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Production Systems and Breeding Practices of Indigenous Sheep Types in Wolaita Zone, Southern Ethiopia

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Abstract
The study was conducted in Wolaita zone of Southern Ethiopia. The objectives of the study were to characterize production system and environment and to identify trait preference, breeding practices and objectives in the study area. A total of 270 households were selected purposively for characterization of the production practices. Data were gathered through semi-structured questionnaire, focus group discussions and field observations. The result of the study showed that the major farming activities were mixed crop and livestock system. Sheep were kept for multiple objectives with source of income being rated the highest. The principal feed sources in the study area were natural pasture and crop residue. The majority of sheep owners herded their sheep during the rainy season and practiced free grazing during dry season. A type of mating practiced in study areas were natural mating or uncontrolled mating within the household's flock and between neighboring flocks. The overall selection age for breeding rams and ewes were 13.3 ± 6.48 and 11.95 ± 5.82 months, respectively. Body size, colour, character and age were the most frequently reported traits in selecting breeding rams; whereas size ,twining ability, age at sexual maturity and color were traits given due emphasis for breeding ewe. Lack of superior genotype, shortage of feed resources and disease were the major sheep production constraints. The overall mean age at first service of males and females were 10.8 ± 1.95 and 10.96 ± 2.60 months, respectively. The overall mean age at first lambing and lambing interval of sheep were 14.84 ± 2.83 months and 7.48 ± 1.88months, respectively.
Keywords: Breeding Practices, Selection criteria, Trait preferences

1. Introduction

Ethiopia is one of the major gateways for domestic sheep migration from Asia to Africa (Devendra and McLeroy, 1982). With 25.5 million sheep (CSA, 2011) and 14 traditional populations (Gizawet al., 2007; Gizaw, 2008), Ethiopia has highly diversified indigenous sheep types which are parallel to the diversity in ecology (Galal, 1983), ethnic communities and production systems in the country (Solomon, 2008). The sheep can survive under harsh environments such as feed scarcity, disease challenges and are highly adapted to low-input systems (Markos et al., 2006). They are also considered as living banks for their owners and serve as a means of ready cash income to meet immediate needs such as acquiring agricultural inputs, paying school fees or tuition, taxes, medical bills and purchasing large animals and a reserve against economic and agricultural production hardship or monetary saving and investment in addition to many of other socio-economic and cultural functions (Markos, 2006).

Knowledge of indigenous animal breeding practices and techniques is important to develop sustainable genetic improvement schemes under smallholder situations. Lack of such knowledge leads to the setting up of unrealistic breeding goals in the design of livestock genetic improvement programs and the consequence of which can put in danger the conservation of indigenous animal genetic resources (Zewdu et al., 2006). The farmers' decision of selection criteria could be affected by breed, production system and herd size (Thiruvenkadan et al., 2009). The traits traditionally considered as criteria for selecting breeding stock are important in describing the adaptive attributes and genetic merits of the indigenous livestock and in identifying farmers' choice of sheep breeds and the underlying factors that determine the choice of genetic stock used. Although documentation of traditional animal breeding practices is very essential for genetic improvement, such information is scant for Wolaita sheep breed at smallholder farmer's level. This study, therefore, was carried out to characterize the production system and production environment in the area and to identify farmer's trait preferences, breeding practices and objectives.

2. Materials and methods

2.1. Description of the Study Area

Wolaita zone is divided in to 12 woredas and 302 rural and 22 urban kebeles. Wolaita zone possesses agro-ecological zones of 11% of wet highlands, 57% of intermediate wet highlands and 32% of semi-dry lowlands. Altitude in the zone ranges between 1500 and 2500 m.a.s.l. except for some parts where it falls below 1500 m. Mean annual rainfall in the area varies between 800 mm and 1400 mm. Average temperature varies between 17

to 31oc in the zone (CSA, 2004). Environmental variables and sheep populations of the study areas are presented in Table 1 (NMA, 2012).

Table 5. Environmental variables and sheep populations of the study locations

District	Altitude (masl)	Latitude (°N)	Longitude (°E)	Annual avg. max.temp.(°C)	Annual avg. min.temp.(°C)	Annual rainfall (mm)	Total sheep popn of the area
Damote Sore	1752	7.98–7.18	37.62–37.83	22.5	17.6	1449	26, 928
Damot Gale	2043	6.89–7.11	37.75–37.99	25.1	13.6	1175	25, 739
Sodo Zuria	1854	6.72–6.99	37.59–37.86	25.6	14.6	1321	23, 457

NMA, 2012

2.2. Sampling Techniques

A multi-stage purposive sampling technique was employed for selection of districts and peasant associations for the study. In the first stage, districts known for their sheep populations were identified and followed by identification of potential peasant association and villages. Potentials for sheep production and road accessibility were used as criteria in selecting the sites. Thus, three districts were purposively selected based on sheep population potential and road accessibility. From each districts three peasant associations was selected purposively based on the same criteria. A total of 180 households (20 from each PA and 60 from each district) were purposefully selected based on possession of sheep for interview.

2.3. Data Collection

Questionnaire was designed to address description of the production environment and sheep husbandry practices. Information on socio-economic practices of each household family and their major sources of income were collected. The type of crop produced including size of land holding for both crop cultivation and land used for grazing of livestock and type of livestock reared by the community in the study area including their number were assessed using questioner and by gathering secondary information. Information on major breeding practices were collected from each selected household through utilizing designed questionnaire and focus group discussion and group discussion with extension workers and model farmers.

2.4. Data Management and Analysis

Data collected through questionnaire were analyzed by statistical analysis system (SAS version 9.2, 2008). Chi-square test was employed when required to test equal probability assumptions. Statistical significance for quantitative data was done using F test. Indices were calculated to provide ranking of the reasons of keeping sheep, trait preferences, livestock species preference, selection criteria, importance of major farming activities to the family food and income and major constraints of sheep production according to the following formula: Index = Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] given for particular qualitative variables divided by Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all qualitative variables considered.

3. Results and discussion

3.1. General Household Characteristics

The study indicated that the majority (83.3%) of the families were headed by the males where as 16.7% of the proportion was headed by females (Table 2). Similar to this study Tesfaye (2008) noticed in Menz area that among the household heads, 89.2 % were male headed while only 10.8 % were female headed. In the study area the sampled households have different educational background. The majority of them (42.8%) were illiterate and 27.8% were able to read and write while the remaining proportion of households having primary and secondary educational background. Similar to this study higher proportion of illiterate and those with lower level of education were reported from Southern Ethiopia (Zewdu et al., 2012). According to respondents in this study, the overall proportions of married, divorced and widowed households were 70%, 9.4% and 20.6% respectively (Table 2).

Table 6. Household information ofthe study areas

Descriptors	District						Overall	
	Soddo Zuria		Damote Gale		Damote Sore			
	N	%	N	%	N	%	N	%
Sex structure								
• Male	51	85	46	76.7	53	88.3	150	83.3
• Female	9	15	14	23.3	7	11.7	30	16.7
Age structure								
• <31	9	15	15	25	3	5	27	15
• 31-40	14	23.33	14	23.33	23	38.33	51	28.33
• 41-50	23	38.33	12	20	26	43.33	61	33.88
• 51-60	9	15	15	25	6	10	30	16.67
• >60	5	8.33	4	6.66	2	3.33	11	6.11
Marital status								
• Married	42	70	42	70	42	70	126	70
• Divorced	6	10	5	8.3	6	10	17	9.4
• Widowed	12	20	13	21.7	12	20	37	20.6
Educational status								
• Illiterate	28	46.7	26	43.3	23	38.3	77	42.8
• Read and write	5	8.3	20	33.3	25	41.7	50	27.8
• Primary	18	30	12	20	12	20	42	23.3
• Secondary	9	15	2	3.3	-	-	11	6.1

N=Number of households

3.2. Major Farming activities and land holding

The major farming system in the study area was mixed crop and livestock farming. The area is suitable for both rearing of livestock and cultivating crops. Among the common crops in the study area, teff (96%), haricot bean (83%) and sweet potato (75%) were the major crops used for income and household consumption which are grown in the main rainy season.

Average land holding of farmers for crop cultivation in Soddo Zuria, Damote Gale and Damote Sore districts were 0.57, 0.42 and 0.34 hectares, respectively. About 88.9 % of the total land in study area was used for crop cultivation during both the main and short rain seasons. On the other hand, the average land holding of farmers for grazing in Soddo Zuria, Damote Gale and Damote Sore districts were 0.16, 0.09 and 0.11 hectares, respectively. This indicates that 11.1% of the total land which held by the farmers in the study area was used for grazing purpose.

3.3. Flock Size and Structure

Flock size and structure of sheep in the study area is presented in Table 3. Breeding ewes take a major portion in Soddo Zuria (18.3%), Damote Gale (33.3%) and Damote Sore (18%) districts, followed by male lambs between 6 months to 1year and castrates, except in Damote Sore district which had lower number of castrates compared to others. Large proportion of breeding ewes in the flock implies the production of large number of lambs as reflected in this study. This in turn is believed to have direct impact on selection intensity. On the other hand, large numbers of castrates show that there is experience of fattening in the study area.

Table 7. Sheep flock structure by age group in the study area

Flock class	Soddo Zuria		Damote Gale		Damote Sore		Overall	
	Mean+ SD	%	Mean+ SD	%	Mean + SD	%	Mean + SD	%
Ram lambs < 6 months	0.30+0.47	7.32	0.15+0.37	7.69	0.15+0.37	6	0.20+0.40	7
Ewe lambs < 6 months	0.35+0.49	8.54	0.15+0.37	7.69	0.40+0.75	10	0.30+0.56	8.74
Ram 6 months to 1year	1.00+0.73	18.3	0.15+0.49	5.13	0.75+0.55	28	0.63+0.69	17.1
Ewe 6 m to 1 year	0.90+0.72	17.1	0.05+0.22	2.56	0.80+0.70	26	0.58+0.70	15.2
Breeding ram>1 year	0.85+0.59	18.3	0.20+0.52	7.69	0.35+0.67	10	0.46+0.65	12
Breeding ewe>1year	1.05+0.83	18.3	1.30+1.08	33.3	0.55+0.69	18	0.96+0.92	23.2
Castrate	0.60+0.69	12.2	1.60+1.50	35.9	0.05+0.22	2	0.75+1.14	16.7

3.4. Purposes for Keeping Sheep

Ranking of the sheep production objectives by smallholder farmers in the study area is presented in Table 4. The primary reason for keeping sheep for Soddo Zuria district sheep owners was for cash income followed by meat consumption, manure, saving, wealth status, skin and for ceremony in that order with an index value of 0.48,

0.34, 0.13, 0.02, 0.02,0.01, and 0.01, respectively, whereas in case of Damote Gale district the primary reason of keeping sheep was for cash income followed by meat consumption, saving, ceremony, wealth status, skin and for manure with an index value of 0.43, 0.31, 0.15, 0.06, 0.03,0.02, and 0.01, respectively. In Damote Sore district the primary purpose of keeping sheep was for cash income followed by ceremony, manure and for meat consumption purpose with an index value of 0.46, 0.25, 0.15, and 0.14, respectively.

Table 8. Ranked and Percentage of breeding objectives of farmers in the study area

Ranked breeding	Percentage of breeding objectives						
Objectives	Meat	Manure	Skin	Savings	Ceremonies	Wealth stat	Income
Soddo Zuria							
✓ Rank 1	5	-	-	-	-	-	95
✓ Rank 2	90	5	-	5	-	-	-
✓ Rank 3	5.5	72.2	5.5	-	5.5	11.1	-
✓ Index	0.34	0.13	0.01	0.02	0.01	0.02	0.48
Damote Gale							
✓ Rank 1	25	-	-	-	-	-	75
✓ Rank 2	45	-	-	25	10	5	15
✓ Rank 3	20	5	10	40	15	5	5
✓ Index	0.31	0.01	0.02	0.15	0.06	0.03	0.43
Damote Sore							
✓ Rank 1	10	-	-	-	-	-	90
✓ Rank 2	10	35	-	-	55	-	-
✓ Rank 3	35	20	-	-	40	-	5
✓ Index	0.14	0.15			0.25		0.46
Overall Index	0.26	0.09	0.01	0.06	0.11	0.01	0.46

Index, sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for particular purpose divided by sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all purpose.

3.5. Feed Resources and Grazing Practice

According to the respondents the main feed resource for sheep in the study area included natural pasture and crop residues (Table 5). However, its contribution varied between seasons where during the dry season the contribution is almost consistent (index value of 0.33 for natural pasture and 0.29 for crop residues) but higher for natural pasture during the wet season (index value of 0.50 for pasture and 0.21 for crop residues). The major crop residues used in the study area include maize, sorghum, barely, teff and wheat. The availability of feed for sheep in the study area shows seasonality. Mostly feed shortage is experienced during the dry season. Almost all of the respondents (92%) in the study area reported severe seasonal shortage of feed for a period of three to four months (March to June). During this period most farmers in the study area feed their sheep crop residues, hay, local brewery by-products ‘’Attela’’and wheat bran.

Table 9. Source of feed during the dry and wet season of study areas

Feed source	Soddo Zuria		Damote Gale		Damote Sore		Overall	
	WS Index	DS Index	WS Index	DS Index	WS Index	DS Index	WS Index	DS Index
Natural pasture	0.48	0.38	0.51	0.12	0.52	0.49	0.50	0.33
Established Pasture	0.32	0.08	0.22	0.12	0.01	-	0.18	0.07
Hay	0.01	0.09	-	0.31	0.12	0.19	0.04	0.20
Crop residues	0.09	0.26	0.20	0.31	0.33	0.29	0.21	0.29
Fallow land	-	0.01	-	0.01	-	-	0	0.01
Concentrate	0.10	0.18	0.07	0.13	0.03	0.03	0.06	0.12

WS= Wet Season DS= Dry Season,

Management with respect to feeding and grazing was different for dry and wet seasons. During the rainy season the majority (36.1%) of sheep owners in the study area herded their sheep whereas, 28.0% practiced free grazing, 11.4% used paddocking and 24.5% of the farmers practiced tethering. During dry season 33.1%, 32.6%, 12.1% and 22.2% of respondents practiced free grazing, herding, paddocking and tethering, respectively (Table 6). More of the communal grazing lands in the study area were declined and the possible reasons were the increasing of cultivation land for crops and increasing of human population number. Sheep were grazed mixed with other livestock on these communal grazing lands where they spend eight to ten hours each day on average depending on the season.

Table 10. Grazing method practiced in the study area

Grazing Method	Soddo Zuria		Damote Gale		Damote Sore		Overall	
	WS(%)	DS(%)	WS(%)	DS(%)	WS(%)	DS(%)	WS(%)	DS(%)
Free grazing	22.3	33.3	28.5	32.5	33.3	33.3	28.0	33.1
Herded	16.3	3.84	26.9	29.1	65.0	64.9	36.1	32.6
Paddock	28.2	30.3	4.32	4.42	67.0	1.75	11.4	12.1
Tethered	33.2	32.6	40.3	34.0	-	-	24.5	22.2

3.6. Herding Practices

The main objective of herding is to prevent sheep from damaging crops, theft and predators. In the study area all classes of sheep were herded together during the day time, whereas new born lambs were managed separately for some days near the house. The majorities (70%) of sheep owners were keeping their sheep separately, 15% with cattle and 15 % of respondents herded all together (Table 7).

In Soddo Zuria about 15.79% of the sheep owners kept their sheep with adjacent households in the village but majority (84.21%) did not mix with other sheep flock in the village. In Damote Gale about 45% respondents were mixing their sheep flocks with adjacent households in the village, whereas 55% were not doing so. About 70% of sheep owners in Damote Sore were not mixing their sheep, whereas 30% were keeping their sheep with adjacent households in the village.

Table 11. Herding practices on households of study areas

	District							
	Soddo Zuria		Damote Gale		Damote Sore		Overall	
Way of herding	N	%	N	%	N	%	N	%
Sheep of a household run as a flock	51	84.21	33	55	42	70	126	69.5
Sheep of more than one household run as a flock	9	15.79	27	45	18	30	54	30.5
Sheep flock is herded								
➢ Together with cattle	6	10	9	15	12	20	27	15
➢ All herded Together	6	10	12	20	9	15	27	15
➢ Sheep herded separately	48	80	39	65	39	65	126	70

N=Number of households; N.B. More than one response was possible

Gender role and responsibilities in sheep husbandry is presented in Table 8. In this study, all family members are involved in sheep rearing activities, though their level of involvement varied based on the type of activities. The results indicated that majority of male respondents were involved in purchasing, selling and breeding activities whereas most of the women were engaged in taking care of the sick animals and providing feed supplements to the animals, this may be because most of the women were home makers and stayed at home while the male members had other activities to perform. The younger members of the family were mostly engaged in herding activities.

Table 12. Division of labour in sheep rearing activities of the households

Activities	Age and sex group							
	Male ≥15yr		Female ≥15yr		Male <15yr		Female <15yr	
	N	%	N	%			N	%
Purchasing	117	65	69	38.33	78	43.33	39	21.66
Selling	105	58.33	57	31.66	60	33.33	36	20
Herding	90	50	90	50	66	36.67	69	38.33
Breeding	90	50	90	50	63	35	45	25
Caring for sick Animals	81	45	99	55	42	23.33	45	25
Feeding	84	46.67	117	65	63	35	72	40

N =number of household; N.B. More than one response was possible

3.7. Breeding Management

3.7.1. Breeding practices

The type of mating practiced in study areas were almost natural mating or uncontrolled mating within the household's flock and between neighboring flocks. There is no respondent reported controlled breeding. The main reasons for this uncontrolled mating were lack of awareness, presence of insufficient number of ram, and as a result of communal grazing and watering point in the study area. Since the mating system was uncontrolled, almost all of the farmers in the study area were not controlling their ram from mating ewes of another sheep flock. At the same time farmers allowed their ewe to be served by rams of another sheep flock

About 10.53%, 60% and 11.11% of sheep keepers in Soddo Zuria, Damote Gale, and Damote Sore districts, respectively, reported that they do not have their own breeding ram (Table 9). Those farmers who did not own breeding ram indicated that they use neighboring ram or their ewe mated with breeding ram from other flock during communal One or more breeding ram ownership were reported by 89.4%, 40% and 88.89% of farmers in Soddo Zuria, Damote Gale, and Damote Sore districts, respectively. The majority of the breeding rams in Soddo Zuria (93.75%), Damote Gale (50%) and Damote Sore (60%) were originated from own flock.

The major purpose for keeping breeding ram(s) in the study area was for fattening as indicated by 50%, 70% and 70% of the respondents in Soddo Zuria, Damote Gale, and Damote Sore districts, respectively (Table 9). However, about 10% of the respondents in Soddo Zuria, 20% in Damote Gale, and 20% in Damote Sore reported that they keep rams for breeding purpose alone. 30%, 10% and 10% of sheep owners in Soddo Zuria, Damote Gale, and Damote Sore districts, respectively showed interest to keep rams for breeding and fattening purpose at old age.

Table 13. Breeding management and practices of study areas

	District					
	Soddo Zuria		Damote Gale		Damote Sore	
Breeding Management	N	%	N	%	N	%
Ram possession						
• Having no breeding ram	6	10.53	36	60	7	11.11
• Having one breeding ram	19	31.58	12	20	53	88.89
• Having > 1 ram	35	57.89	12	20	0	0
Sources of breeding ram						
• Own (private) flock	56	93.75	30	50	36	60
• Purchased/market	4	6.25	30	50	24	40
Purposes of keeping breeding ram						
• Mating	6	10	12	20	12	20
• Socio-cultural	6	10	0	0	0	0
• Fattening	30	50	42	70	42	70
• Mating and Fattening	18	30	6	10	6	10
Special management for breeding ram						
✓ Yes	18	30	12	20	15	25
✓ No	42	70	48	80	45	75

3.7.2. Selection criteria for breeding ram and ewe

Selection of parents for the next generation in both the rams and ewes was very common among the sampled farmers. Of the total respondents, 90%, 55% and 75% of the farmers in Soddo Zuria, Damote Gale, and Damote Sore districts, respectively, practice selection of breeding rams. Similarly, 90%, 70% and 70% of the respondents in Soddo Zuria, Damote Gale, and Damote Sore districts practice selection of breeding ewes, respectively. The overall selection age for breeding rams and ewes were 13.3 ± 6.48 and 11.95 ± 5.82 months, respectively.

Ranking of important traits as perceived by farmers for breeding rams and ewes in the study sites are summarized in Table 10. Age (0.46), colour (0.32) and adaptability (0.14) of breeding rams ranked first, second and third for Soddo Zuria district sheep owners. In all districts the most preferred colors by the sheep owners were red and white and red colors together, whereas black colour was not preferred by all of the sheep owners. Similarly, in Damote Gale district, breeding ram was ranked first for colour (0.33), second for body size (0.32), and third for age (0.14), respectively. In Damote Sore district, body size, colour and conformation/shape of breeding ram were ranked first, second and third with an index of 0.31, 0.30, and 0.11, respectively. Similarly, in the study by Zewdu etal., (2012), traits like size, color, and tail formation were all considered as important in Horro & Adiyo Kaka and given due emphasis in selecting breeding rams.

In Soddo Zuria district, selection of breeding ewes, traits of age at first maturity (0.29), lamb survival (0.23) and coat color (0.15) were their first, second and third traits, respectively. On the other hand, in Damote Gale district coat color type (0.35), body size (0.33) and twining ability (0.17) were the first three important traits in their order, respectively. According to the sheep owners in Damote Sore district their major criteria for selection of breeding ewe were body size /appearance/, twining ability and tail length with an index of 0.28, 0.24 and 0.21, respectively. Similar to this study (Zewdu etal., 2012) indicated that size, color and tail formation were the most highly rated traits in selecting breeding females in Horro & Adiyo Kaka districts of south west Ethiopia.

Table 14. Ranking of selection criteria for breeding rams and ewes

Class and selection criteria	Soddo Zuria	Damote Gale	Damote Sore
	Index	Index	Index
Breeding ram			
❖ Size /appearance	-	0.32	0.31
❖ Color	0.32	0.33	0.30
❖ Horns	-	0.02	0.10
❖ Character	-	-	0.08
❖ Conformation/shape	-	0.09	0.11
❖ Adaptability	0.14	0.05	0.01
❖ Growth	0.02	0.06	0.05
❖ Age	0.46	0.14	-
❖ Libido	0.05	-	0.01
❖ Tail length	0.01	-	0.02
Breeding ewe			
❖ Size/appearance	0	0.33	0.28
❖ Colour	0.15	0.35	0.02
❖ Lamb survival	0.23	0	0.01
❖ Lamb growth	0.11	0	0.04
❖ Age at first sexual maturity	0.29	0.12	0.14
❖ Lambing interval	0.03	0	0.07
❖ Twining ability	0.15	0.17	0.24
❖ Milk yield	0.04	0	0
❖ Tail type/length	0.01	0.03	0.21

3.7.3. Sheep culling and market age

The mean (±SD) market age of male sheep were 10.89 + 1.02, 12.33 + 2.0 and 10.86 + 1.63 months in Soddo Zuria, Damote Gale and Damote Sore districts, respectively, whereas their female counterpart were 11.2+ 1.2, 12.71 + 1.9, and 13.85 + 2.1, respectively. This shows that male sheep are marketed at earlier age than female sheep in order to generate immediate cash income; however, female sheep are marketed when there is serious money shortage.

The mean (± SD) culling age of male sheep in Soddo Zuria, Damote Gale and Damote Sore districts were 3.5 + 0.79, 4 + 1.25, and 3.57 + 1.02, respectively, whereas their female counterpart were 4.7 + 0.57, 6.2 + 0.92, and 5.2+ 0.43, respectively. Mostly culling of breeding ram was accomplished to fulfill immediate need of cash and when the animals faced health problem. When farmers need instant money they give priority to sell their sheep.

Table 15. Mean market and culling age of sheep in the study area

Parameter	Soddo Zuria		Damote Gale		Damote Sore	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Market age (months)						
Male	10.89	1.02	12.33	2.0	10.86	1.63
Female	11.2	1.20	12.71	1.9	13.85	2.1
Culling age (years)						
Male	3.5	0.79	4	1.25	3.57	1.02
Female	4.7	0.57	6.2	0.92	5.2	0.43

SD=Standard Deviation

3.7.4. Castration and fattening

3.7.4.1. Castration

Castration was practiced by 90%, 85% and 95% of the farmers in Soddo Zuria, Damote Gale and Damote Sore, respectively (Table 12). The reasons for castrating their sheep in Soddo Zuria were 40% for control breeding, 95% for improve fattening, 55% for better temperament and 45% for better price. In Damote Gale 65% to control breeding, 85% to improve fattening, 75% for better temperament and 70% for better price, whereas in case of Damote Sore 35% of sheep owners were castrating their sheep for control breeding, 50% to improve fattening and 40% to acquire better price (Table 12). Similar to this study Zewdu et al.,(2003) indicated that in Adiyo Kaka and Horro districts castration was primarily practiced to improve the fattening potential (63.3% and 47.4%) and castration to control breeding was rarely reported.

According to the respondents 90%, 65% and 85% of sheep owners in Soddo Zuria, Damote Gale and Damote Sore districts, respectively, were providing their sheep with supplementary feeds like wheat bran, grain,

salt and local brewery by-products like "Attela". In Soddo Zuria district 90% and 10% of sheep owners were practicing modern and traditional systems, respectively. In Damote Gale70% and 30% of the respondents were using modern and traditional systems, respectively, whereas in Damote Sore district it was 75% and 25%, respectively (Table 12).

Table 16. Castration practices of sheeps in the study area

Castration	SoddoZuria		Damote Gale		Damote Sore	
	N	%	N	%	N	%
Castration practice						
✓ Yes	54	90	51	85	57	95
✓ No	6	10	9	15	3	5
Castration reason						
✓ Control breeding	24	40	39	65	21	35
✓ Improve fattening	57	95	51	85	30	50
✓ Better temperament	33	55	45	75	0	0
✓ Better price	27	45	42	70	24	40
Supplementary feed for castrated sheep						
✓ Yes	54	90	39	65	51	85
✓ No	6	10	21	35	9	15
Castration method						
✓ Modern	54	90	42	70	45	75
✓ Traditional	6	10	18	30	15	25

N=No of households

3.7.4.2. Fattening

In the study area majority (78.3%) of the sheep owners practiced fattening of sheep. Among the feed types used for fattening in the study area were natural pasture (grazing), local brewery by-products and concentrates. Fattening coincides with the availability of good quality and quantity of natural pasture, better forage production and aim to specific market (holiday market). Most farmers in the study area were fattening their sheep within 5 to 12 months.

In Soddo Zuria, Damote Gale and Damote Sore districts, sheep owners were mostly using castrates for fattening purpose; in terms of index were 0.48, 0.41 and 0.47, respectively. (Table 13) Young males were the second most categories of sheep used for fattening purpose in Soddo Zuria and Damote Gale districts with an index of 0.34 and 0.32, respectively but older males in Damote Sore district. According to the respondents in the study area within the same age categories females were less proportionally used for fattening compared to males. The reason behind this is that they used these animals for reproduction purpose instead of fattening.

Table 17. Categories of sheep for fattening in the study area

Type of sheep for fattening	Soddo Zuria	Damote Gale	Damote Sore
	Index	Index	Index
Culled young female	-	0.08	0.02
Culled young male	-	0.01	0.11
Young females	0.18	0.04	-
Young males	0.34	0.32	0.04
Castrates	0.48	0.41	0.47
Older males	-	0.12	0.25
Older females	-	0.01	0.11

3.8. Major Constraints of Sheep Production

The major constraints of sheep production in the study areas were poor genotype, disease, feed shortage, drought, predator, water shortage and insufficient market access (Table 14). Low genetic potential of sheep for functional traits was ranked as the first important constraint with an index of 0.44 in Soddo Zuria, 0.49 in Damote Gale and 0.43 in Damote Sore districts. The second and third major constraints were disease (0.33) and feed shortage (0.22) for Soddo Zuria, feed shortage (0.35) and diseases (0.04) for Damote sore and market access (0.25) and disease (0.15) for Damote Sore.

Table 18. Major constraints to sheep production in the study area

Constraints	Soddo Zuria	Damote Gale	Damote Sore	Overall
	Index	Index	Index	Index
Feed shortage	0.22	0.35	0.12	0.23
Water shortage	0.01	0.03	0.01	0.02
Disease	0.33	0.04	0.15	0.18
Drought	-	0.03	0.04	0.02
Market	-	0.03	0.25	0.10
Genotype	0.44	0.49	0.43	0.45
Predator	-	0.03	-	0.01

3.9. Reproductive Performances

According to the respondents the overall mean age of males and females to attain sexual maturity were 10.8 ± 1.95 and 10.96 ± 2.60 months, respectively (Table 15). This study seem to be in agreement with that reported by Mukasa-Mugerwa and Lahlou-Kassi (1995) for Menz sheep that have mean age at first service of 10 months.

The overall mean age at first lambing of sheep in the study area were found to be 14.84 ± 2.83 months (Table 15). According to Zewdu (2006), this result is in agreement with that of Bonga sheep where average age at first lambing was 14.9 ± 3.12 months but higher than Horro sheep which have mean age at first lambing of 13.3 ± 1.70 months. The obtained mean age at first lambing was shorter than 16.5 months reported by Gautsch (1987) for Menz sheep.

The mean lambing interval of sheep in the study area was 7.48 ± 1.88 months (Table 15). This result was shorter than reported lambing interval of 8.92 ± 2.13 and 9.23 ± 2.44 months for Bonga and Horro sheeps, respectively (Zewdu, 2006). The average reproductive life span of ewes was 7.02 ± 2.42 years. This result was in consistent with the result of 7.91 ± 3.10 and 7.45 ± 2.73 years for Horro and Bonga ewes (Zewdu, 2006).

Table 19. Reproductive performances of Wolaita sheep

Characters	Soddo Zuria	Damote Gale	Damote Sore	Overall
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Age at sexual maturity for male (months)	12 ± 0	11.3 ± 1.49	9.3 ± 1.95	10.8 ± 1.95
Age at sexual maturity for female (months)	12 ± 0	12.8 ± 2.11	8.57 ± 2.34	10.96 ± 2.60
Age at first lambing (months)	18 ± 0	12.9 ± 2.25	13.16 ± 1.68	14.84 ± 2.83
Lambing interval (months)	6 ± 0	7.08 ± 1.56	9.05 ± 1.7	7.48 ± 1.88
Reproductive life span of ewes (years)	8 ± 0	9.7 ± 2.20	4.65 ± 1.01	7.02 ± 2.42

4. Summary and Conclusion

This study was carried out to describe production system, production constraints and to identify trait preferences and breeding practices. The overall major farming activities in the study area were mixed crop and livestock farming. All of the surveyed households owned sheep which are essential part of livestock keeping in the study areas and they are mainly kept for source of cash income, meat, ceremonies purpose, manure, and savings. The major crops grown for income and household consumption in the study area during the main rainy season were teff, haricot bean, sweet potato and bread wheat. The principal feed sources in the study area were natural pasture or grazing land and crop residue. Management with respect to feeding and grazing was different for dry and wet seasons. During the rainy season the majority of sheep owners in the study area herded their sheep whereas during dry season majority of respondents practiced free grazing. A type of mating practiced in study areas were almost natural mating or uncontrolled mating within the household's flock and between neighboring flocks. The majority of the sheep owners practiced castration and fattening of sheep. Castrates and young males were the most common categories of sheep used for fattening purpose. 73.3% and 76.67% of sampled households practice selection of breeding ram and ewes, respectively. The overall selection age for breeding rams and ewes were 13.3 ± 6.48 and 11.95 ± 5.82 months, respectively. In study areas body size, colour, character and age were the main criteria's for selection of breeding rams, whereas, size (appearance), twining ability, age at first sexual maturity and color were for breeding ewes. The most preferred colors by the sheep owners were red and white and red colors together, whereas black colour was not preferred by most of the sheep owners. The major constraints of sheep production in the study area were lack of superior genotype, shortage of feed resources and disease. The overall mean age at first service of males and females were 10.8 ± 1.95 and 10.96 ± 2.60 months, respectively. The overall mean age at first lambing and lambing interval of sheep were found to be 14.84 ± 2.83 months and 7.48 ± 1.88months, respectively.

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