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Description of Sheep Production System, Husbandry Practices and Assessment of Major Constraint in Dawuro Zone and Konta Special Wereda of South Region of Ethiopia

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Description of Sheep Production System, Husbandry Practices and Assessment of Major Constraint in Dawuro Zone and Konta Special Wereda of South Region of Ethiopia

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Keywords: description, production system, husbandry practices, constraint, dawuro, konta.

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I. Introduction

In the country the production system and marketing are almost traditional (Legesse et al., 2008) but in this circumstance sheep are used to generate income that is used to purchase cloths, food items, breeding stock, oxen, fertilizer, household supplies and also to pay taxes (Chipman, 2003). Developing countries like Ethiopia, where subsistence agriculture is common, and farmers keep small ruminants for trade and meat consumption in household where gross income is determined by the size of the flock number raised by the owners (Gemeda *et al.*, 2007).

Even if the productivity of indigenous sheep breed is clearly low due to a number of limitations like genotype, feed, disease, institutional, environmental and infrastructural constraints (Niftalem, 1990; Abebe, 1999; Markos, 2006) the sheep types have the ability to add value in subsistence way of living of the low input smallholder and pastoral production systems(Kosgey and Okeyo, 2007). So, this study was carried out to describe sheep population and the production system in the Dawuro (Tocha and Mareka) zone and Konta special woreda is the base stone for any breed or/and production improvement pans. in general the objective of this study was to describe sheep husbandry practices, production system and to assess major constraint of the study area.

II. Materials and Methods

a) Description of the Study Areas

i Dawuro Zone

Dawuro zone is one of the 13 zones of Southern Nations Nationalities and Peoples Regional state (SNNPR) and geographically located in south western part of the country. Dawuro zone is bordered by Hadiya zone in the North, Kemebata-Tembaro zone in North east, Wolayita zone in the East, Gamo-Gofa zone in the west and Konta special woreda and Jimma (Oromiya) zone in the west (Terefe Degefa *et al.*, 2003). Dawuro zone is delineated by Omo River in north and south and Gojeb River in North-west (Anonymous, 2004). Dawuro

is situated at an altitude ranging from 730 to 2850 m.a.s.l., longitude 37°09'E and latitude 7°08 'N. The capital of Dawuro zone is Tercha, which is located at about 507 km from Addis Ababa and 282 km from Hawassa (the capital city of SNNPR). The annual mean maximum and minimum temperature of the zone is 26.4°C and 14.9°C, respectively (Agricultural office of the zone). The annual mean rainfall of the zone ranged from 1200 to 1800 mm (BoPED, 1998). The main rainy season of the zone is between June to September (long rainy season), short rainy season from March to April, and dry season lasts from October to February and May (Agricultural office of the zone). Dawuro zone has five woredas and 37 *kebeles* or Peasant Associations (PA). Agro- ecologically Dawuro consist of highland (*Dega*; 20.9%), mid-highland (*Woinadega*; 41%) and lowland (*Kolla*; 37%). The land use pattern is composed of 30 % annual crops , 25% of perennial crops, 10 % of grazing land, 40 % covered with forest land and agro - forestry. Topographically the district consists of plain (10%), mountain (85%) and plateau (5%). Totally Dawuro zone covers about 446,082 hectare of land.

From the natural vegetation perspective, Dawuro zone predominantly known for growing bamboo. Bamboo has a vital and critical role in each and every living process of Dawuro people. Most of the houses and fences are made of bamboo and the known cultural food in the area known as "*Kocho*", which is made of the Enset crop (*Enset verticosum*), is also processed with the material made of bamboo.

According to Central Statistical Agency (CSA, 2008), Dawuro has an estimated total human population of about 492,000. The study zone has also a total of 332,490 cattle, 106,163 sheep, 51,755 goats, 6,724 horses, 2,655 donkeys, 5,237 mule, 171,716 poultry and 9,483 beehives (South Agriculture and Rural Development Office).

ii *Konta special woreda*

The other area where the study was conducted was Konta special woreda of Southern Nations, Nationalities and Peoples Regional state (SNNPR). Konta special woreda is situated at an altitude of 900-2300 m.a.s.l. at a distance of 330 & 460 km of Hawassa & Addis Ababa respectively. The average maximum and minimum annual temperature of the woreda is 37°C and 21°C, respectively. The main rainy season lies in between June to September (long rainy season), short rainy season from March to April, and the dry season lasts from October to February and May (Agricultural office of Konta special woreda).

Agro- ecologically, Konta special woreda consists of highland (*Dega*; 6%), mid-highland (*Woinadega*; 54%) and lowland (*kola*; 40 %). About 30% of the Konta special woreda land is covered with annual crops, 25% covered with perennial crops, 5% covered with grazing land, 15% covered with forest and bush land and 10% agro forestry. Topographically the district consists of plain 15%, mountain 80% and plateau 5 %. (Agricultural Office of Konta Special woreda). Konta special woreda has 71,212 heads of cattle, 16,457 heads of sheep, 11,873 heads of goat, 1,137 heads of horse, 510 heads of mule, 77,226 poultry and 20,263 beehives (South Agriculture and Rural Development Office).

b) Sampling Technique

Sampling frame was established in a multistage clustered sampling procedure in compliance with the main indigenous sheep types of the study area. A rapid reconnaissance survey was made prior to the actual survey work in order to locate the distribution of sheep and their production system in the study area. Dawuro Zone has five woreda, of which 3 woreda were selected strategically based on agro-ecology and sheep population distribution.

From each selected woreda of Dawuro zone and Konta Special Woreda, 3 peasant associations (PA; sampling sites) were selected based on the distribution of sheep population, agro-ecology and accessibility. About 20 households were randomly sampled from each Peasant association based on the distribution of sheep through discussion with key informants in the village and secondary information. The number of households which were included in the study was 120 from six PA's of Dawuro zone and 60 from three PA's of Konta special woreda. In total, 180 households were selected for survey. Secondary information on the distribution, number and types of sheep across the different woreda was obtained from agricultural offices of the respective zone and district before starting the actual field work. Geographical location of the study areas are indicated in Figure 1.

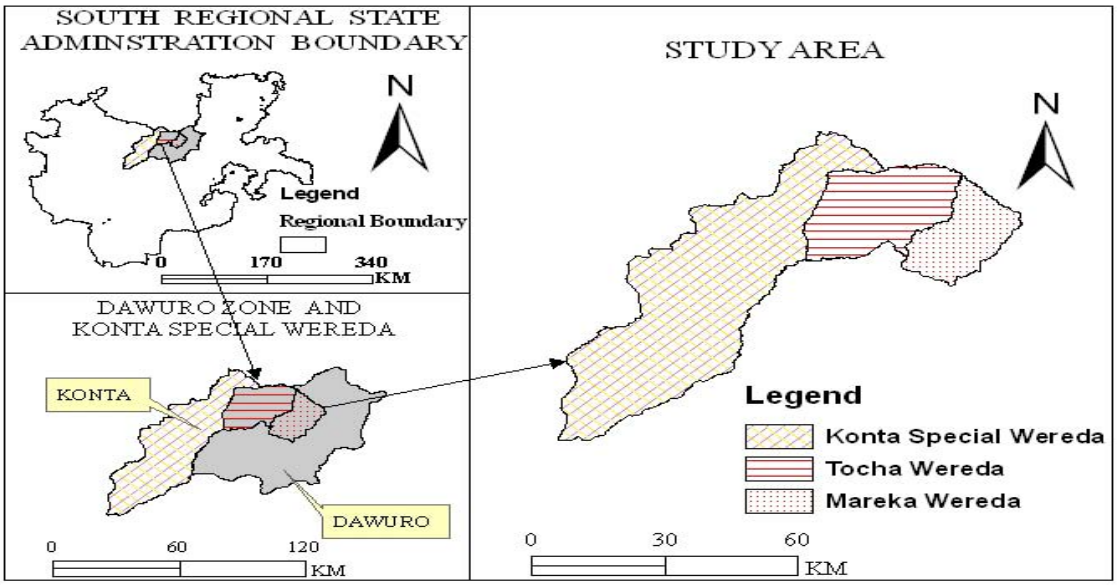

Figure 1 : Map of the study areas

c) Data Collection Procedure

A structured questionnaire, group discussion and secondary sources were used to gather data on sheep production system and husbandry practices.

d) Questionnaire and group discussion

Structured questionnaires were prepared, translated in to local language and administered to collect information on the existing socio-economic characters (sex, age, education level, household size, livestock possession, economic benefit of sheep and major production constraints), reproductive performances (age at first lambing , lambing interval, litter size and lambing pattern), flock structure, breeding management, selection criteria, culling age , castration practices, docking practices, feeds and feeding management, water source and watering , major diseases of sheep in the area, sheep production system and husbandry practices from each selected flock owners and key informants via interview.

Organized group discussion were held with clan or village leaders, Woreda agricultural experts(extension agents), sheep owners and elderly female and male member of the society who are known to have better knowledge on the present and past social and economic status of the area. Discussions were focused on the origin and history of the sheep population, special characteristics of the sheep in the area, chain of sheep market and exchange of sheep with neighbor zones and woreda, current status and major constraints of sheep, production system, and social bylaws on communal interest like communal gazing land, watering point and utilization of ram for breeding. Discussions were held using a prepared check list. Information on the description of the sheep population was recorded from direct counting of qualitative characters and measurements of quantitative characters from all members of the sampled sheep.

e) Data Management and Statistical Data Analysis

The collected data from each study site were checked for any error and corrected during the study period, coded and entered into computer for further analysis.

f) Questionnaire data

Data collected through questionnaire (survey) were entered into Statistical Package for Social Sciences (SPSS 16.0 for windows, release 16.0, 2007). An index was calculated to provide overall ranking for qualitative data such as constraints of sheep production, purpose of keeping sheep, function of male and female sheep and supplementary feeds 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.

The rate of inbreeding from effective population size for a randomly mated population was calculated as Ne = (4Nm Nf) / (Nm + Nf); Where Ne = effective population size, Nm = number of breeding males and Nf = number of breeding females. The rate of inbreeding coefficient (F) was calculated from Ne as ΔF = 1/2Ne (Falconer and Mackay, 1996).

III. Results and Discussion

a) General Household Information

A total of one hundred eighty households (60 from each district and 20 from each Peasant Association [PA]) were considered for the household survey in the current study. The result of demographic and socio-economic characteristics of the households is presented in Table 1.

Table 1 : Sex, education background and age structure of the household

Household	Dawuro Zone				Konta Special Woreda	
	Tocha Woreda		Mareka Woreda			
	N	%	N	%	N	%
Sex						
• Male	58	96.7	53	88.3	50	83.3
• Female	2	3.3	7	11.7	10	16.7
Education background						
• Illiterate	24	40.0	19	31.7	27	45.0
• Only read &write	9	15.0	22	36.7	10	16.7
• Only 1-8	14	23.3	12	20.0	18	30.0
• Only 9-12	13	21.7	7	11.6	5	8.3
Age						
• <30	12	20.0	15	25.0	26	43.3
• 31-40	16	26.7	25	41.7	21	35.0
• 41-50	13	21.7	16	26.7	10	16.7
• 51-60	12	20.0	4	6.6	3	5.0
• >60	7	11.6	0	0	0	0

In this study male headed household accounted for the largest proportion of the studied samples (respondents) throughout the study areas. Thus, the proportion of male headed household in Tocha, Mareka and Konta special woreda was 96.7%, 88.3% and 83.3%, respectively. Interviewed households in the study area have different educational backgrounds. The largest proportion of household heads in Tocha (40%) and Konta Special woreda (45%) were illiterate; whereas the largest proportion in Mareka woreda (36.7%) were only able to read and write. The proportion of household heads in grade 9-12 were 21.7% in Tocha; whereas the proportion for Mareka and Konta special woreda was 11.6% and 8.3%, respectively.

b) Farming Activities

In all the studied districts, farmers practice crop and livestock production. Both livestock and crop has vital role in each and every living process of the farmers (Table 2). In Dawuro zone (Tocha and Mareka) and konta special woreda farmers mainly grow barley, wheat, teff, sorghum, maize, been, pea, taro and enset (kocho).

Table 2 : Importance or use of major farming activities in the study area

Importance	Dawuro Zone				Konta Special Woreda	
	Tocha		Mareka			
	N	%	N	%	N	%
For food consumption						
• Crop production	60	100	60	100	57	95
• Livestock production	0	0	0	0	3	5
For Income						
• Crop production	7	11.9	6	10	25	41.7
• Livestock production	1	1.7	0	0	22	36.7
• Both	51	86.4	54	90	13	21.7

N = number of observation, %=Percentage of respondent (hose hold)

c) Livestock species composition in the study areas

The average livestock possessions in the study areas are presented in Table 3. The largest average number of livestock possessed by the three woreda was sheep, chicken, followed by cattle. Because of the fact that this study involved farmers who owned sheep, as a major criterion, all respondent (100%) across the study area had sheep. However, the proportion of farmers who owned cattle was 16.61%, 21.38% and 16.97% in Tocha, Mareka and Konta special woreda, respectively. The average holding of sheep at Tocha, Mareka and Konta, which was 11.35 ±2.33, 9.72±1.04 and 10.75±2.88, respectively, was lower than the average holding reported for Gumuz sheep (16.02 ± 14.1), comparable to 11.3 ± 1.27 reported for Adiyo Kaka sheep, but higher than 8.2 ± 2.05 reported for Horro

sheep (Solomon, 2007; Zewdu, 2008). The average number of pack animals (horses, mules and donkeys), however, was the lowest in the studied areas, except in Konta woreda where the proportion of horse and donkey is higher than that of goat.

Table 3 : Average (±SD) livestock species composition in Dawuro Zone and Konta Special Woreda

Location and livestock		N	Mean flock size	%	SD	Minimum	Maximum
Tocha							
	Cattle	57	3.75	16.61	1.43	1	6
	Sheep	60	11.35	50.27	2.33	5	15
	Chicken	58	4.28	18.95	2.11	1	10
	Donkey	5	1.2	5.31	0.45	1	2
	Mule	7	1.0	4.43	0	1	1
	Horse	17	1.0	4.43	0	1	1
Mareka							
	Cattle	59	5.05	21.38	1.29	2	8
	Sheep	60	9.72	41.15	1.04	6	13
	Chicken	60	5.38	22.78	2.06	2	11
	Donkey	16	1.38	5.84	0.5	1	2
	Mule	8	1.0	4.23	0	1	1
	Horse	11	1.09	4.61	0.3	1	2
Konta							
	Cattle	55	5.07	16.97	2.49	1	11
	Sheep	60	10.75	35.98	2.88	4	16
	Goat	6	1.67	5.59	1.21	1	4
	Chicken	41	6.22	20.8	3.74	2	20
	Donkey	2	2.5	8.37	2.12	1	4
	Mule	3	1.0	3.35	0	1	1
	Horse	12	2.67	8.94	1.67	1	6

d) Sheep Flock Structure

The overall mean sheep flock size was higher for Tocha Woreda followed by Konta and Mareka (Table 4). In Tocha woreda, breeding ewes accounted for the largest number (2.37±1.31; 20.7%) followed by ram lambs less than 6 months old (1.83±.65; 16%), castrates (1.65±.81), rams [6-12 months old] (1.61±.76) and ewes [6-12 months old] (1.51±.60). In Konta as well, breeding ewes accounted for the largest number (2.18±1.33; 20.2%). However, unlike Tocha, it was followed by castrates (2.0±1.8; 18.6%), ram lambs less than 6 months old (1.73±.65), rams [6-12 months old] (1.41±.65) and ewe lambs less than 6 months old (1.31±.56). In Mareka woreda, the largest number of sheep category in a flock was ram lambs less than 6 months old (1.70±.82; 17.6%) followed by castrates (1.65±.1.11; 17%), breeding ewes (1.48±.83; 15.3%), ewes [6-12 months old] (1.35±.48) and rams [6-12 months old] (1.34±.48). However, the number of breeding rams in a flock was generally small. In fact the proportion of breeding ram and ewe can determine the production of lambs in a flock. The proportion of breeding ewes (15.3-20.7%) obtained in this study was below 30% reported for Keffa and Bench-Maji ewes (Dejen, (2010), 46.8% reported for Menz breeding ewes and 49.2% reported for Afar ewes (Tesfaye (2008). The ratio of breeding ram to ewe was 1:1.98. This ratio is higher than 1:5.21 reported for Keffa and Bench-Maji (Dejen, 2010),, 1:6.7 for Gumuz Solomon (2007), 1:8.3 reported for Menz 1:17.4 reported for Afar sheep (Tesfaye, 2008).

Table 4 : Average sheep flock structure in surveyed households in the study areas

Sheep flock structure	Tocha			Mareka			Konta		
	N	Mean±SD	%	N	Mean± SD	%	N	Mean± SD	%
Ram lambs [less than 6 months old]	36	1.83±.65	16	31	1.70±.82	17.6	19	1.73±.65	16.0
Rams [6-12 months old]	31	1.61±.76	14.1	35	1.34±.48	13.8	24	1.41±.65	13.1
Breeding ram [older than 1 year]	18	1.05±.23	9.1	12	1.08±.28	11.1	17	1.0±.00	9.3
Castrates	48	1.65±.81	14.4	29	1.65±.1.11	17.0	22	2.0±1.8	18.6
Ewe lambs [less than 6 months old]	29	1.41±.67	12.3	23	1.06±.25	10.9	23	1.31±.56	12.1
Ewes [6-12 months old]	37	1.51±.60	13.2	42	1.35±.48	13.9	33	1.12±.54	10.4
Breeding ewes [older than 1 year]	45	2.37±1.31	20.7	50	1.48±.83	15.3	48	2.18±1.33	20.2

e) Trend in Livestock Population and Land Holding

As indicated in (Table 5). The majority of the farmers in Tocha woreda reported a decreasing trend in cattle population (81.4%), while slightly larger proportion of farmers in Mareka (48.3%) and Konta (49.1%) woreda reported an increasing trend in cattle population. On the other hand, majority of the households studied across all the woreda reported an increasing trend in sheep population (53.7-86.4%). A decreasing pattern of land holding was observed by most of the respondents (91.7 %) in Tocha, while the largest proportion of farmers in Mareka (76.6%) and Konta reported (58.3%) that they observed no change. Nevertheless, still some number of farmers in Mareka (21.7%) and Konta (31. %) woreda admitted a decline in landholding pattern. The increase in human population, lack of expansion of land, over farming of land and land degradation because of erosion are some of the reported factors for declining landholding in the present study.

Table 5 : Trend in Livestock Population and Land holding

Trends	Woreda					
	Tocha		Mareka		Konta	
	N	%	N	%	N	%
Cattle population						
• Increase	11	18.6	29	48.3	27	49.1
• Decrease	48	81.4	27	45.0	22	40.0
• No change	0	0	4	6.9	6	10.9
Sheep population						
• Increase	51	86.4	35	58.3	29	53.7
• Decrease	8	13.6	25	41.7	19	35.2
• No change	0	0	0	0	6	11.1
Land holding Status						
• Decrease	55	91.7	13	21.7	19	31.7
• Increase	5	8.3	1	1.7	6	10.0
• No change	0	0	46	76.6	35	58.3
Reason for decreasing land holding						
• Increase in population	47	85.5	13	52	10	27.0
• Lack of expansion of land	_	_	12	48	23	62.2
• Over farming of land	7	12.7	_	_	1	2.7
• Degradation of land because of flood	1	1.8	_	_	3	8.1

f) Purpose of Keeping Sheep

i *Purpose of keeping male Sheep*

The purpose of keeping male sheep by farmers in the study areas is presented in Table 6. The primary purpose of keeping male sheep in Tocha woreda was reported to be for saving (to be used as an asset) with an index value of 0.28, followed by income generation [index=0.21]. However, keeping sheep for meat purpose in Tocha stands last [index=0.13].

Table 6 : Purpose of keeping male sheep as ranked by respondents in the study areas

Purpose of keeping male sheep by Woreda	Index
Tocha Woreda	
• For meat	0.13
• As indictor of wealth	0.18
• For breeding	0.18
• As an asset (saving)	0.28
• As income source	0.21
Mareka Woreda	
• For meat	0.21
• As indictor of wealth	0.11
• For breeding	0.11
• As an asset (saving)	0.30
• As income source	0.25
Konta Special Woreda	
• For meat	0.16
• As indictor of wealth	0.11
• For breeding	0.12
• For manure	0.16
• For skin	0.08
• As an asset (saving)	0.18
• As income source	0.18

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 each purpose divided by sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) for all purpose of keeping sheep in a production system.

Similar to Tocha, the primary reason for keeping male sheep in Mareka woreda was for saving (to be used as an asset) with an index of 0.30 followed by income generation (index= 0.25), and meat (index= 0.21). However, the primary purpose of keeping male sheep for the Konta farmers was both for saving (as an asset) and income generation with comparable index values of 0.18, followed by manure and meat with the index of 0.16. Unlike Tocha and Mareka, farmers in Konta woreda keep sheep for manure production and skin as well. In general, this study showed that farmers across all the woreda keep sheep for multipurpose. The finding is in agreement with Abebe (1999) who reported that farmers in central highlands of Ethiopia rear sheep for multi-purposes.

ii *Purpose of keeping female Sheep*

The purposes of keeping female sheep by farmers in the study area are presented in Table 7. As breeding is a means to maintain the flock the primary purpose of keeping female sheep in Tocha woreda was for breeding with the index of 0.48 followed by saving (to be used as an asset), income generation and meat with an index of 0.24, 0.14 and 0.13, respectively. For Mareka farmer's the primary purpose of keeping female sheep was to use it as an asset with an index of 0.32, followed by for breeding, income generation and for meat with the index of 0.27, 0.26 and 0.14, respectively. Konta farmers give priority for breeding with an index of 0.32, followed by meat, as an asset and income generation with an index of 0.28, 0.23 and 0.16, respectively. From this study it is apparent that farmers in Tocha and Konta are different from Mareka since the former ranked the primary purpose of keeping female sheep for breeding than the latter. The finding is in contrast with Kosgey (2004) who observed low ranking of small ruminants for breeding purpose among the smallholders and pastoralists in Kenya.

Table 7 : Purpose of keeping female sheep in the study area as ranked by respondents

Purpose of keeping by Woreda	Index		
	Tocha	Mareka	Konta
• For meat	0.13	0.14	0.28
• For breeding	0.48	0.27	0.32
• As an asset (saving)	0.24	0.32	0.23
• As income source	0.14	0.26	0.16

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 each purpose divided by sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) for all purpose of keeping sheep in a production system.

g) Feed source and grazing management

Feed resources commonly used by farmers in the study area across the different seasons are presented in Table 8. The quantity and quality of feed resources available for animals primarily depends upon the climatic and seasonal factors (Zewdu, 2008). In this study, natural pasture (fig. 2), improved forge, hay, crop residue and crop after math are the common feed resources used in the study area. Natural pasture was the major feed source in rainy season across all the studied woreda. However, the major feed resource commonly used in dry season was crop residue as reported by 76, 98 and 85% of the farmers in Tocha, Mareka and Konta Woredas, respectively. Even though the use of hay was moderate in the study area, farmers in Tocha and Konta use hay both in rainy and dry season. The importance of natural pasture as major feed resource for sheep was also reported by Solomon (2007). In general, natural pasture, crop residue, crop after math, hay and improved forge serve as feed sources during both the rainy and dry season in Tocha. In Mareka, however, natural pasture, crop residue and crop aftermath are the main feed sources during rainy season, while during dry season crop residue, natural pasture, crop aftermath and hay are the major feed resources for livestock. The common feed resources in rainy season in Konta include natural pasture, crop residue, and crop after math, improved forge and hay.

Seasonal feed shortage is among the major constraints that limit sheep production in the study area as reported by 98.3%, 100% and 73.3% of the respondents in Tocha, Mareka and Konta Woreda, respectively. Similarly, feed shortage was reported to be a major production constraint in many parts of the country (Abebe, 1999; Samuel, 2005; Tesfay 2008). The Period of critical feed shortage in the study area ranges from June to November. This period covers long rainy season, where most of the arable lands are covered by crops, and short dry season until harvesting the grains. To manage feed shortage farmers provide supplements like local brewery and liquor residues (Tella and Katikalla atella), grains, leaves of inset, grass hay , crop residues.

Figure 2 : Tocha sheep grazing in natural pasture

The major crop residues used for supplementation by Tocha farmers were wheat (74.1%), barely (79.3%), sorghum (24.1%), maize (74.1%), beans (38.6%) and peas (17.2%). Similarly farmers in Mareka woreda supplement their animals with wheat (68.3%), barely (68.3%), sorghum (68.9%) maize (100%) beans (68.3%) and peas (100%) residue. The proportion for Konta farmers was 25%, 21.7%, 16.7%, 71.1%, 23.3% and 18.3% for wheat, barley, sorghum, maize, been and pea, respectively.

The use of common salt (mineral supplementation) as supplement for sheep was well recognized and practiced by majority of farmers in all study sites. The same practice was reported on Bonga and Horro sheep keepers (Zewdu, 2008).

Table 8 : Feed resources commonly used in the study area by Woreda and season

Type of feed sources	Tocha				Mareka				Konta			
	Rainy season		Dry season		Rainy season		Dry season		Rainy season		Dry season	
	N	%	N	%	N	%	N	%	N	%	N	%
• Natural pasture	60	100	46	78	60	100	40	67	56	93.3	39	65
• Improved forage	8	14	10	16.9	0	0	0	0	17	28.8	13	21.7
• Hay	13	22	14	23.7	0	0	35	58	3	5.3	15	25
• Crop residue	46	78	45	76.3	20	33.3	59	98	39	65	51	85
• Crop after math	39	66	32	54.2	12	20	40	67	26	44.1	18	30

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

As showed in table 9, during the rainy season majority (64.4%) of sheep owners in Tocha and Konta (58.3%) freely release their sheep for grazing where as in Mareka majority (85 %) of the farmers practice tethering (Fig. 3). However, during the dry season 59.3% and 53 % of Tocha and Konta farmers, respectively, herded their sheep. In Mareka tethering was the most important practice mostly because of it avoids crop damage; protect the stock against theft, ease of protecting from predation and proper utilization of the limited grazing land. Such reasons were reported in the area earlier (Dejen, 2010; Zewdu, 2008; Workneh, 1992).

Table 9 : Grazing method practiced in the study area in different season

Grazing method	Tocha				Mareka				Konta			
	Rainy season		Dry season		Rainy season		Dry season		Rainy season		Dry season	
	N	%	N	%	N	%	N	%	N	%	N	%
Free grazing	38	64.4	26	44.1	19	31.7	59	88	35	58.3	32	53
Herding	30	50.8	35	59.3	39	65	0	0	26	43.3	32	53
Rotational grazing	10	16.9	16	27.1	21	35	5	8.3	11	18.6	13	22
Tethering	22	37.3	0	0	51	85	0	0	23	38.3	27	45

N.B. More than one response was possible

Figure 3 : Mareka ewe tethered at around homestead

h) Water sources and watering

According to the respondent (Table 10), river was the major water source in dry season across all the study woreda (64% of Tocha farmers; 51.7 % of Mareka farmers and 58 % of konta farmers). Similarly, river was the major water source during rainy season in Tocha (67.9%) and Konta (47%), while in Mareka spring water (48%) was the main water source during rainy season. Solomon (2007) also reported that river was the major water source in Gumuz sheep in north western lowland of Amhara region.

During the dry season, Tocha (62.5 %), Mareka (96.7%), and Konta (60%) farmers allowed their flock to take water as they needed and when they want, where as 37.5%, 3.3% and 35% of the farmers allowed access to water only once per day. On the other hand, during rainy season majority of the farmers in Tocha (92.9 %), Mareka (100 %) and Konta (58.3%) provided water as they needed and when they want.

Table 10 : Water sources and watering in the study area by Woreda and season

Water source	Tocha				Mareka				Konta			
	Dry season		Wet season		Dry season		Wet season		Dry season		Wet season	
	N	%	N	%	N	%	N	%	N	%	N	%
Deep water hole	1	1.8	–	–	–	–	–	–	–	–	–	–
Pond	19	34	10	17.9	7	11.7	7	12	–	–	7	13
River	36	64	38	67.9	31	51.7	24	40	34	58	27	47
Spring water	–	–	8	14.3	22	36.7	29	48	18	31	9	16
Rain water	–	–	–	–	–	–	–	–	–	–	6	11
Tape water	–	–	–	–	–	–	–	–	–	–	2	3.5
Mix of pond, spring and rain water	–	–	–	–	–	–	–	–	7	12	6	11

i) Housing

In the study area, sheep are housed in different ways (Table 11). The majority of the respondent in Tocha (82.1%), Mareka, (66.7%), and Konta (68.3%) house their sheep in the main house together with the family. Separate sheep house was also reported by some farmers across all the woreda. However, the proportion of farmers using Kitchen to house sheep is negligible and limited to Mareka and Konta woreda only.

Table 11 : House types for sheep in the study area

House types	Tocha		Mareka		Konta	
	N	%	N	%	N	%
In the main house	46	82.1	40	67	41	68.3
Separate sheep house	10	17.9	19	32	13	21.7
Kitchen	–	–	1	1.7	6	10

j) Fattening and castration sheep

i *Fattening*

Sheep fattening is practiced by 89.7% farmers in Tocha, 100% farmers in Mareka and 93.3% farmers in Konta woreda. This study demonstrates that majority of the male sheep in a household is kept for fattening purpose and sold at an early age. Among the feed types used for fattening across all the woreda, natural pasture (grazing), crop residue, local brewery residue (*atella* of *katikalla* and *tella*), grain, salt, leaf and root of sweet potato, concentrate and improved forge were the major feed resources used for fattening. In the study area, fattening usually practiced following the end of the main rainy season and in the beginning of dry season coilciding with the availability of good quality and quantity natural pasture, better forage production and aim to specific market (holiday market). Some farmers also reported that they perform fattening activity twice a year, during the time when the quantity and quality of available feed resource is high.

ii *Castration*

Tocha (77.8%), Mareka (84.7 %) and Konta (96.7%) sheep owners practiced castration. All sheep owners in three districts use traditional castration method to castrate their sheep by crashing the vas deference using stone. Majority of the Tocha (64.3%), Mareka (100 %) and Konta (93.2%) rams were castrated from 6 month to 18 month of age. Farmers believed that castration at early age affect the growth of the sheep.

Castration was primarily practiced to improve the fattening potential in all districts. In the study area the aim of castration was to sell at higher price and gaining much profit form fattened sheep. Tocha (90.5%), Mareka (92.3%) and Konta (86.2%) farmers gave more attention for fattening while 4.8% of Tocha and 3.4% of Konta farmers castrate their sheep to avoid unnecessary mating. In some rare cases, farmers in Tocha (2.4%) and Konta (6.9 %) castrate rams to improve ram temperament so as to avoid ram run from the flock.

k) Source and Current status of Dawuro and Konta sheep types

In this study, focal group members (key informant) believed that Dawuro sheep breed was kept for long past by their ancestors and transferred to the current generation. They pointed out that this sheep type is distributed to Jimma (Oromiya) and Konta special woreda from Dawuro zone. They strongly believe that no any other sheep breed entered in to the flock from the neighboring zones and woreda. However, to somehow, they agree on similarities between Keffa (Bonga) and Dawuro sheep in their appearance, even though the two breeds are different in various characters. Example Keffa sheep is large in body size than Dawuro sheep and have got relatively long and wide tail. Zewdu (2008) reported that Bonga sheep had wide and long tail with straight pointed end and twisted end. As indicated by Tsedeke *et al.*, (2011) Sheep from Adilo, Alaba, Kambata Tambaro, Dawuro, Wolaita, Gamo Gofa and Hadiya areas of the SNNP region are collectively called 'Wolaita sheep' and according to the morphological and molecular characterization work of Ethiopian sheep breeds by Solomon(2008) the Dawuro type are categorized under breed of Arsi and population of Arsi-Bale and Adilo.

Focal group members recognized that starting from long past selection against the horned sheep was practiced by their ancestors and still they believed that horned sheep are very thin, stunted growth and low quality for meat. Consequently, the present Dawuro sheep population is almost hornless.

On the other hand, key informant in Konta special woreda believed that the Konta sheep inter in to the special woreda from the neighboring zone of Keffa through marketing exchange. Group members also indicated that the sheep population of Dawuro and Konta are currently at increasing trend because of increased awareness towards the better market opportunity created this time. Thus, today sheep populations of Dawuro and Konta are marketed and distributed to Jimma (Oromiya zone) and Chida (the capital of the special woreda).

l) Typical Features of Dawuro and konta Sheep Types

For both Dawuro and Konta sheep, fattening potential, twining rate, short lambing interval and resistance to disease and cold climatic condition are considered as special merits of the sheep types. The coat color is dominated by dark and light red brown (Figure 4) and the tail is wide and long with straight pointed end and twisted end. Male and female are hornless (polled), the ear is long, and the hair is short and smooth. Similarly Zewdu (2008) reported that Bonga sheep population resembles that of Dawuro and Konta sheep types.

Figure 4 : Sheep from Dawuro (left) Sheep from Konta (right)

m) Effective Population Size and Level of Inbreeding

Phenotypic diversification of sheep breed can be resulted after the process of interbreeding of different populations. On the other hand, homogeneous sheep breed can be the result of the effect of inbreeding where increased level of inbreeding and decreased genetic diversity may be the result of the utilization of breeding ram/s born with in the flock, small flock's size, random mating and lack of awareness about inbreeding. In this study the small number of breeding ram per household is believed to increase the level of inbreeding. The effective population size (Ne) and the rate of inbreeding coefficient (ΔF) calculated for Tocha, Mareka and Konta sheep are presented in Table 12. When sheep flock of a household were not mixed, ΔF for sheep in Tocha, Mareka and Konta were 0.17, 0.20 and 0.18, respectively. The value was higher than the maximum acceptable level of 0.063 (Armstrong, 2006). For Tocha sheep, Ne was higher than the Ne of the other two districts but ΔF was higher (0.2) for Mareka sheep. The result was also higher than what has been reported for Chena (0.0998), Gesha (0.1199), Semien bench (0.1873) and Debub bench sheep (0.0833). Tesfaye (2008) reported lower ΔF of 0.079 than the present result for Menz and 0.2 for Afar sheep.

Table 12 : Effective population size and level of inbreeding when flocks of sheep are not mixed in Dawuro (Tocha and Mareka) and Konta woreda

District	When flocks are not mixed			
	N_m	N_f	N_e	ΔF
Tocha	1.05	2.37	2.91	0.17
Mareka	1.08	1.48	2.5	0.20
Konta	1	2.18	2.74	0.18

N_e = effective population size; ΔF = coefficient of inbreeding. N_m = number of male; N_f = number of female.

n) Coat Color Preferences

Farmers in Tocha and Mareka prefer a particular coat color such as red (solid or light), brown, (solid or light), grey and white. However, they give less attention for black coat colour. Preference of farmers for a particular coat color might be associated with belief, market demand and socio-cultural practices. Like Dawuro (Tocha and Mareka), farmers in Konta also give more attention for red (solid or light), brown, (solid or light), and grey coat colour. In contrast to Dawuro zone, black and white colour was not preferred at all in Konta special woreda. In general, this study showed that black colored sheep are less preferred by almost all respondents across all the districts. The damaging effect of predator on sheep production around Konta is very common. Thus, white color is less preferred by Konta farmers since they believe that white colored animals are easily attacked by predator, disease and harsh environment.

o) Disease

It is well documented that disease control is very basic for genetic improvement of livestock (Solomon, 2007). Healthy sheep with normal physiological function and structure that enable the sheep to attain highest production is vital. In this study internal and external parasite, Diarrhoea and *megaga (local name) were* the most frequently reported diseases

of sheep across all the studied woreda (Table 13). Almost all farmers in Mareka, 91% in Tocha and 75% farmers in Konta use modern drugs to treat their sheep against the disease.Similarly about 92.9 %, 100 % and 68.3% of farmers in Tocha, Mareka and Konta woreda, respectively, get veterinary service from governmental clinics. However about 1.8% and 5.4% farmers in Tocha use private clinic and simple drugs from open market. About 6.7% farmers in Konta used drugs from open market while 25% get veterinary service from both governmental clinic and shop/open market. The majority of farmers had access to veterinary services in less than one km distance. Only 1.8% farmers in Tocha and 6.7 % farmers in Konta travel about 15km to get veterinary service. On the other hand 8.8% of farmers in Tocha, 33.3% in Mareka and 11.7% in Konta travel 6km for veterinary service.

Table 13 : List of diseases reported by farmers in the study woredas

Woreda	Common name of the disease	Local name of the disease	No	%	Description of the symptoms
Tocha	Pasteurellosis	-	1	1.67	-
	Sudden death	*Attadafi*	4	6.67	Acute death of sheep
	Coccidosis	*Azurit*	1	1.67	Emaciation and anemia
	Internal and external parasite	*Tegega tewasiyan*	13	21.7	Rough hair, loss of appetite and Diarrhea
	Common cold	*Sal*	4	6.67	Coughing
	-	*Yechenkelat mabet*	8	13.3	-
	-	*Megaga*	9	15	Unable to balance head
	Diarrhea	*Kezen*	20	33.3	Diarrhea
Mareka	Internal and external parasite	*Tegega tewasiyan*	34	56.7	Rough hair, loss of appetite and diarrhea
	-	*Megaga*	6	10	Unable to balance head
	Diarrhea	*Kezen*	20	33.3	Diarrhea
Konta	Internal and external parasite	*Tegega tewasiyan*	19	31.7	Rough hair, loss of appetite and Diarrhea
	Common cold (coughing)	*Sal*	3	5	Coughing
	-	*Megaga*	14	23.3	Unable to balance head
	Diarrhea	*Kezen*	24	40	Diarrhea

p) Docking

In this study farmers reported that docking is practiced by 93% of farmers in Tocha, 96.7% in Mareka and 90% in Konta. According to the respondents, docking female sheep was done for various reasons. Thus, all the sampled farmers in Tocha, 86.2% in Mareka and 59.6% in Konta woreda reported that they practice docking for fattening (farmers believes that undocked ewe could not gain body weight easily), ease of mating (enable the ram to mate easily), ease hygiene during delivery and to have better market price (docked ewe has better market demand than their undocked contemporaries).

q) Sheep Disposal and Market Age

The average market and culling age of sheep in Tocha, Mareka and Konta are presented in Table 14. The average market age of male sheep in Tocha, Mareka and Konta was 11±2.74, 11.4 ±1.37 and 12.43 ±4.8 months, respectively. Similarly, females are sold at an age of 12.78 ±2.46, 12.05 ±2.19 and 13.8 ±5.7 months in Tocha, Mareka and Konta, 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. Dawuro sheep are highly preferred and get highest prices due to their pleasant flavor and tender meat, high carcass and edible non-carcass component yields and high aesthetic value (Tsedeke *et al*., 2011). Most of the time selling and buying process of sheep were carried out in big nearby markets on market days of the week. However, it is not uncommon to sell sheep any day of the week mostly to local traders and to lesser extent to consumers and other farmers. Upon collection of sheep from farmers, local traders in turn sell sheep to traders from nearby zones, who ultimately truck/trek sheep to the nearby cities, mainly to Jimma and Wolayita (Figure 5). Some time the process of marketing sheep takes place without the participation of local traders in which case farmers sell their sheep directly to the main traders.

Figure 5 : Konta sheep being trekked to Jimma city for sell

Though shortage of capital force farmers to sell their sheep any time of the year, , farmers usually prefer to sell their sheep in particular time of the year especially during local holidays and festivals (E.g. Ethiopian New Year, Christmas, Epiphany, Easter, *Meskel*) .because of high demand and better price for sheep meat. However, farmers across all the woredas stressed that long distance trekking of sheep due to inadequate transportation facilities, fluctuation of market price of sheep and lack of market information system are the major problems that challenge sheep marketing.

Table 14 : Average marketing and culling age of sheep (mean ± SD) in the study area

Woreda	Parameter	N	Mean ± SD
Tocha	Market age (months)		
	• Male	58	11.0±2.74
	• Female	58	12.7±2.46
	Culling age (months)		
	• Male	58	35.1±6.36
	• Female	57	35.1±13.2
Mareka	Market age (months)		
	• Male	58	11.4±1.37
	• Female	59	12.0±2.19
	Culling age (months)		
	• Male	60	35.6±8.76
	• Female	59	77.0±15.72
Konta	Market age (months)		
	• Male	60	12.4±4.8

• Female	60	13.8±5.7
Culling age (months)		
• Male	60	39.9±7.2
• Female	60	72.9±12.36

The average culling (withdraw from breeding) age of male sheep in Tocha, Mareka and Konta was 2.93, 2.97 and 3.33 years, respectively. In Tocha females culled at the age of 6.07 years, while in Mareka and Konta it is 6.42 and 6.08 years, 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. Ranking of selling priority of sheep is presented in Table 15. In Tocha castrated sheep, ram lambs and ram are sold first, second and third with index of 0.205, 0.2 and 0.199, respectively. Similarly in Mareka castrated sheep, breeding ram and breeding ewe were sold first, second and third with index of 0.3, 0.22 and 0.21 respectively.

Castrated sheep, ram lambs and aged ewe, were sold first, second and third with index of 0.19, 0.16 and 0.128, respectively, in Konta woreda.

Table 15 : Ranking of selling priority for different sheep category

District and sheep category	Rank1	Rank2	Rank3	Index	Rank
Tocha					
❖ Ram lambs	75	25	0	0.2	2
❖ Ram	80	8.6	11.4	0.199	3
❖ Ewe	0	95.2	4.8	0.145	5
❖ Breeding ram	5	20	75	0.096	6
❖ Castrated	76.3	23.7	0	0.205	1
❖ Aged ewe	0	66.7	33.3	0.148	4
Mareka					
❖ Ram	25	57	17.5	0.22	2
❖ Ewe	0	100	0	0.21	3
❖ Breeding ewe	0	40	60	0.15	4
❖ Castrated	81.4	18.6	0	0.3	1
❖ Aged ewe	0	3	97.3	0.11	5
Konta					
❖ Ram lambs	50	50	0	0.16	2
❖ Ewe lambs	25	25	50	0.116	4
❖ Ram	16.7	14.3	69	0.098	6
❖ Ewe	9.1	45.5	45.5	0.108	5
❖ Breeding ram	0	27.8	72.2	0.08	8
❖ Breeding ewe	0	50	50	0.09	7
❖ Castrated	98.2	1.8	0	0.19	1
❖ Aged ewe	2	90	8	0.128	3

r) Constraints of Sheep Production

Identifying the obstacles of sheep production is a base to solve the problem and to improve sheep genetic resource and sheep productivity. Thus, major constraints challenging sheep production in the study area are presented in Table 16. This study demonstrated that disease and feed shortage are the major constraints challenging sheep production across all the studied woreda. In Tocha disease accounted for the lions share (index=0.35) followed by feed shortage (index=0.30). In Mareka, however, feed shortage was the major constraint with the index of 0.29 followed by disease (index=0.24). Farmers in Konta special woreda ranked disease as a primary problem (index=0.22) followed by feed shortage (index=0.19). Shortage of labor was reported as a limiting factor for sheep

production in Tocha (index=0.21) followed by Mareka (index=0.14) and Konta woreda (index=0.12). Even though predator was not a major concern in Tocha woreda, it was reported to be a major problem in Konta (index=0.19) followed by Mareka (index-0.18). Genotype was considered as a problem across all the woreda, but it was not serious problem in Konta (index=0.09) as compared to Mareka (index=0.14) and Tocha (index=0.12).

Table 16 : Major constraints of sheep production in the study area

Woreda	Constraints	Index
Tocha	Disease	0.35
	Feed shortage	0.30
	Labor shortage	0.21
	Genotype	0.12
Mareka	Feed shortage	0.29
	Disease	0.24
	Predator	0.18
	Labor shortage	0.14
	Genotype	0.13
Konta	Disease	0.22
	Feed shortage	0.19
	Predator	0.19
	Labor shortage	0.12
	Genotype	0.09
	Water	0.07
	Market problem	0.07

IV. Summary and Conclusion

Planning of any breeding program including community based breeding strategy and /or breed improvement scheme needs the identification of genotypic and phenotypic traits of the particular sheep breed and also to know the genetic ability of that breed and the production environment that can influence productivity of the animal. The study was conducted in Dawuro zone and Konta special woreda of South Nations Nationalities and Peoples Regional State of Ethiopia. Even though the study areas are rich in livestock resources including small ruminants, nothing has been done to characterize, identify and document the existing indigenous sheep types and its production system.

A total of 180 households were selected for production system characterization, and 630 mature sheep were sampled for phenotypic characterization of sheep population (qualitative and quantitative characters).The study revealed that, mixed crop-livestock production system was the dominant form of production system across all the locations considered. In Dawuro zone (Tocha and Mareka) and konta special woreda, farmers grow mainly barley, wheat, *teff*, sorghum, maize, been, peas, taro and *enset* (*kocho*) and posses different species of livestock cattle, sheep, poultry, donkey, mule, horse and goat. The average number of sheep per household in Tocha, Mareka and Konta was 11.43, 9.66 and 10.75 sheep, respectively. Ewes older than 1 year accounted for the largest proportion in Tocha (2.37±1.31) and Konta (2.18±1.33) sheep flock, while ram lambs aged less than 6 months accounted for the highest proportion in Mareka sheep flock. Farmers keep male sheep mainly as an asset (saving) and income generation, and female sheep for breeding and as an asset as well.

Natural pasture and crop residue were the main feed sources during rainy and dry seasons across all the woreda. The main source of water for sheep in the study areas were rivers and spring water, and the majority of farmers reported that they allow their flock to get watered as they needed and when they want.

Mostly, sheep get shelter inside the main house. As well as separate sheep house and kitchen were also reported as sheep houses in rare case. Fattening and castration was practiced by almost all sheep keepers.

Random mating or uncontrolled breeding, as a result of communal grazing and common watering point, was the common breeding practice in the study area. Most of households keep only one breeding male

and do not permit inbreeding. All farmers in Mareka and most farmers in Tocha and Konta select breeding ram and ewes based on physical appearance and coat color.

Sexual maturity (age at puberty) was 11.05±1.6, 10.88±1.7 and 9.5±1.4 months for males and 11.13±2.7, 10.8±1.9 and 9.5±1.4 months for females in Tocha, Mareka and Konta, respectively. In this study the average age at first lambing for Tocha, Mareka and Konta sheep was 12.88±1.7, 14.75±1.8 and 14.77±1.8 months, respectively. The average lambing interval for Tocha, Mareka and Konta sheep was 11.62±3.8, 10.33±4 and11.02±3.8 months, respectively The average reproductive life span of Tocha, Mareka and Konta ewes were 9.17±1.70, 9.82±1.51and 9.28±1.62 years, respectively. The results of this study showed that on average an ewe can produce 8.57±3.7 (Tocha), 8.62±4.1 (Mareka) and 10.78±4.7 (Konta) lambs in her life time. Twining rate was reported to be higher for Konta (39.06%) and Mareka (37.8%) as compared to Tocha (24.75 %) sheep.

Internal and external parasites, Diarrhoea and *megaga (local name)* were the major diseases reported for sheep in all the woreda. Feed shortage and disease are the major production constraints in all the woreda. The other problem of sheep production in Mareka and Konta was predator; especially in Konta special woreda the problem was sever. Majority of the sampled farmers in the study area practice docking.

On the other hand,

Increased level of inbreeding and decreased genetic diversity may be the result of the utilization of breeding ram/s born with in the flock, small flock's size, random mating and lack of awareness about inbreeding. In this study the small number of breeding ram per household is believed to increase the level of inbreeding.

V. Recommendations

As farmers pointed out the main obstacle for the sheep production in the study area was disease. Thus, efforts should be geared to control the disease such as detail study and identification of major sheep diseases, planning of adequate health control measures and working for its implementation and fast and efficient vet service. Traits which are very important in sheep productivity are the outcome of genotype and environment. Thus supply of feed (quantity and quality) both during the dry and rainy season should be improved. Establishment of standardized marketing systems with market information system, and infrastructure should be in place.

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