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Characterization of production system and breeding practices of sheep producers in Doyogena district, Southern Ethiopia

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An exploratory survey was undertaken in Doyogena district of Southern Nation Nationalities Peoples region of Ethiopia to understand the sheep production system, the breeding practices, selection criteria and sheep production constraints in order to develop a sheep breeding strategy. Data were collected from 107 households using semi-structured questionnaire and group discussion. Descriptive statistics and index were used to present the data. The agricultural production system of the area was *Ensete ventricosum* -crop-livestock production system. Crop production was found to contribute to most of the households' food and income followed by sheep and cattle production. The main sheep production objective was the sale of young and fattened sheep. The mean sheep holding was 4.02±2.58 to which most (43.5%) were breeding females. Only 47.2% of the respondents own breeding ram and 42.5% of them use controlled mating. Body size (index = 0.232) and appearance (index = 0.305) were the first selection criteria used for ewe and ram selection, respectively. Castration of rams and culling of unwanted sheep through sale, slaughter, and exchange was a common practice. Old age and poor physical condition were the first culling criteria for female and male sheep, respectively. Castration age ranges from 12 to 72 months when the ram have been used for breeding. Castrated animals were the first priority followed by young males to be sold in the flock when the family needs money. Feed shortage (index = 0.34), lack of input like credit service (index = 0.18), and diseases and parasites (index = 0.124) were the top three major sheep production bottlenecks in the district accounting for about 64.4% of the total weight. Finally, to fully utilize the potential of the breed and the area, production constraints need to be addressed along with genetic improvement and appropriate institutional setup.

Key words: Doyogena sheep, *Ensete ventricosum* -crop-livestock production system, fattening, selection criteria.

INTRODUCTION

Sheep production is among the most important agricultural activities in the highlands of Ethiopia where

crop production is unreliable (Kocho, 2007; Gizaw et al., 2013a). Sheep provide farm households with cash income, meat, fiber, and manure. As compared to large ruminants such as cattle, sheep have shorter production cycles, faster growth rate, ease of management, and low capital investment (Gizaw et al., 2013a; Tadesse et al., 2015). In addition, they require small space and feed and therefore are efficient meat and milk producers for the smallholder in areas where there is no enough grazing land. These days, there is a general shift in livestock holding from cattle to small ruminant because of the consistently dwindling grazing land as a result of crop encroachment and degradation of communal grazing lands (Taye et al., 2010).

There is a large number of sheep in Ethiopia (26 million heads; (CSA, 2008)) and diverse genotype of sheep populations (Gizaw et al., 2007) maintained in different agro-ecological zones and ethnic groups. Most of the sheep (about 70%) are found in the highlands of the country maintained in the traditional husbandry system (Mengistu, 2006).

The traditional sheep production system in Ethiopia is constrained by feed scarcity, disease and parasite prevalence, lack of market information and technical capacity, and an absence of planned breeding programs and breeding policies (Kocho, 2007; Gizaw et al., 2013b). Because of this, production and productivity is very low below the biological potential of the animals. However, since these sheep have been evolved over centuries through diverse stress full tropical environments, they have developed different unique adaptive traits (Gizaw et al., 2013b). Therefore, an attempt to improve the productivity of animals needs to consider the prevailing conditions, specific purpose in the production system and their potential under varying management levels (Otte and Chilonda, 2003).

Doyogena sheep, named as Adilo sheep (Gizaw et al., 2007), is a breed of sheep reared in Doyogena district of the Southern Nations Nationalities and Peoples Regional (SNNPR) state. This breed of sheep is believed to be among the productive breeds of the country. However, like other breeds of the country (ESGPIP, 2008; Getachew et al., 2010a), the productivity level is below its genetic potential due to different production constraints and lack of appropriate breeding strategies developed for the breed in the production system. In an effort to develop a breeding strategy for a particular community and breed of sheep, understanding the indigenous breeding strategies and the resultant mode of livestock production is very important (Gizaw et al., 2013b). The objective of this research was to describe the production systems and objectives of sheep production in Doyogena district so as to develop sheep breeding strategy.

MATERIALS AND METHODS

Description of the study area

Survey data collected in Ancha, Serera and Awora peasant associations (PAs, the smallest administrative unit of Ethiopia) of Doyogena district was used for the study. Doyogena district is found in Kembata Tembaro Zone of SNNPR state. The district is situated at 258 km from Addis Ababa, the national capital, and 171 km from Hawassa, the regional capital. Doyogena district has an altitude range of 1900 to 2300 m above sea level (m asl), mean annual rainfall of 1200 to 1600 mm and the mean temperature varies from 10 to 16°C (Bureau of Agriculture (BoA) 2012, unpublished). There are two rainy seasons to which the main rainy season spans from June to September and a small shower falls from February to May. The major livestock species reared by the community include cattle, sheep and goat, equines, poultry, and the honey bee. The major crops grown in the district include *Ensete ventricosum*, Faba bean, wheat, barley, field pea and vegetables and others (Asmare et al., 2016).

Data collection and analysis

The survey district and PAs were purposively selected with an objective to develop a sheep breeding strategy in the study areas by Areka Agricultural Research center and International Center for Agriculture Research in the Dry Areas (ICARDA). Interviewee farmers who participated in the survey were randomly selected from those involved in sheep production.

Survey data was collected using questionnaire, focus group discussion, key informants interviews and visual observations. A semi-structured questionnaire was used to collect data on household characteristics, the major production system of the area, breeding and breeding methods of sheep, feeds and feeding management of sheep, selection, and culling criteria, and major sheep production constraints in the study area. Focus group discussion was held to supplement and verify data collected using the questionnaire survey. Checklist was prepared and used to guide the group discussion.

Data collected from the questionnaire survey were coded, entered, cleaned and analyzed using the Statistical Package for the Social Sciences (SPSS, 2008) computer statistical program. The descriptive statistics, frequency and cross tabulation procedures were used to analyze and present the data. Index was calculated for different parameters using the following general formula:

$$Index = \frac{\sum\left[\begin{array}{l}(N \times \text{Number of HH ranked 1st}) + (N-1 \times \text{Number of HH ranked 2nd}) + \cdots \\ (1 \times \text{Number of HH ranked Nth})\end{array}\right] \text{for each commodity or trait considered}}{\sum\left[\begin{array}{l}(N \times \text{Number of HH ranked 1st}) + (N-1 \times \text{Number of HH ranked 2nd}) + \cdots \\ (1 \times \text{Number of HH ranked Nth})\end{array}\right] \text{for all the commodities or traits considered}}$$

Where the numerator is for each commodity/trait under consideration, while the denominator is the sum of all the commodities/traits in the index calculation; HH: Household; N is a number of ranks.

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Table 1. Relative Household income contribution of crop and livestock in Doyogena district.

Item	Index	Rank
Crop	0.305	1
Sheep	0.248	2
Cattle	0.242	3
Vegetable	0.144	4
Apiculture	0.034	5
Trade	0.015	6
Goat	0.008	7
Poultry	0.003	8

RESULTS AND DISCUSSION

Production system and household characteristics

Most of the respondent farmers were males (89.6%) and have formal education of grade 4 and above (75.5%). About 18.9% of them were illiterate. The literacy rate obtained is higher than other areas reported in the literature (Kocho, 2007; Getachew, 2008; Gemiyu, 2009), indicating that there is better access to education than other areas. This can be taken as an opportunity to designing of breeding programs and other interventions in the area since education has an effect on technology transfer.

The mean age of household heads was 40.89±11.2 years which is in comparison with the results of Kocho (2007) and Gemiyu (2009) in Halaba district and of SNNPR. The average family size was 7.66±2.25 (range 3 to 12) of which 3.88±1.47 were male members and 3.78±1.5 were female members. This result is similar to other results in Alaba area (Gemiyu, 2009). The mean landholding was 0.776±0.46 hectares. There were farmers with no farming land. Most (69.2%, 0.53 ha) of the land was allocated for crop production; fallow[1] land occupied 0.132 ha (17%) and 0.102 ha (13.4%) was allocated for private grazing land. The mean landholding obtained agrees with previous report (Bassa, 2016).

The livelihood of most of the respondent farmers was based on agriculture alone (80.2%). Some farmers diversify their livelihood through trade (16%) and employment (3.8%) in addition to agriculture. The major (98.1%) farming activity was crop and livestock mixed agriculture. The major crops of the area which are produced by most of the farmers were *Enset* (96.2%), vegetable (91.5%), wheat (89.6%) and barley (69.8%). Other crops grown are faba bean (27.4%), field pea (10.4%), and maize (5.7%). The production system of the study area is *Enset*-crop-livestock production system. *E. ventricosum* is a staple food in the area. Every farmer plants *Enset* in the homestead. In southern Ethiopia, *Enset* based farming system is an indigenous and sustainable agricultural system (Mulualem and Walle, 2014). Crop production was found to contribute to most of the households' food and income followed by sheep and cattle production (Table 1).

Sheep production and objective

The mean sheep holding in Doyogena district found in the present study was 4.02±2.58 (Table 2). Most of the flock composition was comprised of breeding ewes (43.5%) followed by lambs (19.05%). The mean number of breeding rams in a household was 0.58±0.8. Castrated sheep were the least numerous in the flock. Flock composition is a reflection of the breeding objectives to which higher proportion of breeding females shows lamb production (Ibrahim, 1998; Taye et al., 2010). The mean flock size obtained in the current study was lower than reports obtained in other areas (Getachew et al., 2010b; Taye et al., 2011; Edea et al., 2012) which might be because of the lower landholding in the area (Kocho, 2007; Taye et al., 2010). The small flock size could be an obstacle to practice within flock selection which calls for necessitation of some form of collective action for the wider genetic pool of the communities flock for effective selection (Gizaw et al., 2013a).

Farmers in Doyogena district keep sheep to get cash income from the sale of young sheep (index = 0.295) followed by the sale of fattening sheep (index = 0.207) (Table 3). Saving and meat consumptions were the third and fourth objectives, respectively. This kind of sheep production objective is common in other parts of the country (Kocho, 2007; Getachew, 2008; Taye et al., 2010). Farmers in the study area prefer to produce Doyogena sheep because of their fast growth, attractive coat color, good physical appearance, adaptability, and twinning ability characteristics.

Sheep breeding and reproductive performances

Most of the respondent farmers (70%) do not determine the age at mating for both male and female sheep. Because there was no seasonal control of mating, there were lambings in every month of the year. However, there were peak lambings from October to December (Figure 1), indicating that most of the conception occurred during or following the small rains in May. A similar type of distribution of lambings throughout the year was reported for other breeds of sheep (ESGPIP, 2008; Taye et al., 2011).

The reproductive performance of Doyogena sheep is presented in Table 4. The mean age at first mating of Doyogena sheep obtained in the current study was 8.06 and 8.0 months for female and male sheep, respectively, which compares with the findings of Kocho (2007). The

[1]Fallow land – is land left from the cropping land for grazing of livestock for some time. It is not permanent grazing land.

Table 2. Flock size and demography of sheep in Doyogena districts.

Class of sheep	Mean	SD	Min	Max
Mean	4.02	2.58	1.00	19.00
Ewe (breeding female)	1.83	1.17	0.00	7.00
Ram (breeding male)	0.58	0.82	0.00	4.00
Young Female	0.55	0.94	0.00	4.00
Young Male	0.32	0.59	0.00	2.00
Lambs (suckling)	0.80	0.98	0.00	4.00
Castrate	0.12	0.43	0.00	3.00

Table 3. Sheep production objectives in Doyogena district as practiced by farmers.

Production objective	Index	Rank
Sale of young sheep	0.295	1
Sale of fattening sheep	0.207	2
Saving	0.159	3
Meat consumption	0.156	4
Manure	0.151	5
Skin	0.023	6
Prestige	0.009	7

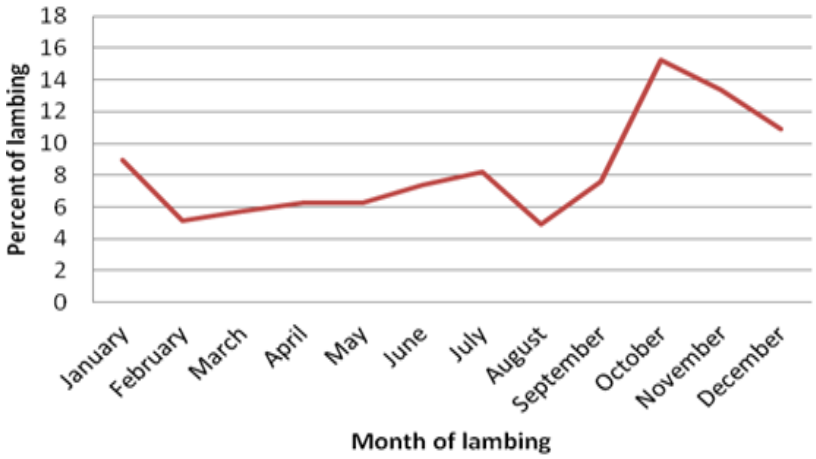

Figure 1. Lambing seasons of Doyogena sheep in Doyogena district.

mean age at first lambing (13.72 months) obtained is similar with Afar sheep (Getachew, 2008), lower than Washera sheep (Taye et al., 2011), and higher than Adilo sheep (Kocho, 2007). However, it is within the range of values reported for tropical sheep (Wilson, 1989).

The lambing interval (10.94 months) is longer than the values reported for other Ethiopian sheep breeds (Kocho, 2007; Getachew, 2008; Taye et al., 2011). With the lambing interval obtained it is not possible to give birth three times in two years which is said to be recommended for tropical sheep (ESGPIP, 2008). The longer lambing interval might be because, among a number of reasons, the breeding and herding methods (tethering method of herding) of the area. Breeding management is the primary responsible factor for lambing interval variation (Wilson, 1989).

Twinning rate obtained (1.45±0.45) is higher than the values reported for other sheep breeds in the country (Mukasa-Mugerwa et al., 2002; Taye et al., 2011) and even from tropical African sheep (Wilson, 1989).

Table 4. Reproductive performances of Doyogena sheep in Doyogena district.

Reproduction parameters	N	Mean	Std. Dev.	Range
Age at first mating of female sheep (month)	97	8.06	2.75	4.00-18.00
Age at first mating of male sheep (month)	100	8.00	2.61	5.00-18.00
Age at first lambing (month)	93	13.72	2.34	10.00-24.00
Lambing interval (month)	84	10.94	2.47	7.00-18.00
Twinning rate (head per ewe lambing)	101	1.45	0.45	1.00-3.00
Reproductive age of ewe (year)	97	8.31	3.00	3.00-17.00
Life time productivity (head)	96	10.05	3.43	4.00-20.00

Twinning rate, a combination of ovulation rate, fertility and embryo survival, is an important trait in small flock production to which sale of lambs is an objective (Taye et al., 2011), which makes use of the available resources efficiently. The higher twinning rate obtained might be because of the farmers' interest to consider the trait when selecting their breeding ewe, and the small flock size they own. Since genetic improvement in twinning rate is possible through selection (ESGPIP, 2008), selection of breeding rams towards twinning rate can bring a better and fast improvement.

Ram ownership and mating practice

About 47.2% of the respondent farmers own ram for breeding only (17%), fattening only (30.2%), breeding and fattening (27.4%) and breeding and prestige (1.8%), while the rest of the farmers get service from their neighbours (40.6%), and ram given from Areka Agricultural Research Center (13.2%). The mean ram ownership was 1.28±0.64. On average a ram serves for about 21.71±9.67 months in the flock. Some farmers keep up to four rams which were ultimately used for fattening. More than half (52.8%) of ram owners give special management for the ram like supplementation and separate housing from the flock. About 42.5% of the ram owners control mating by isolating the ram from the flock and mix them when needed (34.9%) and/or by castrating unwanted rams (6.6%). The rest of the farmers (57.5%) do not control mating because of the reasons including sheep graze together (40.55), lack of ram (3.8%), lack of awareness of the consequences of uncontrolled mating (9.4%), and herding problem (6.6%).

Most (61.3%) of the respondent farmers in the study area understand the effect of inbreeding as stunted growth (58.5%), poor health performance (8.4%), and abortion (4.7%). To control inbreeding, farmers change their ram and ewe (43.5%), separate their breeding ram from those related in the flock by tethering and castrating unwanted rams (8.5%). More than 56.6% of the respondent farmers control mating of related animals like the mating of ram with his mother, daughter, and sister while allowing mating their ram with other flocks and other rams with their flocks (72.6%). The result indicates that, when designing a breeding program for a community, the indigenous knowledge on breeding and mating methods and the herding system should be taken into consideration.

Breeding ewe and ram selection

Table 5 and Figure 2 present selection criteria of sheep in Doyogena area. Almost all (99.1%) respondents select their breeding ewes in which body size (index = 0.232) was the most important ewe selection trait followed by lamb growth (index = 0.175). During the group discussion, farmers indicated that horned ewes give more milk than polled animals supporting better lamb growth. Sheep with toggle are selected against the trait because they are not productive, in farmers view.

Among the respondents, 96.2% of them select their breeding ram from their own flock (71.7%), neighbors flock (46.2%) and purchase from the market (42.5%). Appearance (index = 0.305) and color (index = 0.254) of the ram accounted for more than half of the selection weight used as selection criteria. Likewise, Getachew et al. (2010b) reported that appearance of ram is an important trait for Menz and Afar sheep ram selection. Therefore, these qualitative traits also need to be given special attention when making selection decisions.

Castration practice

Most (84%) of the respondent farmers practice castration of rams for the sake of controlling unwanted mating (43.4%), fattening (77.4%), and improve temperament (39.6%). Similar reason for castration of sheep is reported in the literature (Getachew et al., 2010b). Some (36.8%) of the farmers castrate only during the dry season because they believe that the air condition is conducive than the wet season, and others (35.8%) castrate their rams during the wet season. Only a few practice castration regardless of the season. Castration was done using burdizzo (31.4%) or traditional method of castration using a stone and wood (32.6%), while 36% of

Table 5. Ewe and ram selection criteria as practiced by the sheep producers.

Characteristics	Ewe selection		Characteristics	Ram selection	
	Index	Rank		Index	Rank
Body size	0.232	1	Appearance	0.305	1
Lamb growth	0.175	2	Colour	0.254	2
Colour	0.144	3	Horn	0.133	3
Twinning ability	0.123	4	Character (Temperament)	0.057	5
Mothering ability	0.099	5	Growth	0.132	4
Lamb survival	0.092	6	Libido	0.039	6
Lambing frequency	0.077	7	Age at first maturity	0.039	6
Age at first maturity	0.036	8	Pedigree	0.030	7
Milk yield	0.015	9	Adaptability	0.007	8
Horned	0.008	10	Tail length	0.004	9

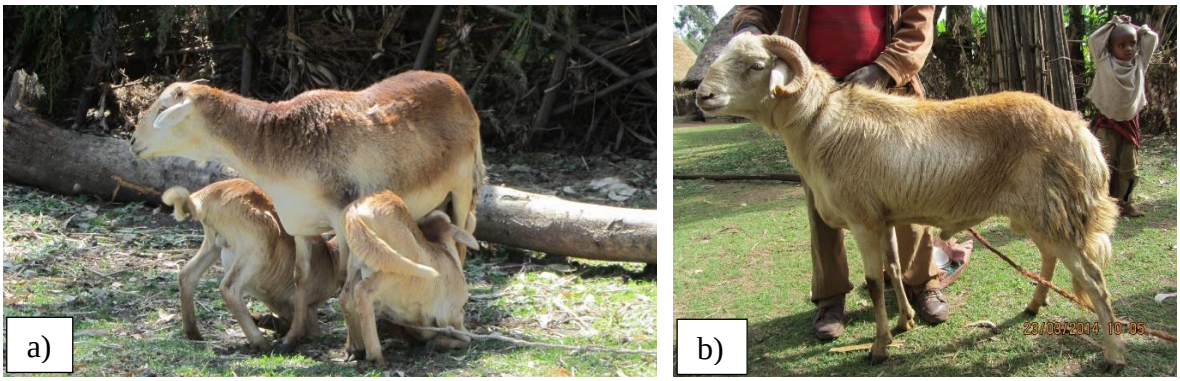

Figure 2. Preferred type of: (a) Ewe with her suckling twin lambs; (b) Breeding ram (Photo courtesy: Mengistie Taye).

the farmers use both methods, as available. The reason farmers use local methods of castration is because they do not have access to burdizzo castration (31.1%), ram response is better (9.4%), and because of tradition (7.5%).

Castration age differs depending on whether the ram has been used for breeding or not. The mean age of castration if the ram was used for breeding was after 28.68±11.15 months and if the ram was not used for breeding, it was at 12.09±4.10 months of age. Ram lambs could be castrated from 4 to 24 months of age when they are not selected for breeding. Some farmers castrate their young male sheep at an early age to control breeding and improve temperament while others tend to wait until the sheep gets matured for better body development and fattening. If the ram was used for breeding, castration age ranges from 12 to 72 months.

Sheep fattening

Sheep fattening is a common practice in the study area that 92.5% of the respondent farmers fatten sheep usually for market (77.4%), and for market and home consumption (13.4%). They fatten sheep by providing concentrate feed (79.2%), restricting movement (43.4%), and simply keeping the sheep for a long time (12.3%). About 56.6% of the sheep fattening farmers fatten from their own flock while 54.7 and 40.6% of them use animals purchased from the market and culled animals, respectively. Among the respondent farmers, 34.9% of them fatten in the dry season, 17.9% in the wet season and 28.3% of them during any time of the year as per the availability of feed and fattening animals. Sheep fatteners prefer to fatten sheep with light yellow and red coat colour (56.60%), castrates (13.21%), sheep with big horn (17%), mature (15%), large and well framed (60.38%), and long tailed (11.32%).

Farmers on average fatten 1.89±0.80 sheep in about 1.81±0.71 rounds per year. Duration of fattening was from two months to as long as 30 months with a mean of 9.65±5.96 months. Farmers prefer to fatten castrates (index = 0.384) with an age ranging from 12 to 60 months followed by intact males (index = 0.342). The mean age of fattening animals obtained was 29.22±10.09, 21.04±10.84 and 40.79±22.97 months for castrates,

Table 6. The culling reason for female and male sheep in Doyogena district.

Reason	Female sheep		Male sheep	
	Index	Rank	Index	Rank
Old age	0.187	1	0.162	4
Poor physical condition	0.167	2	0.210	1
Stunted growth	0.151	3	0.192	3
Sterility	0.121	4	0.028	7
Poor mothering ability	0.120	5	-	-
Disease	0.095	6	0.096	5
Low milk yield	0.093	7	-	-
Bad colour	0.064	8	0.207	2
Poor libido	-	-	0.084	6

Table 7. Priority of class of sheep for sale.

Class of sheep	Index	Rank
Castrate	0.190	1
Young male	0.187	2
Male lamb	0.182	3
Old ewe	0.155	4
Female lamb	0.134	5
Young Female	0.099	6
Ram	0.028	7
Ewe	0.024	8

males and female animals, respectively.

Culling practice

Most (90.6%) of respondent farmers practice culling of both ewes and rams using different criteria (Table 6). Farmers cull unwanted sheep through sale (88.7%), slaughter (36.8%) and exchange with other farmers (2.8%). Culling can be during the dry season (28.3%), wet season (26.4) and any time especially during holidays (34.0%). Old age, poor physical condition, and stunted growth were the first three culling reasons used for female sheep with an index of 0.187, 0.167 and 0.151, respectively (Table 6). For male sheep, poor physical condition (0.21), unwanted color (0.207) and stunted growth were the first three culling criteria used. More than half of the farmers add value to culled animals before selling them. Farmers castrate (index = 0.338) and/or fatten (index = 0.429) male sheep before selling, whereas they fatten (index = 0.575) female sheep before selling.

Sheep marketing

Farmers in Doyogena district sell sheep any time in the year when they need cash. However, sheep fattening farmers fatten and sell during holidays. Castrates (index = 0.19) were the first to be sold followed by young male (index = 0.187) and un-weaned male lambs (index = 0.182) in the flock (Table 7). Breeding ewes and breeding rams were the last choices for sale. Farmers do not want to sell breeding animals unless they are forced to do so.

Doyogena sheep, named as Adilo, has a premium market in Addis Abeba and other nearby markets. Medium and large traders collect fattened male animals to present at Addis Ababa and Shashemene markets during holidays (Kocho, 2007). The mean marketing age for male sheep was 6.11±2.72 months (1 to 12 months) and 6.87±2.55 months (2 to 18 months) for female sheep. Sale of sheep at an early age is common in other areas too (Kocho, 2007; Taye et al., 2010). This, the sale of young animals, has a negative effect on flock productivity that fast growing and good looking lambs could be removed out from the flock before reaching breeding age and replacing themselves (Taye et al., 2010), and therefore drains the genetic pool of the flock. However, the practice can be taken as an efficient method of removing less productive and unselected animals out of the system, if properly managed. Therefore, care should be taken to retain productive animals while removing those with unwanted traits.

Feed and water resources for sheep

Crop aftermath, private grazing land and *Amicho* (*E. ventricosum*) were the first three feed resources for sheep in the dry season with index of 0.194, 0.180 and 0.171, respectively, while private grazing (0.286), improved forage (0.193), and *Amicho* (0.166) were the most important feed resources in the wet season (Table 8). Farmers stated that feed shortage is a critical problem for sheep because of small landholding to allocate for private grazing and lack of communal grazing land, to which detail analysis is required on this aspect.

About 88.7% of sheep holders supplement *Amicho* and purchased concentrate to their sheep during different

Table 8. Wet and dry season feed resources of sheep in Doyogena district.

Feed resources	Dry season		Wet season	
	Index	Rank	Index	Rank
Crop aftermath	0.194	1	0.006	8
Private grazing	0.180	2	0.286	1
Amicho[1]	0.171	3	0.166	3
Concentrate	0.152	4	0.114	5
Communal grazing land	0.119	5	0.159	4
Crop residue	0.111	6	0.041	6
Improved feed	0.062	7	0.193	2
Hay	0.011	8	0.030	7

[1]Enset, Ensete ventricosum

Table 9. Priority of classes of sheep for feed supplementation.

Class	Index	Rank
Suckling ewes	0.319	1
Castrate	0.277	2
Lambs	0.137	3
Pregnant ewes	0.118	4
Breeding ram	0.077	5
Breeding ewes	0.072	6

times of the year: 62.3% supplement at all times of the year while 23.6% only during the dry season and 2.8% only during the wet season. Suckling ewes were the first classes of sheep in the flock to get supplement followed by castrates and lambs (Table 9). 40.6% of the respondent farmers give salt to their sheep at different times of the year with and/or without feed. Spring water (38.7%), stream (34%) and tape water (34.9%) were important sources of water for sheep both in the wet and dry seasons.

Herding of sheep

Most of the farmers herd their sheep with other livestock (63.2%), while 36.7% of them herd separately. About 61.3% of the farmers mix their sheep with other sheep flocks, because they use communal grazing land (50.0%), have labor shortage (7.6%) and during watering time (6.6%). For those mixing their flocks, on average 6.68 (2 to 30) households flocks mix together during grazing time.

Most of the respondents tether their sheep (90.6%) in the wet season to avoid crop damage while they freed them (67.9%) to roam around during the dry season. The use of tethering has an implication on the performances of the flock. While tethering is a means to control breeding allowing selected males to mate with female sheep coming to heat, when breeding is uncontrolled and when there is no follow-up, ewes might not be mated as they come to heat and this elongates lambing interval and in turn overall productivity. Therefore, the method of herding should be considered in the development of a breeding strategy.

Housing of sheep

All the farmers in the study area house their sheep to prevent them from theft, wild animals and environmental calamities in most (82.8%) of the cases with shelter constructed inside the main house. Only 10.3% construct separate house for their sheep and 6.8% of them house their sheep with open barn. About 78.3 and 55.7% of the farmers shelter lambs with adult sheep and sheep with other livestock, respectively. The practice is similar to other findings in the country (Taye et al., 2010; Mekuriaw et al., 2012).

Disease and disease control

The major diseases and parasites of sheep in the study area are presented in Table 10. There was less disease load in the area which is reflected in the low number of death of sheep during the year (only 1 to 3 farmers have lost their sheep due to disease). The major diseases of the area were respiratory diseases which usually cause morbidity. Farmers use different local treatments using usually ginger, garlic, and tobacco leaf. More investigation is however needed as some of the parasites, for example, may cause a substantial economic loss in terms of weight loss.

Farmers in the study area reported that they have access to vaccination (35.8%), diagnosis service (23.6%) and treatment (63.2%) when their sheep get sick from the government health clinic.

Slaughtering of sheep

About 91.5% of the farmers slaughter sheep for home

Table 10. Major diseases of sheep in Doyogena district (the common name is based on the symptoms seen).

Local name	Common name	Symptom	Local treatment
Elamosso	Pink eye disease	Swelling of orbit of eye, eye discharge, loss of vision, reddening and whitening of eye	Washing with water, treat with eye ointment
Samibicho	Respiratory syndrome	Coughing, diarrhea, loss of appetite, weight loss	Drenching garlic, ginger, *Tenadam*, *Emboy*
Gansho	Pneumonia	Coughing, Mucus discharge, Sneezing	Garlic, ginger, lemon, Tobacco

Table 11. Sheep production constraint in Doyogena district.

Constraint	Index	Rank
Feed shortage	0.340	1
Lack of input	0.180	2
Disease and parasite	0.124	3
Extension service	0.105	4
Land shortage	0.068	5
Water shortage	0.066	6
Labour shortage	0.065	7
Market problem	0.037	8
Genotype	0.015	9

consumption during festivals (86.8%), during occasions in the family like a wedding, births, circumcision, and funeral ceremony (83.0%) and whenever sheep for slaughter is available (2.8%). Farmers slaughter intact males (61.1%), females (4.5%), castrate (10.4%) and all types (18.9%). The mean age of sheep used for slaughter was 10.16 (4-36) months for males, 10.14 (4 to 24) months for females and 34.5 (24 to 48) months for castrates.

Sheep production constraint

Like other sheep producing areas of the country (Taye et al., 2010; Hailemariam et al., 2013), sheep production in Doyogena district has production constraints (Table 11). Feed shortage (index = 0.34), lack of input like credit service (index = 0.18), and disease and parasite (index = 0.124) were the three major sheep production bottlenecks in the district accounting for about 64.4% of the total weight. Unlike other areas (Getachew, 2008), genotype is not a problem. This might be partly because of lack of knowledge of the farmers about the availability of other better-producing breeds and the fact that their animals could be improved as there exists within breed variability.

CONCLUSION AND RECOMMENDATION

Sheep production is an integral component of the *E. ventricosum*-Crop-Livestock mixed production system of the area. Sheep are an important livestock species for the area. There is an established practice of selecting breeding rams and ewes by farmers. To help farmers in selecting ewes and rams and make a selection based on recorded data simplified methods of recording should be introduced. Farmers practice controlled breeding which needs to be encouraged and supported by introducing breeding control methods. The effect of tethering method of herding on the reproductive performances of sheep should be considered in developing the breeding strategy. Castration of rams and culling of unwanted sheep are common practices. Farmers in Doyogena district fatten sheep before selling. Feed shortage, lack of input, and disease and parasite are among the major sheep production bottlenecks in the district. To fully utilize the potential of the breed and the area, production constraints should be addressed along with genetic improvement and appropriate institutional setup.

Conflict of interests

The authors have not declared any conflict of interests.

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