kebele based on flock size of sheep through discussion with key informants in the village and secondary information. Accordingly, the total number of households included in the study were184 that were selected from four woredas and two rural kebeles and a total of eight rural kebele.

2.3. Data collection procedures

Structured questionnaires were prepared, pre-tested and administrated to collect information on existing sheep production and husbandry practices from each selected flock owners. Further information was obtained from key informants and secondary sources via interviewee and organizing group discussions. Before commencement of the actual interview with selected farmers, the questioner was pre-tested on a small number of selected farmers from each site. Information from the pre-tested was used to improve the questionnaires.

Formal interview was carried out with 23 randomly selected farmers or households from each study site to get information on household characteristics and general sheep management and breeding practice. Participatory focal group discussion with sheep owners, elders, farmers, village leaders and socially respected individuals, women, tribe/clan leaders and extension agents who are known to have better knowledge on the present and past social and economic status of the study area were also conducted.

2.4. Data management and analysis

Data collected through questionnaire were described by descriptive statistics using Statistical Package for Social Sciences (SPSS 16.0 for windows, release 16.0, 2006) and chi-square were used to compare variables across the two agro-ecologies. Indices were calculated to provide ranking of the reasons of keeping sheep, reason of sheep expansion, reason of feed shortage, common disease and parasite, selection criteria for breeding ewe and contribution of different farming activity to the family food and income and soon of the zone. 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, criteria or preference 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, criteria or preferences.

3. Result and Discussion

3.1. Land holding

On average, the total land holding of households in the study is 1.5ha (Table 6). The size of landholding is significantly ($P<0.05$) different across the two agro-ecologies; this implies that small land holding is found in dega

than weyna-dega areas. The possible reason might be the relations with the time more land are used for cultivation for crop and cereal grains, land degradation due to flooding and the population is more densely due to the availability of resettlement and attribute to the densely of human population per unit area. As a result, land holding per household has declined as human population in the area is increasing.

Table 1. Mean and standard error of land holding per household

Parameter	Dega	Weyna-dega	Overall
Total landholding	1.16±0.09b	1.84±0.10a	1.5±0.07
Cultivated lands	0.70±0.05b	1.18±0.07a	0.94±0.05
Land for grazing	0.18 ± 0.02^{b}	0.31 ± 0.03^{a}	0.24± 0.02
Fallow land	0.17 ± 0.04^{a}	0.18 ± 0.02^{a}	0.18± 0.02
Vegetation cover	0.11 ± 0.02^{b}	0.17 ± 0.01^{a}	0.14± 0.01

a, b, means with the different superscripts across rows are significantly different at (P<0.05), SE= standard error

3.2. Livestock holding

On average, a household owned 5.68 cattle, 18.7 sheep, 3.32 goat and 6.35 chickens (Table 7). There was significant (P<0.05) difference in the livestock density between dega and weynadega area except chicken holding. The advantage of sheep over cattle was because of more productive (more prolific, less gestation interval), easily produced on a small plot of land, contribute to more flexible short-term form of investment and also easily marketable compared to cattle's. This finding is in line with those of Sahana *et al* (2004), Dixit *et al* (2005) and Fikrete (2008).

Table 2. Livestock holding per households in the study area

Species	Dega	Weyna-dega	Overall
	Mean±S.E	Mean±S.E	Mean±S.E
Cattle	4.40 ± 0.29^{b}	7.03 ± 0.46^{a}	5.68±0.29
Sheep	24.3 ± 0.77^{b}	13.1 ± 0.34^{a}	18.7±0.59
Goat	2.50 ± 0.31^{b}	3.79 ± 0.37^{a}	3.15±0.27
Poultry	6.36 ± 0.28^{a}	6.35 ± 0.24^{a}	6.35±0.18

a, b means with different subscripts' differ across rows significant at P<0.05, SE= standard error

3.3. Flock structure of sheep

Flock structure of sheep in the study area is presented in Table 8. According to the survey result, there is higher number of ewe (88.7%) than ram sheep (11.3%). As stated in Table 8, the flock structure of lamb and ewe was higher in the dega than weynadega. This might be attributed to the prevalent practice of keeping ewe for breeding purpose which accounted the greater portion of the newly born animals while rams are either castrated or sold when

they reach market age. The higher proportion of breeding ewe in the flock followed by suckling age group for both species was in agreement with those of Zewdu *et al* (2008) and Mengistie *et al* (2010).

Table 3. Flock structure of sheep owning by the respondents

	Dega	Weyna-dega
Class of species	Mean(S.E)	Mean(S.E)
Lamb	5.9 (0.19)[a]	2.9 (0.09)[b]
Ewes	15.9(0.62)[a]	8.45(0.22)[b]
Intact ram	2.02(0.09)[a]	1.76(0.09)[a]
Castrated ram	2.00(0.12)[a]	1.5(0.08)[a]

a, b, means with the d/t superscripts across rows are significantly (P<0.05) different, S.E= standard error

3.4. Sheep production and management practice

3.4.1. Purpose of sheep keeping

The purpose of sheep keeping in the study is presented in Table 9. The primary reason of sheep keeping by the farmers is for source of income generations through the sale of live animals with an index value of 0.31and the cash obtained might be used to buy clothing and food items, pay taxes, additional fertilizers to manures and household supplies (children schools). The second main reason of sheep keeping is for meat production with an index value of 0.28 and the keeping of sheep production for manure and social and cultural function were ranked as third and fourth with index values of 0.27 and 0.11, respectively. This result is in line with those of Gatenby (2002), Chipman (2003), Adugna and Aster (2007), Belete, (2009) and Mengistie *et al* (2010).

Table 4. Purpose of sheep keeping ranked by the owner of sheep

Purpose	1st	2nd	3th	4th	5th	Index
Source of income	28	57	71	13	0	0.31
Meat	41	50	50	4	2	0.28
Manure	79	49	23	3	0	0.27
Social and cultural Function	6	11	4	35	5	0.11
Rituals	0	0	2	3	13	0.03

Index= (5 for rank 1) + (4 for rank 2) + (3 for rank 3) + (2 for rank 4) + (1 for rank 5) divided by the sum of all weighed purpose of sheep mentioned by thee farmers

The reason for expansion of sheep production in the study area is shown in Table 10. Nearly, ninety nine percent of the interviewed households show the future interest to continue and /or expand sheep production. Among the reason of sheep production expansions, immediate return and high market demand are the most appreciated issues currently. These results are consistent with those of Tsedeke (2007) and Belete (2009) in Alaba areas and Goma district of Jimma zone.

Table 5. Reasons of sheep expansion and ranked by the respondents

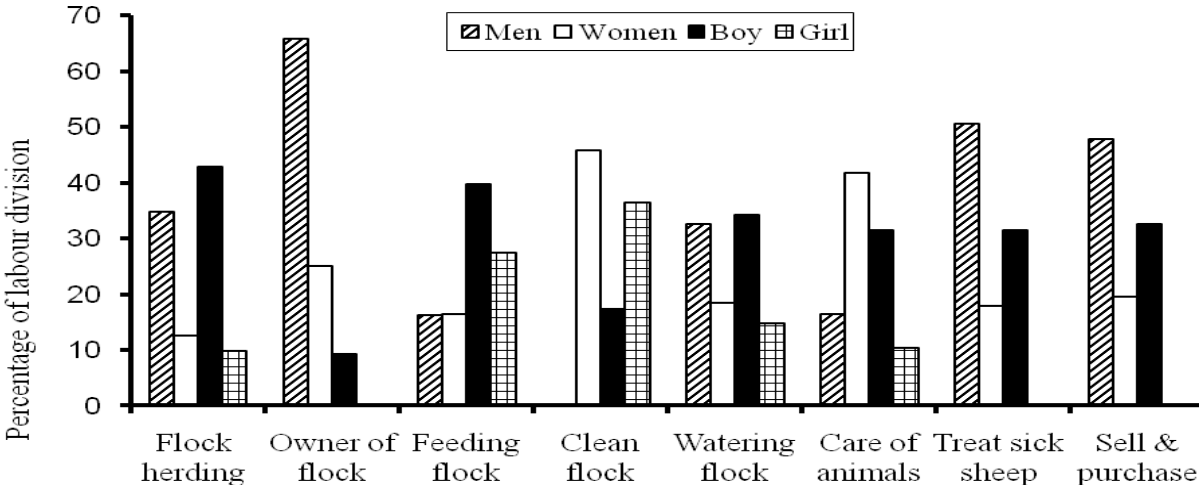
Reasons	1st	2nd	3rd	4th	index
High market demands	62	39	41	32	0.28
Easy to manage and keep	27	73	50	10	0.26
Immediate returns	79	41	48	2	0.31
Appropriate for slaughter	3	25	32	110	0.15

Index= (4 for rank 1) + (3 for rank 2) + (2 for rank 3) + (1 for rank 4) divided by sum of all weighed that mentioned by the farmers.

3.4.2. Labor division in sheep management

The division of activities by different members of households in the area is shown in Figure 4. Purchasing and selling of sheep was the responsibility of husband (mostly household heads). However, women and children were responsible for other purposes of keeping animals. About 50.5% traditional and veterinary services for sick flock were provided by husband. Large proportion of the flocks is owned by the husband (65.8%), women (25.0%), while boys own some 9.2% of the flocks. According to Endashew (2007) women and children may have property right over the flocks, but are not decision makers when it comes to selling of animals. About 48% of sheep were sold by husbands. Husbands possess more power in deciding the use of incomes generated from sale of animals.

Figure 1. Division of family labor for sheep management



3.4.3. Feed resource availability

The common forms of grazing or feed resource are given in Table 11. From the interviewed household, 44%, 23.9%, 10.9%, 10.3%, 6.0% and 4.9% of them utilized communal grazing, private pasture, riverside grazing, grazing stubble, crop residues and road side grazing, respectively. Communal grazing and private pasture grazing is the main feed resources in both agro-ecologies. Similarly, many researchers (Tesfaye 2009; Funte *et al* 2010; Hassen *et al*

2010) indicated that natural pasture were the main source of feed for livestock species in Ethiopia. The chi-square analysis showed that there is no significant (P>0.05) variation in feed resource availability across the two agro-ecology except for private pasture grazing which is significant (P<0.05) higher percentage in the dega area. This might be because of large cultivation of land for annual and perennial crop and increased settlement of human population which reduces the grazing pasture. So, as a result, there is a decline and shrinking of grazing lands.

Table 6. Commonly available of feed resources

Parameters	Dega	Weyna-dega	Overall	$\chi 2$
	N (%)	N (%)	N (%)	
Communal grazing	38 (41.3)	43 (46.7)	81 (44.0)	1.089
Grazing stubble	8 (8.70)	11 (12.0)	19 (10.3)	0.528
River side grazing	10 (10.9)	10 (10.9)	20 (10.9)	0.249
Private pasture grazing	23 (25.0)	21 (22.8)	44 (23.9)	3.810*
crop residue	7 (7.60)	4 (4.30)	11 (60)	0.870
Road side grazing	6 (6.50)	3 (3.30)	9 (4.90)	1.051

N= number of respondents, * significant level at P<0.05

Sheep were kept alone or together with other livestock species (Table 12). According to the respondents, about 63.0% of the respondents kept sheep only, 28.3% together with goat and (8.7%) together with goat and cattle. The tendency of keeping sheep with large ruminants is lower. In wet season, when the major feed resource was communal or private grazing, about 70.1% of the respondents use tethering grazing system so that sheep do not go in to the crop fields.

In the dry season, majority of the respondents (75.5%) practiced free grazing their animals while about 19.0% and 5.4% of the respondents used tether and cut and carry method of feeding systems, respectively. On the contrary, majority (79.4%) of the households used free grazing in South West Ethiopia during wet season as reported by Belete (2009). About 32% of the respondents in weyna-dega agro-ecology used free grazing of their flock which is higher (P<0.05) than dega areas. This is because the weyna-dega area has relatively better communal grazing land compared with other agro-ecologies.

During the dry season, about 77.2% of the respondent practiced free grazing in the weyna-dega which is almost similar (P>0.05) within the dega (73.9%). However, in wet season, about 77.2% of the respondents, tether feeding is more (P<0.05) practiced in the dega than in the weyna-dega areas (66.3%).

Table 7. Grazing management practices of sheep in the study area

Grazing management practices	Dega N (%)	Weyna-dega N (%)	Overall N (%)	$\chi 2$
Ways of grazing				
Sheep alone	64 (69.6)	52 (56.5)	116 (63)	3.359
Sheep and goat	18 (19.6)	34 (37)	52 (28.3)	6.862*
Together with other Livestock	10 (10.8)	6 (6.5)	16 (8.7)	1.095
Grazing in dry season				
Free grazing	68 (73.9)	71(77.2)	139 (75.6)	0.265
Tether grazing	20 (21.8)	15 (16.3)	35 (19)	0.882
Cut and carry	4 (4.3)	6 (6.5)	10 (5.4)	0.423
Grazing in wet season				
Free grazing	7 (7.6)	29 (31.5)	36 (19.57)	16.715*
Tether grazing	71(77.2)	58 (63.1)	129 (70.11)	10.041*
Cut and carry	14 (15.2)	5(5.4)	19 (10.32)	4.754*
Use of supplementary feed	79 (85.9)	76(82.6)	155 (84.24)	0.368

N= number of respondents, * indicates significant level at P<0.05

3.4.4. Reason of tethering

The result from Table 13 indicates that about 80.9% of the respondents tether their animals in the study area. However, significantly higher numbers of respondents tether their animals in the dega area when compared to those in the weyna-dega. The main reasons for tethering (as presented in Table 13) are to prevent crop damage or disturbance, followed by optimal usage of labor, predators and to prevent unwanted breeding. The result of the chi-square analysis shows that there are significant (P<0.05) variation across the two agro-ecologies for the tethering management practice. However, there is no significant variation between the two agro-ecologies when it comes to the reason behind the same. The observations as discussed above are in accordance with that of Tsedeke (2007), Belete (2009) and Funte *et al* (2010).

Table 8. Reasons of sheep tethering reported by the respondents

Reason of tethering	Dega N (%)	Weyna-dega N (%)	overall N (%)	$\chi 2$
Practice of tethering	83(90.23)	66(71.74)	149(80.98)	68.17*
Reason of tethering				
To avoid crop and vegetation	54 (65.1)	40 (60.6)	94 (63.1)	4.263*
Save labor	16 (19.3)	14 (21.2)	30 (20.1)	0.039
Protect from predators	8 (9.6)	7 (10.6)	15 (10.1)	1.236
Avoid inbreeding	5 (6)	5 (7.6)	10 (6.7)	0.087

N= number of respondents,* significant at P<0.05

3.4.5. Common types of diseases and parasites

The result from Table 19 indicates that health problem of sheep is prevalent in the study area. Flocks health management is very important in traditional sheep production system if mortality is to be kept reasonably low. Based on the survey results, it can be concluded that, Peste des petits ruminants (PPR), foot and mouth disease, pasteurellosis and anthrax are the most important diseases prevalent in the study area, besides the same incidences of teniasis (tape worm) helminthes problems and ecto- parasitic load (tick and mites) too are prevalent. Among the above mentioned diseases the ones causing the most serious/economic loss are foot and mouth disease, pasteurellosis and Peste des petits ruminants. These diseases were identified by the symptoms when asked for the respondents and the symptoms for PPR are sudden onset of depression, fever, discharge from eyes and nose, for foot and mouth disease: high fever, blister (wound) formation around the mouth; for anthrax; animals died suddenly without any sign and blood with feace and for Pastureollisis: animals go off feed and more animals affected simultaneous (at the same time). As reported by Tajebe *et al* (2011) economic losses due to disease and parasites have quadruplet their effect further when factors such as feed shortage, poor management practices and environmental factors are prevalent.

Nearly a quarter of the respondents indicated that the primary reasons for the prevailing high rate of mortality can be attributed to diseases and parasitic infestations prevailing in the area (Table 20). This result in line with the reports of Tsedeke (2007), Tsedeke and Endriase (2011) in Alaba and Woliyta and Dawro zone, respectively. According to the report of Yohannes (2007) parasite and infectious disease were the major cause of sheep mortality in Alamata woreda of Southern Tigary.

Table 9. Common disease and parasites that affect sheep production as ranked by the respondent

Type of disease	1st	2nd	3rd	4th	5th	6th	7th	index
Internal parasites	19	17	8	23	2	0	1	0.1
Tape worm	34	21	14	10	9	0	0	0.13
PPR	22	45	55	34	2	5	3	0.21
FMD	30	58	55	23	0	0	0	0.23
Pasturelloesis	40	31	33	41	21	2	3	0.22
Anthrax	26	4	6	8	7	0	1	0.08
Ticks and mites	12	3	0	2	0	0	1	0.03

Index= ((7 for rank 1) + (6 for rank 2) + (5 for rank 3) + (4 for rank 4) + (3 for rank 5) + (2 for rank6) + (1 for rank 7)] divided by sum of all weighed purposes mentioned by the respondents. PPR= Peste des petits ruminants, FMD= foot and mouth disease

There appears to be a relationship between disease incidence and feed scarcity period which causes sheep mortality. According to group discussion, farmers cited that feed shortage was acute during the months of February to May. Sheep in the area get sick during these periods. This might be due to feed deficiency, which predisposes the animals

to low disease resistance. This confirms to the finding of Yenesew (2010) and Desta and Oba (2004) who reported considerable mortality of sheep caused by feed deficiency under traditional management system. Shortage of feed and inadequate supplementary feeding were reported to be a major cause of livestock mortality and poor performances in highland agro-ecologies of southern and central Ethiopia (Desta and Oba 2004; Hassen *et al* 2010).

Table 10. Major causes of sheep mortality as rated by sheep owners

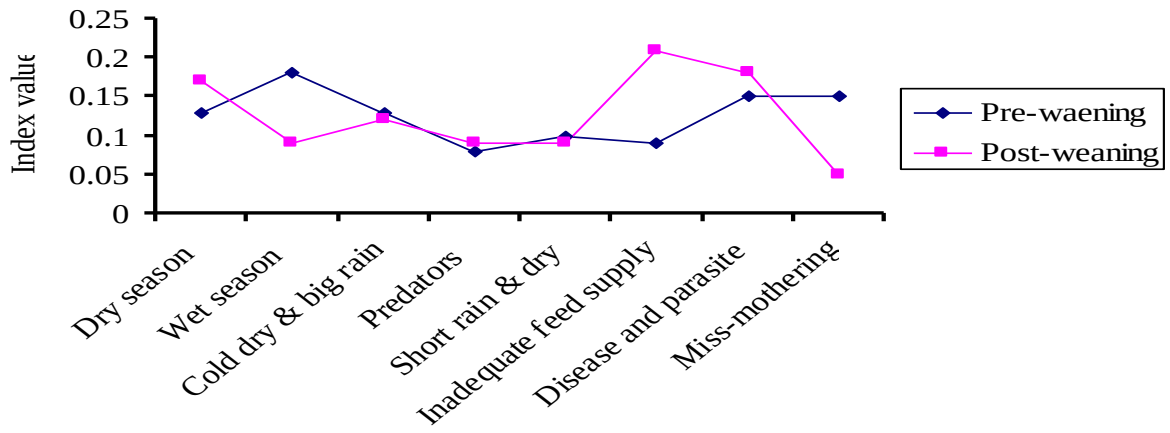
Causes	1st	2nd	3rd	4th	5th	index
Disease and parasites infection	84	77	13	03	10	0.33
Feed and water scarcity	67	55	29	12	15	0.29
Lack veterinary service	27	24	54	28	2	0.19
Lack of animal health professions	2	17	32	51	22	0.13
Drought of the area	2	8	7	25	23	0.06

Index= ((5 for rank1) **+ (4** for rank 2) + (3 for rank 3) + (2 for rank 4) + (1 for rank 5)) divided by sum of all weighed of mentioned by the respondents.

3.4.6. Causes of pre and post -weaning mortality of lambs

The major cause of pre and post weaning mortality in lamb is presented in Figure 1.The major causes of pre and post weaning mortality of lamb were attributed to causes associated with during wet season and inadequate feed supplies, followed by inadequate mothering ability and losses due to diseases and parasites. The indexed value was similar for deaths associated with during dry season which may be attributed to lack of nursing associated with poor fodder availability and also during the long rains which may also be attributed due to the fact that ewes are usually unable to graze in the rains and often go hungry. This is in agreement with the observations of Mukasa-Mugerwa *et al* (2002).

Figure 2. Causes of pre and post -weaning mortality of lambs



3.4.7. Off take and replacement of sheep flock of households

The off take and replacement of sheep flock is presented in Table 24. Most of the replacement of stock reported by the respondents is home born (82.1%) while 15% of the flock was procured from the markets while an insignificant number of sheep were obtained as gifts (3.26%). Chi-square analysis showed that there is no significant (P>0.05) variation for the replacement of sheep flock across the two agro-ecology. The results regarding off take indicate that sales (46.2%) followed by mortality (40.2%), predatory losses (6.5%) and slaughter for consumption (7.1%) is the main reasons. There is also no significant differences between the agro ecologies except that higher (P<0.05) incidences of mortality have been reported from the wenya-dega (43.5%) than dega (37%) areas. The replacement and off take of sheep through similar routes was also reported in southern and other part of the country (Endashew 2007; Tsedeke 2007; Belete 2009).

Table 11. Way of replacement and outlet of sheep flock of households

Way of routes	Dega	Weyna-dega	Overall	χ^2
	N (%)	N (%)	N (%)	
Replacement				
Home born	76 (82.6)	75 (81.5)	151(82.1)	0.037
Purchased	15 (16.3)	12 (13.0)	27 (14.6)	0.041
Gift	1(1.09)	5 (5.43)	6 (3.26)	2.757
Off take				
Sale	45 (48.9)	40 (43.5)	85 (46.2)	0.274
Mortality	34 (37)	40 (43.5)	74 (40.2)	5.113*
Slaughter	7(7.6)	5 (5.4)	12 (6.5)	0.357
Predators	6 (6.5)	7 (7.6)	13 (7.1)	0.083

N= number of respondents, * χ^2 significant at P<0.05

3.5. Source of rams and selection of breeding rams and ewes

The primary criteria pertaining to selection of breeding rams are presented in Table 25. The results are indicative that the primary selection criteria in the dega were based on the breed characters of the ram (40.2%) while body conformation was the primary selection criteria for the respondents of the weyna-dega (56.5%). While equal numbers (16%) of the total farmers attributed the importance of the physical traits in selection of the rams. This finding is in consonance with the results of Endashew (2007), Zewdu *et al* (2009) and Tajebe *et al* (2011).

Table12. Selection criteria for breeding rams

	Dega	Weyna-dega	Overall	
Parameters	N (%)	N (%)	N (%)	χ^2
Breed character(local pure breed)	37 (40.2)	16 (17.4)	53 (28.8)	11.687*
Body Conformation	21(22.8)	52 (56.5)	73 (39.7)	21.822*
Physical character	15 (16.3)	15 (16.3)	30 (16.3)	0.029
Age	19 (20.7)	9 (9.8)	28 (15.2)	4.212*

N= number of respondents, * significant at P<0.05

However, the results of the interviews indicated that the breeding was uncontrolled; the findings are in close agreement with that of Tajebe *et al* (2011) who reported that uncontrolled breeding is a management tradition with the hope to have and lambing distributed throughout the year in order to obtain year round output and reduce risk. The result from the chi-square analysis indicated that significantly (P<0.05) higher number of respondents in dega selected for breeding of ram by local breeds (breed character), while in weyna-dega agro-ecology they selected based on body conformation.

The results pertaining to the ram use pattern (Figure 5) indicates that most of the rams are owned by the farmers themselves in both agro-ecological zones. However in the absence of the same, they usually use ram available with the neighbors and very few respondents purchased rams for breeding purpose. The results are indicative to the fact that a fair degree of inbreeding can be expected in the flock as a single ram may be siring a number of offspring's in a year and from neighboring households. The obtained result is in agreement with that of Tesfaye *et al* (2010) and Tesfaye *et al* (2011).

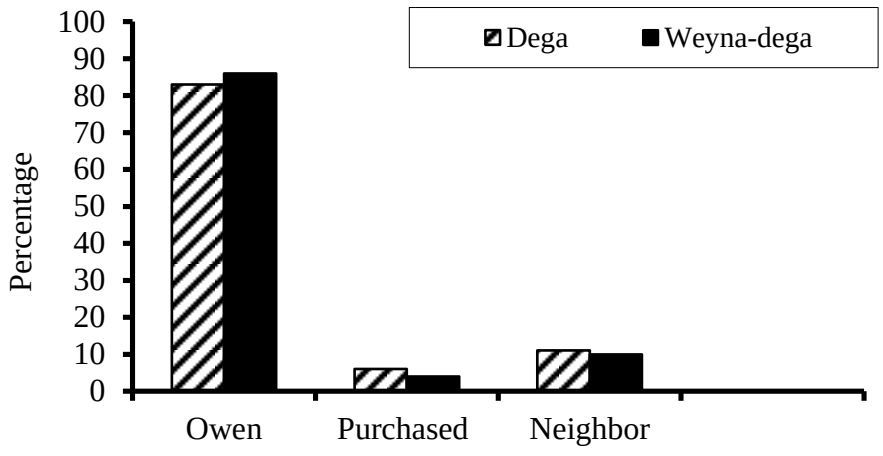


Figure 3. Source of breeding ram sheep

The selection criterion of the breeding ewes as practiced in the study area is presented in Table 26. The primordial criteria for selection of breeding ewe was based on body condition of the animal itself, performance history, , tail, coat color, ear and horn shape were ranked as first, second, third, fourth, fifth and sixth with an index value of 0.23, 0.21, 0.19, 0.17, 0.12 and 0.07, respectively. The results obtained in the current finding are more or less in agreement with the observations of Tsedeke (2007), Tesfaye (2008), Zewdu *et al* (2008) and Tesfaye *et al* (2010) those also reported that farmers in various regions of Ethiopia gave importance to body condition when selecting the breeding ewes. This may be because a well conditioned ewe can bear strong lambs and have enough milk to nurse them, also well conditioned ewes are expected to have least trouble during lambing and dystocia problems are also expected to be the least.

Table 13. Selection criteria of breeding ewe as ranked by the farmers

Selection criteria	1st	2nd	3rd	4th	5th	6th	index
Color	6	78	16	1	2	1	0.13
Horn shape	0	8	23	22	23	58	0.08
Ear	0	4	34	69	45	27	0.12
Tail length	18	21	73	42	34	5	0.19
Performance history	70	50	10	12	23	4	0.21
Body conformation	89	60	24	4	3	10	0.27

Index= ((6 for rank 1) + (5 for rank 2) + (4 for rank 3) + (3 for rank 4) + (2 for rank 5) + (1 for rank 6)) divided by the sum of all weighed

3.5.1. Reproductive performance of sheep

Age at first lambing

The average reproductive performance of sheep in the study is presented in Table 27.The average age at first lambing (AFL) was assessed to be 12.4 months. Age at first lambing (AFL) results as assessed in the study significantly ($P<0.05$) differed across the two agro-ecologies; it may be ascribed to the fact that the ewes attain maturity later in the dega areas when compared to those reared in the wenya-dega region which may be a fallout of both genetic and non genetic factors affecting of the trait. The result is in agreement with that of Belete (2009). The average age at first lambing (AFL) (taking both the agro-ecologies into account) is in agreement with the observations of Tsedeke (2007) in Alaba area of SNNPRs. However, the mean values are lower than those reported by Fikerte (2008), Mengestie *et al* (2011) and Zewdu (2008). The average AFL reported by Tesfaye (2008) was higher than the present finding.

Lambing interval

Lambing interval (LI), presented in Table 27, is one of the most important components affecting the lifetime productivity of the ewe. The average LI (7.34 month) as assessed in the study indicates that the ewes are regular breeders and they may be lambing three in two years. The results further indicate that there is no significant

(P>0.05) variation for the trait between the ewes reared in the two agro ecologies. This may be ascribed to the fact that the rams are always besides the ewes when the flock is grazing. Lambing interval of 7.34 month in this study is shorter than 9.16 month for washera sheep breed (Mengistie 2008) and 9 month for indigenous sheep in Alaba area (Deribe 2009).

Litter size

The average litter size or prolificacy as obtained in the present study area is 1.3 lambs per head; this result is comparable to the observation of Abergell sheep breed as reported by Tajebe *et al* (2011) in Northern Ethiopia. However, the average litter size is lower than the average litter size reported by Tsedeke (2007) and Belete (2009) in-mixed crop livestock production in Alaba area of SNNPRs and Goma district of Jimma zone, respectively. However, Mukasa-Mugerwa *et al* (2002) reported 1.13 in Menz and 1.14 in Horro Ethiopian highlands sheep.

Table 14. Reproductive performance of indigenous sheep breeds

	Dega	Weyna-dega	overall
Parameter	Mean ±SE	Mean± SE	Mean ±SE
Age at first lambing*	13.2 ±0.47[a]	11.5±0.29[b]	12.4±0.28
Lambing interval*	7.65±0.19[a]	7.04±0.18[a]	7.34±0.13
litter size**	1.28±0.05[a]	1.32±0.05[a]	1.3±0.04

[a, b], means with different subscripts significantly (P<0.05) differ across the rows, SE= standard error, ** in heads, * in months

3.6. Major constraints of sheep production

The main reasons (as indicated by the respondents, presented in Table 29) limited sheep production in the study area were disease and parasite. Lack of proper watering and feed resources followed by lack of extension support were the other important limiting factor affecting production of sheep. The current results are in accordance with the results of Hassen *et al* (2010), Solomon *et al* (2010) and Tsedeke and Endiras (2011).

Table 15.Major constraints to sheep production as rated by the respondents

Constraints	1st	2nd	3rd	4th	5th	index
Inadequate/lack of extension support	57	29	27	37	16	0.24
Labor shortage	1	1	38	31	34	0.09
Disease and parasite	33	91	21	15	0	0.26
Inadequate feed of grazing land	60	35	39	15	16	0.25
Predators	19	13	33	35	28	0.15

Index= ((5 for rank 1) + (4 for rank 2) + (3 for rank 3) + (2 for rank 4) + (1 for rank 5) divided by the sum of all weighed mentioned by the respondents

Disease and parasite were the most important constraints hindering sheep production by causing high mortalities as indicated earlier in Table-20. This is in agreement with the report of Beyene *et al* (2011) in Benshangul Gumuz Region. Similarly, Tajebe *et al* (2011), the main reason for the decline of livestock population in northern Ethiopia were found to be disease and parasite together with feed shortage.

4. Conclusion

From this study it could be concluded that the general production system and sheep management system in the study areas was characterized by mixed crop-livestock production system. Sheep play an important role in the livelihoods of people in the study area, and they have potential for greater contribution through better health management and genetic improvement.

The larger part of the flock was composed of breeding ewes and young lamb. The flock size as obtained in the study was higher than the reports from many such locations within the country. This indicated that sheep were the predominant species in both areas; their contribution as source of income generation was more than other farming activities.

The key feed sources in both agro-ecologies were communal or natural pasture and private pasture grazing. Disease and parasite prevalence and inadequate feed shortage were the two most important sheep production constraints in the study area. Through breeding was generally uncontrolled in the study area. Mating usually occur everywhere at the time of feed availability. Further research are needed to examine the relationship between phenotypic measurement in the same and other breed of the region with maximum number of observation and the effect of season and parity of the phenotypic trait should be studied.

Acknowledgment

My sincere thanks to the Southern Agricultural Research Institute (SARI) for the reliable budget support, in particular to Ato Asrat Tera (Livestock Research Director of SARI) and Dr. Nugussie Dana (Director General of SARI) for their kind and prompt response to all enquiries during the course of this study. My special thanks go to Gamogofa zone Agricultural and Rural Development Office of southern Ethiopia for giving me the chance and allowing me to do my thesis in their woreda for selecting high sheep population density. I would like to pass my deepest gratitude and appreciation to my major advisor Dr. Aberra Melesse, Associate Professor of Animal Breeding at Hawassa University.

5. Reference

[1] Adugna Tolera and Aster Abebe 2007 Livestock production in pastoral and agro-pastoral production systems of southern Ethiopia. Livestock Research for Rural Development. Volume 19, No 177. http://www.lrrd.org/lrrd19/12/tole19177.htm.

[2] Belete Shenkute 2009 Production and marketing systems of small ruminants in goma district of

jimma zone, western Ethiopia. Msc. Thesis. Hawassa University, Awassa, Ethiopia. Pp. 35-82.

[3] Chipman J 2003 Observation on the potential of Washera sheep for improved food security around quairit and Adet West Gojjam, Northwestern Ethiopia. A field study Hosted by International Livestock research institute (ILRI), Addis Ababa, Ethiopia. 17p.

[4] CSA (Ethiopia Central Statistical Agency) 2010 Agricultural Sample Survey. The 2009/10 National Statistics. Report on livestock and livestock characteristic. Volume II, February, 2010, Addis Ababa, Ethiopia.

[5] Desta Z H and Oba G 2004 Feed scarcity and livestock mortality in enset farming systems in the Bale highlands of Southern Ethiopia. Outlook on Agriculture. 33: 277-280

[6] Dixit S P, Gaur G K, Yadav D K and Singh 2005 Characterization of the Rampur Bushair sheep in north temperate region of India. Animal Genetic Resource information, 36, FAO. Rome,
Italy. 36p.

[7] Endashew Assefa 2007 Assessment on production system and marketing of goats at Dale district (Sidama Zone). MSc Thesis. University of Hawassa, Awassa, Ethiopia.

[8] FARM-Africa 1996 Goat type of Ethiopia and Eritrea. Physical description and management system. Published jointly by FARM-Africa, London, UK, and ILRI (international livestock research institute), Nairobi, Kenya. 76p.

[9] Fikerte Fewer 2008 On-farm characterization of blackhead Somali sheep breed and its production system in Shinile and Erer districts of Shinile zone. An MSc Thesis Hramaya University, Hramaya. Pp.115.

[10] Funte S, Negesse T and Legesse G 2010 Feed resource and their management system in Ethiopia highlands: the case study of Umbulo Wacho watershed in southern Ethiopia. Ministry of Agriculture and Rural Development, Southern Nations, Nationalities and Peoples Regional State, Tropical and Subtropical Agro-ecosystems, 12: 47 – 56

[11] Gatenby R M 2002 Sheep production in the Tropics and Sub-tropics. Tropic, Longman London,
UK.178p.

[12] Hassen Ahmed, Ebro Abule, Kurtu Mohammed and Treydte A C 2010 Livestock feed resources utilization and management as influenced by altitude in the Central Highlands of Ethiopia. Livestock Research for Rural Development. Volume, 22, 229. Retrieved March 14, 2012, from http://www.lrrd.org/lrrd22/12/hass22229.htm

[13] IBC (Institute of Biodiversity Conservation) 2004 The State of Ethiopia's Farm Animal Genetic

[14] Resources: Country Report. A Contribution to the First Report on the State of the World's Animal Genetic Resources. IBC. May 2004. Addis Ababa, Ethiopia.

[15] Jaitner J J, Soweb E and Secka-Njieb L 2001 Ownership pattern and management practice of
small ruminant in the Gambia-implication for breeding programs. Small Ruminant Research. 40:101-108

[16] Kosgey I S, Rowlands G J, van Arendonk J A M and Baker R L 2006b Small ruminant production in smallholder and pastoral/ extensive farming systems in Kenya: a review. Small Ruminant Research. 61:64-73.

[17] Kosgey I S, Verbeek E, Kanis E, and Bett R C 2007 Socio-economic factors influencing small ruminant breeding in Kenya. Livestock Research for Rural Development. 19 (6).

[18] Kosgey I S and Okeyo A M 2007 Genetic improvement of small ruminants in low-input, small holder production systems: technical and infrastructural issues. Small Rumin.Research.70:76-88.

[19] Markos T, Ayalew W, Awgichew K, Ermias E and Rege J E O 2004 On-station characterization of indigenous Menz and Horro sheep breeds in the central highlands of Ethiopia. Animal Genetic Resources Information.35:61-74.

[20] Markos Tibbo 2006 Productivity and health of indigenous sheep breeds and crossbreed in the central highland of Ethiopia. Doctoral thesis, Swedish University of Agricultural Sciences, Uppsal, Sweden.

[21] Mengistie Taye 2008 On-farm performance of Washera sheep at Yilmanadensa and Quarit Woredas of the Amhara National Regional state. MSc. Thesis submitted to Hawassa University, Awassa, Ethiopia, Pp. 45-56.

[22] Mengistie Taye, Girma Abebe, Solomon Gizaw, Sisay Lemma, Abebe Mekoya and Tibbo Markos 2010 Traditional management systems and linear body measurements of Washera sheep in the western highlands of the Amhara National Regional State, Ethiopia. Livestock Research for Rural Development Volume, 22, 169.

[23] Mengistie Taye, Girma Abebe, Sisay Lemma, Solomon Gizaw, Abebe Mekoya and Marikos Tibbo 2011 Reproductive performance and survival of Washera sheep under traditional management system at Yilmanadensa and Quarit district of the Amhara National Reginal state of Ethiopia. Journal of Animal and Veterinary Advances, 10(9): 1158-1165.

[24] Mukasa-Mugerwa E, Anindo D, Sovania S, Lahlou-Kassi A, Tembely S, Rege J E O and Baker R L 2002 Reproductive performance and productivity of Menz and Horro sheep lambing in the wet and dry seasons in the high lands of Ethiopia. Small Ruminant Research. 45:26-271.

[25] Rege J E O, Tembely S, Mukasa E, Sovanis, Anindo D, Lahlou, Kassi A and Baker R L 1996 Preliminary evidence for genetic resource to endo-parasites in Menz and Horro Lambs in the high land of Ethiopia. In S.H.B.

[26] Lebbies, and E. Kagwini (eds). Small Ruminant Research and development in Africa. Pp 37-41. In: A proceeding of the third Biennial Conference of the Africa Small Ruminant. Research. Network 5-9 December 1974 UICC, Kampala, Uganda ILRI, Nairobi, Kenya.

[27] Sahana G, Jain A and Maity S B 2004 Characterization and evaluation of Jalauni sheep. Animal Genetic Resource Information, 34. FAO. Rome, Italy.

[28] Solomon Gizaw J A M, Van Arendonk H, Komen J J, Winding and O Hanotte 2007a population structure, genetic variation and morphological diversity in indigenous sheep of Ethiopia. Animal Genetics, 38:621-628.

[29] Solomon Gizaw, Azage Tegegne, Berhanu Gebremedhin and Dirk Hoekstra 2010 Sheep and goat production and marketing systems in Ethiopia: Characteristics and strategies for improvement. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 23. ILRI (International Livestock Research Institute), Nairobi, Kenya. 58p.

[30] Tajebe Seare, Gangwar S K & Kefelegn Kebede 2011 Performance and physical body measurement of Abergell sheep breed under traditional management system of Tigray Regional state, Northern Ethiopia. International Journal of Science and Nature, Volume. 2(2): 225 – 230.

[31] Tesfaye Getachew Mengistu 2008 Characterization of Menz and Afar indigenous sheep breeds of smallholders and pastoralists for designing community-based breeding strategies in Ethiopia. A MSc. thesis, Haramaya University, Ethiopia.

[32] Tesfaye Tsegaye 2009 Characterization of Goat Production Systems and On- Farm Evaluation of the Growth Performance of Grazing Goats Supplemented With different Protein Sources in Metema Woreda, Amhara Region, Ethiopia. A MSc. Thesis, Haramaya University, Ethiopia. Pp. 39-55.

[33] Tesfaye G, Haile A, Tibbo M, Sharma A K, Sölkner J and Wurzinger M 2010 Herd management and breeding practices of sheep owners in a mixed crop-livestock and a pastoral system of Ethiopia. African Journal of Agricultural Research Vol. 5(8): 685-691.

[34] Tesfaye Getachew, Solomon Gizaw, Sisay Lemma and Mengistie Taye 2011 Breeding practices, growth, and carcass potential of fat-tailed Washera sheep breed in Ethiopia. Tropical Animal Health Production 43:1443–1448.

[35] Tsedeke Kocho 2007 Production and marketing system of sheep and goat in Alaba, southern Ethiopia. A MSc. thesis submitted to the department of animal and range science, Awassa College of Agriculture, school of graduate studies, Hawassa University, Awassa, Ethiopia. Pp 36-77.

[36] Tsedeke Kocho and Endrias Geta 2011 Agro-ecologic mapping of livestock system in smallholder crop-livestock mixed farming of Wolayita and Dawuro districts, Southern Ethiopia. Livestock Research for Rural Development. Volume 23, 51p.

[37] Yakubu A 2010 Path coefficient and path Analysis of body weight and biometric traits of Yankasa lambs. Slovak Journal of Animal Science, 13: 7-25.

[38] Yenesew Abebe 2010 Assessment of Small Ruminant Production Systems and On-farm Evaluation of Urea Treated Wheat Straw and Concentrate Feeding on Sheep Body Weight Change in Burie Woreda, West Gojjam. An MSc thesis Haramaya University, Harmaya, Ethiopia. Pp. 40-74.

[39] Yohannes Tekle 2007 Major animal health problems of market oriented livestock development in Alemata woreda, Southern Zone of Tigray. A MSc. thesis submitted to the Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia. Pp. 20-22.

[40] Zewdu Edea, A. Haile, M Tibbo, A K Sharma J Sölkner and M Wurzinger 2008 Sheep production systems and breeding practices of smallholders in western and south-western Ethiopia: Implications for designing community-based breeding strategies BOKU-University of Natural Resources and Applied Life Sciences Division of Livestock Sciences. Gregor- Mendel-Strasse 33, A-1180 Vienna, Austria

[41] Zewdu Edea, Aynalem Haile, Markos Tibbo, Sharma A K, Johann Sölkner and Maria Wurzinger 2009 Breeding Practices of Indigenous Sheep Breeds of Smallholders for Designing Community Based -breeding Strategies in Ethiopia. Proceedings of the 16th annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, October 8 to 10, 2008, Part II: Pp. 241-246.