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Sheep Fattening Practices in Fogera District, Amhara National Regional State, Ethiopia.

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Abstract
The study was conducted in Fogera district with the objectives to understand farmers' sheep fattening practices, and to identify the opportunities and challenges of sheep fattening practices. The study area was stratified into three groups based on agro- ecology in Mizuwa watershed i.e., upper, medium and lowers with an average altitude of 2061, 1853 and 1794 m.a.s.l, respectively. Seven kebeles were selected purposively from these agro-ecologies. A total of 140 households (HHs) were selected randomly that is twenty from each kebeles. Each HHs was interviewed with a semi-structured questionnaire. General issues related to sheep fattening practices, opportunities and challenges were obtained through group discussion with key informants. Data analyses were carried out using both SPSS software and index method. In the study area about 44.3% of the respondents were involved in sheep fattening practices. The major available livestock feed resources identified in the study area were natural pasture 28.6%, crop residue 27.75%, stubble grazing 13%, hay 13.45%, fodder trees and improved forages 14% and agro industrial by products 3.2%. Majority (61 %) of the respondents used separated room in the family house for fattening sheep. More than 63% of the respondents used veterinary service. Three months of feeding of fattening sheep was reported by majority of HHs. The reported major constraints for sheep fattening practice in the study area in the order of importance were feed shortage, disease, land, breed, capital, house, market and water. As an opportunity, however, at present sheep population are at increasing rate and farmers are also looking for the availability of seasonal feed resource like grass pea residue, rice bran and other crop residues. Hence, detail studies on suitable sheep breed, chemical composition and digestibility of the major available supplement feeds are further required to plan a sustainable sheep fattening program at smallholder level.
Keywords: Agro ecology, Sheep fattening

INTRODUCTION

Livestock perform multiple functions in the Ethiopian economy by providing food, cash income, promoting saving, social functions, and employment. Feed shortage is one of the limiting factors for increasing production and productivity of small ruminant in most of the agro-ecological zones in Ethiopia (IPMS, 2010). As demand for livestock products increases (FAO, 2009) and agricultural intensification gaining a momentum, livestock, particularly small ruminant, became an important agricultural enterprise in Ethiopia (Awgichew Ayalew, 2000). The estimated livestock population comprises of approximately; cattle, sheep, goat, equines, camel, beehives and poultry of about 52.13 million, 24.2 million, 22.6 million, 8.8 million, 0.99 million, 5 million and 44.89 million respectively (CSA, 2011/12).

Sheep fattening is a common practice in different parts of the country, though the degree of fattening and resource base differs markedly. Less than 39% of the farmers who owned small ruminants practice some form of fattening before marketing while majority of the farmers sale their animals earlier before the animals attaining the optimum market weight (Solomon Abegaz.*et al*, 2005; Getahun Legesse, 2008). Fattening is generally profitable because the value per kilogram of live weight increases as both weight and condition increase (ESGPIP, 2012).

Fogera district is very well known by Fogera cattle breed, emerging sheep fattening practice and cereal crop production (mainly rice production) and the resulting crop-residues could be used as potential feed source for sheep fattening. Although, huge supply of crop residues is expected in the district; there is little information reported about its utilization for sheep fattening in Fogera district. Although Fogera district has large resource of sheep population and lack of management practices. This study was designed to generate baseline information on sheep fattening practices and to identify the major development constraints and opportunities for sheep fattening in the district.

MATERIALS AND METHODS

The Study Area

The research was conducted in Fogera district north western Ethiopia. It lies between 110° 41' to 110° 53' north latitude and 370° 41' to 110° 53' east longitude and at altitude of 1802 meters above sea level (m.a.s.l.) and with annual rainfall range from 1,000–1,500 mm. The mean maximum and minimum temperature are 11^0C and 27^0C, respectively.

Sampling Methods and Sample Size

In the current study, information was first gathered from Fogera district agricultural office about traditional sheep fattening activity in each kebele of the district. Considering the 28 *kebeles* under each traditional agro-ecological zone classification using secondary data obtained from FWARDO; mountain and valley bottom (22 *kebeles*) and plain area (6 *kebeles*) agro-ecology were categorized. In a watershed (Mizuwa watershed) purposive sampling procedure was used to select *kebele* administrations and simple random sampling was used to select households per *kebele* administrations to conduct survey. The survey was undertaken in seven *kebeles* stratified based on watershed location as upper land (Chalma, Alember), mid land (Woji awuramba, Diba sifatra, Quhar Michael) and lower lands (Abua kokit and Nabega) and 20 heads of the households (HHs) were randomly selected and interviewed from each *kebele* administrations. Therefore, a total of 140 HHs were used in the study.

Data Collection

Survey data were collected by interviewing the farmers with a semi-structure questionnaire. One day orientation was given to four district experts and three development agents a total of seven enumerators on how to deliver the questionnaire. The interview was done with in Amharic local language. The major issues raised in the questionnaire interview were: sheep production and fattening practices; feed sources for fattening; constraints and opportunities of sheep fattening. Focus group discussion was also conducted in the study area to complement the information which obtained through questionnaire. Participants involved in the focus group discussion were elders (men and women), administration members, and livestock experts both at district and peasant administration level.

Field observation was made by the researcher to enrich the data about feeding, watering, housing, and healthcare of the fattening sheep, utilization and management of communal grazing land and crop-residues, local brewery by-products (*atela*) and feed resource situation.

Statistical Analysis

Statistical package for social science (SPSS, version 20, 2011) was used for the analysis of the survey data. Person Chi-square with absolute frequency and percentage used for ranking of different levels within the group of variables. Index was calculated for questions that require ranking of the response. Index was computed with the principle of weighted average according to the following formula as employed by (Musa *et al*. 2006):

Index = $R_n*C_1+R_n\text{-}1*C_2\ldots R_1*C_n/\sum R_n*C_1+ R_n\text{-}_1*C_2\ldots R_1$

Where;

R_n = Value given for the least ranked level (example if the least rank is 5^{th} rank, then $R_n\text{-}_5$, $R_n\text{-}_1$=4 and … R_1= 1)

C_n = Counts of the least ranked level (in the above example, the count of the 5^{th} rank = C_n, and the counts of the 1^{st} rank = C_1)

RESULT AND DISCUSSION

Source of Fattening Sheep

Respondents' preference for fattening sheep and sheep fattening practices are shown in Table 4.4 and Table 4.5. The source of fattening sheep in the study area were 60.2% own production and 39.8% immediate purchasing from nearby local market during the time of fattening. In respondents' preference of sheep for fattening; the upper agro-ecology preference of respondents for fattening were wether (castrated ram), ram, lamb, cull ewe and maiden in their order of rank. In the mid agro-ecology respondents preferred ram, cull ewe, lamb, wether (castrated ram) and maiden ewe. From the lower agro-ecology they preferred ram, wether (castrated ram), lamb, maiden ewe and cull ewe in the order of rank. As ranked, the type of sheep for fattening purpose ram, wether (castrated ram) and lambs were preferred mostly by respondents. The reasons for this were the preference of the demands or market need and attain their weight as fast as possible. Some farmers preferred for fattening purpose unproductive ewe that were not used for replacement or production. This indicates that farmers have knowledge or an experience for fattening animals and used to increase their income or profit.

Figure 4.2: Wether (castrated ram) for fattening purpose in the study area

Table 4.4: Types of sheep used for fattening purpose in Fogera district ranking

Agro-ecologies	Type of sheep prefer for fattening purpose	Rank given by respondents (%)										Sum	Index value	Rank
		1		2		3		4		5				
		M		M		M		M		M				
		N	Fre	N	Fre	N	Fre	N	Fre	N	Fre			
Upper land	Ram	10	55	7	28	7	21	0	0	0	0	104	0.280	2
	Wether	14	70	8	32	3	9	0	0	0	0	111	0.299	1
	Lamb	0	0	4	12	10	30	11	22	1	1	65	0.175	3
	Cull ewe	0	0	6	24	4	12	6	12	8	8	56	0.151	4
	Maiden ewe	0	0	0	0	1	3	8	16	16	16	35	0.094	5
Mid land	Ram	9	45	2	8	0	0	0	0	0	0	53	0.290	1
	Wether	2	10	2	8	4	12	2	4	1	1	35	0.191	4
	Lamb	1	5	5	20	2	6	2	4	1	1	36	0.197	3
	Cull ewe	2	10	3	12	3	9	3	6	3	3	40	0.219	2
	Maiden ewe	0	0	0	0	2	6	4	8	5	5	19	0.104	5
Lower land	Ram	24	120	2	8	0	0	0	0	0	0	128	0.308	1
	Wether	7	35	14	56	5	15	0	0	0	0	106	0.255	2
	Lamb	2	10	16	64	7	21	1	2	0	0	97	0.234	3
	Cull ewe	0	0	0	0	1	3	5	10	20	20	33	0.080	5
	Maiden ewe	0	0	1	4	3	9	16	32	6	6	51	0.123	4

*Fre=frequency; M=weighted frequency; N= total number of respondent**;** **Index for all agro-ecologies for fattening purpose= sum of fattening purpose parameter ranked in each agro-ecology i.e. 5*1st ranked fattening purpose parameter + 4*2nd ranked fattening purpose parameter + 3*3rd ranked fattening purpose parameter + 2*4th ranked fattening purpose parameter + 1*5th ranked fattening purpose parameter /sum of all weighted fattening purpose parameters described by the respondents in each agro-ecology

The overall practices of sheep fattening in the study area out of 140 respondents 44.3% farmers were practiced. The trend of sheep fattening in the study district for six years data shows that 1072, 1897, 3433, 4443, 5536 and 13,000 numbers of sheep for the years 2000, 2001, 2002, 2003, 2004 and 2005 EC, respectively. Hence, sheep fattening practice in the district is increasing at increasing rate from year to year (FWARDO, 2013). Small ruminants are kept by smallholders in the crop-livestock systems for domestic consumption, sale of offspring and reproduction/replacement of stocks and this could lead for sheep increment (IPMS, 2013). Other study also emphasized the role of sheep in mixed crop–livestock systems (Solomon Abegaz *et al.,* 2010). Sheep are more dominant than goats in this production system. This system is generally found in areas where the altitude ranges between 1500 and 3000 m.a.s.l.

Out of the selected *kebeles* one *kebele* (Woji awuranba) found in the mid agro-ecology didn't practiced sheep fattening. The reason was less awareness and before now there is no sheep production experience in the area. But, about 34 numbers of sheep were owned by the farmers (Woje awuranba *kebele* office, 2013). Farmers responded that the type of sheep breed that used for fattening were 95.8% of Farta and 4.2% of Washera sheep.

The respondent that owned Washera breed preferred for fattening purpose; because of fast growth rate and better live weight gain/performance than the Farta sheep. Similar results as reported by Shigdaf Mekuriaw *et al.* (2012), farmers participating in rearing Washera, Farta and their crossbred sheep have different preferences for the breeds and different traits. The same author reported that 65% of the farmers reported that Washera sheep have better growth performance; they grow fast and gain better weight when fed well compared to Farta and their crossbred sheep. While 35% of the farmers said that the crossbred sheep have faster growth than Farta sheep and good fattening potential like pure Washera sheep. Correspondence analysis of chi-square (X^2) test showed that own production of fattening sheep were used. Analysis of variance showed that both sources of fattening sheep had significant effect ($P<0.05$) on fattening practices.

Especially, the majority of lower land agro-ecology farmer practiced sheep fattening by immediately purchasing in dry season due to water logging problems of the area in wet season that were not suitable for production. In the study area, frequency of fattening practiced 42.9%, 33.1%, 21.6% and 2.4% of respondents only one time, two times, three times and four times were fatten per year. The fattening time were significantly different ($P<0.05$) across the study area. The majority of the respondents practiced only once in a traditional/semi intensive way of fattening system. This system generally depends on grazing natural or planted pastures and crop residue with variable degrees of supplementation. Hence, animals require a long period of time to attain market weight and condition. It is also associated with huge fluctuations in the weights and conditions of the animals due to unavailability of feed, mating of rams and poor health, and housing of the animals. Generally, thus selected farmers averagely fatten 3 sheep per fattening period.

Table 4.5: Shows practices of sheep fattening, breed of fattening sheep, source of fattening sheep and times of sheep fattening per year

Sheep fattening practices		Upper land				Midland				Lower land						Total %
		Chalma		Alember		Woji awuranba		Diba sifatra		Quhar michael		Abua Kokit		Nabega		
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	
The practices of sheep fattening	Yes	14	70	11	55	0	0	7	35	4	20	8	40	18	90	44.3
	No	6	30	9	45	20	100	13	65	16	80	12	60	2	10	55.7
The breed of fattening sheep	Farta	14	100	11	100	0	0	7	100	3	75	8	100	18	100	95.8
	Washera	0	0	0	0	0	0	0	0	1	25	0	0	0	0	4.2
	Crossed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
The source of fattening sheep	Own production	13	92.8	5	45.5	0	0	1	14.3	3	75	4	50	15	83.3	60.2
	Immediate Purchase	1	7.2	6	54.5		0	6	85.7	1	26	4	50	3	16.7	39.8
Frequency of sheep Fattening per year	Only one time	13	92.9	9	81.8	0	0	2	28.6	1	25	1	12.5	3	16.7	42.9
	Two times	1	7.1	2	18.2	0	0	2	28.6	1	25	6	75	8	44.4	33.1
	Three times	0	0	0	0	0	0	2	28.6	2	50	1	12.5	7	38.9	21.6
	Four times	0	0	0	0	0	0	1	14.2	0	0	0	0	0	0	2.4

*N= total number of respondent

Selection Criteria for Fattening Sheep

Farmers' selection criteria for buying fattening sheep are presented in Table 4.6. Respondents considered different criterion used for purchasing of fattening sheep were body size/frame, body condition, health, age, price, color, breed, horn presence and adaptation in their order of importance. Fatteners used for selecting sheep by considering simultaneous visual assessment for fattening purpose. Similarly, in selection of fattening sheep farmers should also consider the body condition, skeletal frame, castration, breed, sex, weight and age of animals (ESGPIP, 2012). Other researchers also reported almost similar criteria of these types that the farmer's used in selecting sheep that is going to join the fattening activity.

Table 4.6: Farmers selection criteria for buying fattening sheep in Fogera district ranking

Criterion	Rank given by respondents (%)																		Sum	Index value	Rank
	1		2		3		4		5		6		7		8		9				
	M		M		M		M		M		M		M		M		M				
	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre			
Age	6	54	4	32	6	42	9	54	11	55	2	8	0	0	0	0	0	0	245	0.143	4
Body size	12	108	13	104	7	49	2	12	1	5	2	8	1	3	0	0	0	0	289	0.168	1
Breed	1	9	3	24	1	7	4	24	2	10	6	24	9	27	8	16	4	4	145	0.084	7
Health	7	63	4	32	8	56	6	36	7	35	5	20	1	3	1	2	0	0	247	0.144	3
Body condition	10	90	12	96	4	28	3	18	4	20	1	4	3	9	0	0	1	1	266	0.155	2
Price	0	0	3	24	11	77	9	54	9	45	6	24	0	0	0	0	0	0	224	0.130	5
Color	2	18	0	0	1	7	5	30	4	20	11	44	12	36	3	6	0	0	161	0.094	6
Adaptation	0	0	0	0	0	0	0	0	0	0	1	4	2	6	11	22	24	22	56	0.033	9
Horn presence	0	0	0	0	0	0	0	0	0	0	4	16	10	30	16	32	8	8	86	0.050	8

*Fre=frequency; M=weighted frequency; N= total number of respondent**;**

The Fattening System

Major Feed Resources, Utilization and Management Systems

The major livestock feed resources available in the study areas are shown in Table 4.7 & 4.8. The major available feed resources in the study areas are crop residues, natural pasture, hay, stubble grazing and agro industrial by products, fodder trees and improved forages. The proportion of; natural pasture 28.6%, crop residue 27.75%, stubble grazing 13%, hay 13.45%, fodder trees and improved forages 14% and agro industrial by products 3.2%. Similarly, the major available feed resources in Ethiopia are natural pasture, crop residues, aftermath grazing, agro-industrial by-products, to a lesser extent improved pasture, and forage crops (Alemayehu Mengistu 1987; Seyoum Bediye and Zinash Sileshi, 1989). In dry season the major livestock feed resources identified in the study area were untreated crop residue (maize stover, millet straw, tef straw, grass pea residue, rice straw, barley straw, wheat straw, bean hulls, oat straw and groundnut residue), natural pasture, stubble grazing, hay, fodder trees (chibha/*Ficus thonningii*, warka, bambula, wanza/*Cordia africana*, girar/*Acacia abyssinica*, quara/*Erythrina abyssinica*, bamba/*ficus sycomorus*, anfar/*Acacia nilotica*, sesbania/*s.sesban*, luceania/*L.leucocephalala*, pigeon pea) and improved forages (Napier grass ,vetch, cow pea), feed supplements (local brewery (*atela*), rice bran, oil seed meals, and flour milling by products) and urea treated crop residues in the order of their rank in Table 4.7. Crop residue and crop stubble grazing are important sources of feed during the dry season. Similarly Belete Shenkute (2009) reported from the interviewed households, 59.4%, 23.5%, 19.4% and 32.1% utilize communal grazing, roadside grazing, riverside grazing and grazing aftermath, respectively. In wet seasons of the year when the major feed source is communal grazing, 79.4% of households use herded grazing system so that sheep and goats do not go into crop fields as herders are closely following.

In wet season, the major livestock feed resources were identified as natural pasture, untreated crop residue (millet straw, tef straw, rice straw), green forage, fodder trees, stubble grazing on irrigated crops (near to July), and feed supplements (local brewery (*atela*), rice bran, oil seed meals, and flour milling by products) in the order of their rank in Table 4.8. Crop residues have certain inherent disadvantages in that nutritionally they have low digestibility and are deficient in nitrogen and in many mineral elements, they are physically resistant to combination and may contain high amounts of indigestible lignin and silica. Low digestibility associated with low nitrogen content of the feed limits intake and animals on these diets are often in negative energy and nitrogen balance. It is therefore, essential that these deficiencies are corrected when crop residues are used as feeds. Crop residue utilization had several problems in the study area like less attention to improve the quality, storage, fully collect during surplus and mixing with other having better quality feeds. In comparable, strategies for ensuring adequate nutrition of small ruminants must be based on optimizing overall agricultural and livestock productivity from available resources, improving existing technologies and integrating technology that employs multipurpose crops and animals and recycling of crop residues and by-products as nutrients for both animals and plants (Njwe, 2010).

Similarly, reported by Yeshitla Admasu (2008), utilization efficiency had great problems when it comes to crop residues because of less attention given to storage and crop residues are excessively dumped during harvest period in addition to competition of alternative uses of crop residues was reported in Alaba district. In contrast, in the study area some farmer used techniques to improve crop residue like mixing of cereal and legume residues, formulation of rice bran with atela, mixing of crop residue with browse trees etc. to increase the productivity of their animals. There are different techniques by which the quality of a feed could be improved to cite some of these physical treatment from a simple soaking with water, chopping, grinding and pelleting up to the high chemical treatment, especially the latter improves the nutritive value of crop residues by 30% there by removing the hard cover of plant cellulose. In contrast, crop residues are not exposed to such treatments in the survey areas in Alaba district reported by (Yeshitla Admasu, 2008).

Grazing land is the common source of feed in wet season; whereas crop residues are the common feed sources in dry season. Hence, communal grazing land is grazed throughout the year. But, the availability and quality of feed was very poor especially the lower altitude in the study area. In some areas grazing land management were started to get additional feed, avoid the common weed called amekala (*Asracantha longifolia)*, to protect the disappearance of grasses with animal and to keep the grazing land boundary. This practice were commonly presented in the mid and lower land agro ecologies. Seasonally, the feed availability in wet season from July to September most interviewed farmers agreed that animals not allowed grazing because of water logging or flooding over the grazing land. Therefore, they fed their livestock green grass from crop boarder and private grazing land with cut and carry feeding system, stored crop residue and purchasing supplement feed i.e. rice bran from the district town. Similarly, the seasonal availability and importance of the major feed resources in different agro-ecologies/production systems represented by Gomma, Metema, Mieso and Fogera PLWs. Most farmers responded that natural pasture is the most important source of feed during the wet season in all systems. Its availability is insignificant during the dry season, except in the wet highlands. Crop residue and crop stubble grazing are important sources of feed during the dry season (IPMS, 2010). The trend of using resources depends on factors like availability, the current price in which they are purchased, their quality in providing better performance to fattening animals within a short period of time, and easy to transport and manage during the feeding time (Gizat Teshale, 2012).

In the study area especially low land agro-ecology the trend of using feed resources depends on factors like availability, seasonality and feed quality. There are three aspects of the feed problems, namely, the issue of increasing the efficiency with which the available feed is utilized (e.g. forages, crop residues, agro-industrial by-products and nonconventional feeds), the inability to make maximum use of the limited total feed resources and the inadequate supplies of feed (Devendra, 1987) and water. Fatteners used the feed resources that increase the performance of animals based on the availability and low price like rice bran which is highly used in dry and wet season especially for sheep and cattle livestock classes. In addition, low land ecology used green forage in the dry season from watershed of Gumara and Rib rivers irrigation development; like grasses, thinning of maize and grass pea mainly by using cut and carry feeding system were observed. This increases livestock water productivity. In the upper altitude fatteners fed their animal mostly hay and crop residues. The availability of hay is low due to grazing land changed to crop land production and it increases the abundance of crop residues. These crop residues have high crude fiber and low crude protein. This implies that they fed to their fattening animal mostly crop residues as main basal feed rather than hay; and animals had long period of time (e.g. up to 6 months) to attain their final weight. This decreases livestock water productivity.

According to Firew Tegegne and Getnet Assefa (2010) of the agro-industrial by-products, rice hull and rice bran, noug seed cake are the two most commonly available agro-industrial by-products which are used as animal feed in Fogera district. These by-products are usually mixed with residues of home brewed beverages (*atela)* and fed to animals. Because there is no tradition of fattening cattle in the district, the agro-industrial by-products, especially rice hull and rice bran, are not efficiently utilized. In contrast to this study, Belete Anteneeh (2006) reported that majority of farmers were practicing a traditional cattle fattening system. These producers are feeding on either free grazing or by cut and carry system in the times when the forage species were available from July to October. But, now a day most farmers use rice bran for fattening and supplementation for sheep and cattle in wet season mostly when the lower altitude farmers scarce with animal feed. Therefore, respondents used concentrate supplementation for their livestock was a significant different ($P<0.05$) in the study sites.

Table 4.7: Resources availability at dry season in Fogera district (1, 2, 3…..ranking)

Type of feed resource	Rank given by respondents (%)																Sum	Index value	Rank
	1		2		3		4		5		6		7		8				
	M		M		M		M		M		M		M		M				
	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre			
Natural Pasture	1	8	50	350	36	216	39	195	4	16	3	9	0	0	0	0	844	0.22	2
Untreated Crop residues	131	1048	5	35	2	12	0	0	0	0	0	0	0	0	0	0	1095	0.285	1
Stubble grazing	0	0	39	273	54	324	37	185	1	4	2	6	0	0	0	0	792	0.21	3
Hay	6	48	40	280	35	210	21	105	2	8	0	0	0	0	0	0	651	0.17	4
Green forage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Urea treated Crop residues	0	0	1	7	2	12	1	5	1	4	2	6	0	0	0	0	34	0.01	7
Feed supp-lement	1	8	1	7	0	0	6	30	20	80	0	0	0	0	0	0	125	0.033	6
Browse feeding	0	0	1	7	10	60	14	70	35	140	8	24	0	0	0	0	301	0.08	5

*Fre=frequency; M=weighted frequency; N= total number of respondent:**Index for all agro-ecologies for feed resource = sum of single feed resource parameter ranked in each agro-ecology i.e. 8*1st ranked feed resource parameter + 7*2nd ranked feed resource parameter + 6*3rd ranked feed resource parameter + 5*4th ranked feed resource parameter + 4*5th ranked feed resource parameter + 3* 6th ranked feed resource parameter +2*7th ranked feed resource parameter +1*8th ranked feed resource parameter /sum of all weighted feed resource parameters described by the respondents in each agro-ecology

Table 4.8: Feed resources availability at wet season in Fogera district (1, 2, 3…..ranking)

Type of feed resource	Rank given by respondents (%)																Sum	Index value	Rank
	1		2		3		4		5		6		7		8				
	M		M		M		M		M		M		M		M				
	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre			
Natural Pasture	103	824	22	154	9	54	2	10	1	4	0	0	0	0	0	0	1136	0.352	1
Untreated crop residues	24	192	62	434	32	192	8	40	0	0	0	0	1	2	0	0	860	0.27	2
Stubble grazing	0	0	2	14	19	114	7	35	1	4	0	0	0	0	0	0	167	0.05	6
Hay	5	40	13	91	19	114	15	75	0	0	0	0	0	0	0	0	320	0.099	4
Green forage	4	32	30	210	23	138	12	60	5	20	1	4	0	0	0	0	464	0.14	3
Urea treated Crop residues	0		0		0		0		0		0		0		0	0	0	0	0
Feed supplement	0	0	3	21	6	36	4	20	6	24	1	3	0	0	0	0	104	0.032	7
Browse feeding	0	0	1	7	10	60	11	55	13	52	2	6	0	0	0	0	180	0.06	5

*Fre=frequency; M=weighted frequency; N= total number of respondent; ** Index for all agro-ecologies for feed resource = sum of single feed resource parameter ranked in each agro-ecology i.e. 8*1st ranked feed resource parameter + 7*2nd ranked feed resource parameter + 6*3rd ranked feed resource parameter + 5*4th ranked feed resource parameter + 4*5th ranked feed resource parameter + 3* 6th ranked feed resource parameter +2*7th ranked feed resource parameter +1*8th ranked feed resource parameter /sum of all weighted feed resource parameters described by the respondents in each agro-ecology

Status of Communal and Private Grazing Lands in Fogera District

The status of grazing land in the study area is shown in Table 4.9. The rate of the extent of change of communal grazing land last five years were 36.1%, 45.6%, 12.5%, 5.8%, and 0% responded as decreasing substantially, decreasing slightly, no change, increasing slightly and increasing substantially, respectively. This indicates that the size of communal grazing land were at decreasing rate due to mostly by the expansion of crop land. Similarly, According to Bedasa Eba (2012) study, 88.7% in Fogera responded that the grazing lands are deteriorating. The reasons behind are increasing rate of human population and more food demand. According to Firew Tegegne and Getnet Assefa (2010), in Basona district indicated that crop lands have expanded at the expense of grazing lands and the contribution of grazing lands is declining from year to year. Similarly, the status and size of the communal grazing land was decreasing from time to time with the expansion in acreages of farmland, which is a result of the increase in human population reported by (Gizat Teshale, 2012 and Shigdaf Mekuriaw *et al.,* 2012). In this study private natural pasture is protected from grazing late after one month the start of rain i.e. July up to the harvesting time of hay (up to November). This protection of private grazing land provided hay for the farmers. In the study area, 66.4% of interviewed farmers practiced hay making; and 33.6% of respondents were

not practicing hay making mainly due to shortage of land. Generally, respondents decided the harvesting time of hay as pattern of rain fall 69.9%, plant growth 29% and need of the animal 1.1%; and the types of storage were stalk outside 81.7% and under shed 18.3%. In line with this study, private natural pasture is protected from grazing during June to September (Bedasa Eba, 2012). The decision of harvesting time of hay was significantly different ($P<0.05$) in the different agro-ecology and this might be due to awareness and feed shortage problems.

Also Gizat Teshale (2012) reported in Gondar Zuria district, the feed obtained from grazing lands is inadequate both in terms of quantity and quality throughout the year. Similarly, the productivity and species composition quality of communal grazing land trend presented Table 4.9 in the study area were 61.7%, 16.9%, 11.4%, 8.1% and 1.9% of respondents agreed as decreasing substantially, decreasing slightly, no change, increasing slightly and increasing substantially, respectively. As compared to Bedasa Eba (2012) study, the grazing land quality is slightly having better improvement than deterioration in the study area. The availability of water for livestock in the study area compared as 10.3%, 47.9%, 32.7%, 8.3% and 0.8% in decreasing substantially, decreasing slightly, no change, increasing slightly and increasing substantially, respectively.

In each altitude, the main problems are grazing land changed to crop land, over stocking on grazing land and soil erosion, expansions of weeds e.g. amekala *(Asracantha longifolia)* and water logging in wet season were identified. In the area, animals grazed throughout the year a daily mean length value of 7.73 hours including over stocking. This results, soil compaction and grass disappearance due to trampling of animals on grazing lands. For example, weed known as *Asracantha longifolia* (Amekela) invades most of the communal grazing lands. This is an annual weed of the swampy or poorly drained areas, often found in black soils (Bedasa Eba, 2012). Hence, respondents agreed that the options to improve grazing land are decrease livestock number, making of soil and water conservation on the grazing land, controlled grazing, clearing of invaded weeds, tether feeding, keep communal grazing land boundary, uses cut and carry feeding and over sowing of improved seeds on natural pastures. Therefore, some farmers closed the communal grazing land July to September to protect the disappearance and increase the quantity of grasses that results due to trembling of grasses with animals. Similarly, Mohamed Saleem (1995) indicated that interventions for increasing the grazing pasture yield and quality include fertilizer inputs and forage legume over sowing accompanied by soil ripping. International water management institute had introduced grazing land management activities to reduce the level of over grazing, which was established as a demonstration site. The project incorporated activities like planting different types of fodder crops including vetiver grass, pigeon pea, cowpea, sesbania, Napier grass, and others; preparation and application of by-law; taking care of the planted crops including weeding; distribution of forage seeds, improvement of crop residue with urea treatment and establishment of forage nursery site (IWMI, 2012). Generally, the analysis of variance shows that there were no significance difference ($P<0.05$) of communal grazing land quality across altitudes.

Table 4.9: The trend of communal grazing land in Fogera district

Status	Rate of the extent of change	Agro-ecologies						Total %
		Upper land		Midland		Lower land		
		N	%	N	%	N	%	
Rate of the extent of change communal pasture area	Decreased substantially	7	17.5	17	28.3	25	62.5	36.1
	Decreased slightly	21	52.5	34	56.7	11	27.5	45.6
	No change	8	20	6	10	3	7.5	12.5
	Increased slightly	4	10	3	5	1	2.5	5.8
	Increased substantially	0	0	0	0	0	0	0
Quality of communal pasture area	Decreased substantially	23	57.5	33	55	29	72.5	61.7
	Decreased slightly	7	17.5	14	23.3	4	10	16.9
	No change	4	10	7	11.7	5	12.5	11.4
	Increased slightly	5	12.5	4	6.7	2	5	8.1
	Increased substantially	1	2.5	2	3.3	0	0	1.9
Water availability for livestock	Decreased substantially	5	12.5	5	8.3	4	10	10.3
	Decreased slightly	24	60	35	58.3	10	25	47.9
	No change	9	22.5	14	23.3	21	52.2	32.7
	Increased slightly	2	5	6	10	4	10	8.3
	Increased substantially	0	0	0	0	1	2.5	0.8

*N= total number of respondent

Major Crop Residues and Utilization

The major crop residues available in the study area and utilization were ranked according to their abundance in Table 4.10. The major crop residues grown by farmers in the study area are maize stover, millet straw, tef straw, chickpea residue, grass pea residue, rice straw, barely straw, bean residue, groundnut residue, wheat straw, and oat straw in the order of their abundance or farmers participation. Maize, millet, tef, grass pea and rice are the dominant grown crops and their residues constituted the largest share of crop residues fed to livestock in the area. Crop residues fed mostly started at the beginning of the dry season.

However, feeding of fattening animals in the upper land used crop residues such as maize stover, mixing of (tef straw, millet straw and pulse straw) and *atela* including salt. In the lower agro-ecology farmers fed their fattening animals mainly rice straw, grass pea at the time of pudding or green and after threshing the crop and by-products (rice bran, *atela*, and oil seed cake) including salt mostly in the morning. In the lower altitude some farmers fed grass pea grain to their fattening sheep in the form of cooking to remove its toxicity. These crop residues are good sources of metabolizable energy and crude protein. According to Bedasa Eba (2012), both farming systems of Fogera, most of the respondents practiced storage of the available crop residues around home. But, there were no treatments or improvements made during feeding to increase the quality of straws. In contrast, 81.4% of the respondents practiced storage of the available feed outside (under the sun) and 18.6% of the respondents practiced under the shed; whereas in wet season the lower land farmers stored crop residues in separated house or in the family. But, in dry season lower land farmers store crop residue mostly outside the homestead. However, there were 10% of the respondent made crop residue treatments with urea to increase the quality of straws. This increases livestock water productivity. Devendra (1982) observed that a decrease in nutritive value of rice straw due to exposure to weather. Amare Haileslassie *et al*. (2011b) and Descheemaeker *et al*. (2012) already demonstrated that crop residues management like chopping and urea treatment improves the feed quality and therefore livestock water productivity values. The digestibility of straw can, however, be improved by alkali treatment, ammoniation, and treatment with poultry manure or feeding with green forage legumes (Njwe, 2010*)*. Smith (1993) also listed chopping, grinding, and treatment with urea as the most appropriate methods of improving the feed value of crop residues at the smallholder level. According to Bedasa Eba (2012), untreated crop residues may reduce the quality of available feed for livestock and lower the value of livestock water productivity. Hence, treated crop residues may increase nutrient intake, digestibility and productivity of the animals. Therefore, it increases livestock water productivity. According to Njwe R.M. (2010*),* with increases in population pressure and the demand for more food and farmland, the use of crop residues and by-products is increasing. Straw, for example, is a valuable feed resource especially during the dry season.

Table 4.10: Major crop residues used for animal feed in Fogera district (ranked according to abundance) based on respondents

	Rank given by respondents (%)																							
	1		2		3		4		5		6		7		8		9		10		11			
Crop residue	M		M		M		M		M		M		M		M		M		M		M		Sum	Index value	Rank
	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre			
Tef straw	10	110	33	330	5	45	26	208	6	42	4	24	1	5	1	4	0	0	0	0	0	0	768	0.172	3
Millet straw	8	88	44	440	10	90	23	184	1	7	2	12	1	5	2	8	1	3	0	0	0	0	837	0.188	2
Barley straw	19	208	4	40	10	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	338	0.076	7
Maize stover	6	66	63	630	9	81	14	72	1	7	1	6	3	15	0	0	0	0	0	0	0	0	877	0.197	1
Bean straw	2	22	16	160	1	9	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	199	0.045	8
Grass pea straw	4	44	17	170	4	36	14	72	1	7	11	66	6	30	1	4	1	3	1	2	1	1	435	0.098	5
Groundnut residue	3	33	3	30	1	9	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0.018	9
Rice straw	3	33	12	120	1	9	14	72	11	77	14	52	2	10	6	24	4	12	3	6	3	3	418	0.094	6
Wheat straw	2	22	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0.007	10
Chickpea residue	9	99	24	240	2	18	9	72	3	21	1	6	0	0	0	0	0	0	0	0	0	0	456	0.102	4
Oat straw	1	11	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	.005	11

*Fre = frequency; N= total number of respondent; M = weighted frequency; **Index for all agro-ecologies for Crop residue= sum of single crop residue parameter ranked in each agro-ecology i.e. 11*1st ranked crop residue parameter + 10*2nd ranked crop residue parameter + 9*3rd ranked crop residue parameter + 8*4th ranked crop residue parameter + 7*5th ranked crop residue parameter + 6* 6th ranked crop residue parameter +5*7th ranked crop residue parameter +4*8th ranked crop residue parameter + 3* 9th ranked crop residue parameter +2*10th ranked crop residue parameter +1*11th ranked crop residue parameter /sum of all weighted crop residue parameters described by the respondents in each agro-ecology

Fodder Production and Utilization

Table 4.11 presents fodder production and utilization in the study area. Respondents have mentioned grown fodder trees in the study area like chibha (*Ficus thonningii*), warka, bambula, wanza (*cordia Africana*), girar (*acacia abyssinica*), kuara (*erythrina abyssinica*), bamba (*ficus sycomorus)*, anfar (*acacia nilotica*), sesbania/*s.sesban*, luceania/*L.leucocephalala*, pigeon pea are important browse trees in the study area. Fodder trees were planted from backyard, soil and water conservation areas, on grazing lands, on gullies and enclosed area in all agro-ecologies of the study area. But, the degrees of plantation were different according to the suitability of the forage in that particular altitude. Therefore, the upper land agro ecology interviewed farmers were growing/producing were 57.5% and the rest 42.5% of respondents were not practicing fodder production. In the midland agro ecology 53.3% were participating and the rest of 46.7% of the respondents were not practiced fodder production for their livestock. From the lower land 30% were growing and 70% of the respondents were not practicing fodder trees. However, Feeding of these fodder trees increase livestock water productivity values. Comparably, in Amhara National Regional State browse species like sesbania, tree lucerne and pigeon pea, Chibha *(Ficus thonningii)*, and Girawa (*Vernonia* spp.) are important fodder trees (Firew Tegegne and Assefa Getnet, 2010). In general, the upper land and midland farmers similarly practiced fodder production, whereas the lower land farmers were the least in fodder production and feed for their livestock. The reasons were water logging of the area that was not suitable for plantation of different indigenous browse trees. During the time of data collections the improved fodder trees like sesbania tree were grown in the area and fed for their animal through cut and carry feeding system. According to Njwe R.M. (2010) production systems using tree legumes usually consist of either a dense population of trees in a small area, a row of trees planted as "hedgerow" on bunds, as edges of crop areas or interplant with crops (alley cropping). The leaves of trees can be used as a high quality supplement to crop residues and grass. Hence, supplementing browse trees increase the intake of roughage feeds and increases the live weight of fattening animal.

According to Gizat Teshale (2012), natural pasture and fodder trees are used when there is feed shortage as gap filling material in Gondar Zuria district. In comparable, respondents that were participated in fodder production mentioned the importance of browse trees during drought and when feed shortage occur to full fill the feed gap; the time of drought used for maintenances, increase meat and milk production; use for the introduction of wet season when feed shortage occurred; in sun time used to shed for animals; for fuel, increases soil fertility, used for soil and water conservations. In the other way, respondents were not participated in fodder plantation put the reasons like free grazing; animals destroyed the new introduced browse trees, and have no knowledge for the importance of browse trees, low attention give for browse trees and lack of awareness about the importance of fodder trees. In addition, there are improve grasses and legumes in the study area like Napier grass, Rhodes grass, pigeon pea, cow pea, vetch and oat grown in the different development strategies (e.g. used irrigation and rain fed). Thus green forage feeding of animals increases livestock water productivity.

The feeding systems of fodder trees were depicted in (Table 4.11). In all agro-ecologies respondents fed browse trees to their animals as cut and carry feeding alone, cut and carry feeding by mixing with straw and; cut and direct browsing on standing tree in their order of ranking. According to Njwe R.M. (2010), small ruminants can be integrated into an alley cropping by cut and carry feeding of portions of the tree foliage or by grazing natural fallow regrowth and trees during periodic fallow years. The cut and carry feeding applies to goats and sheep while the grazing system is limited to sheep because goats tend to de-bark the trees. Fast growing leguminous trees like *G. septium* and *L. Ieucocephala* are essential for the system of feeding. In order to give sufficient benefit to the crop and avoid the possibility of soil mining, it is recommended that approximately 75% of the available tree foliage be applied to the soil as mulch while the rest is given as feed to animals. This results the resilience of the environment through degradation because by cut and carry feeding system of browse trees. Hence, respondents were fed browse trees had a beneficiary by increasing livestock productivity when compared to not fed browse trees. Therefore, the analysis of variance shows that there was significance difference ($p<0.05$) of browse tree utilization in the study area.

Table 4.11: Ranking of Fodder trees feeding system in Fogera district ranking

Agro-ecologies	Fodder trees feeding system	Rank given by respondents (%)						Sum	Index value	Rank
		1		2		3				
		M		M		M				
		N	Fre	N	Fre	N	Fre			
Upper Land	Cut and carry feeding alone	16	48	0	0	0	0	48	0.244	1
	Direct browsing on standing tree	0	0	3	6	1	1	7	0.036	3
	Cut and carry feeding by mixing with straw	0	0	3	6	3	3	9	0.046	2
Mid Land	Cut and carry feeding alone	26	78	2	4	0	0	82	0.416	1
	Direct browsing on standing tree	0	0	2	4	1	1	5	0.025	3
	Cut and carry feeding by mixing with straw	2	6	2	4	0	0	10	0.051	2
Lower Land	Cut and carry feeding alone	9	27	0	0	0	0	27	0.137	1
	Direct browsing on standing tree	1	3	0	0	0	0	3	0.015	3
	Cut and carry feeding by mixing with straw	2	6	0	0	0	0	6	0.030	2

* Fre = frequency; N=number of respondents; M = weighted frequency;

Length and Methods of Feeding for Fattening

Five feeding lengths have been identified in the study area were 2 months (10.8%), 3 months (59.2%), 4 months (7.9%), 5 months (0.9%) and 6 months (21.3) of the respondents in the study area. However, feeding lengths in the upper land agro-ecology were 2 months (12.7%), 3 months (35.4%), 4 months (9.1%), 6 months (42.9 %) and farmers not used for 5 months feeding length. Whereas, in the mid land agro-ecology the feeding lengths were 2 months (12.8 %), 3 months (85.7%) and the rest feeding length were not practiced in this ecology. In the case of lower land agro-ecology feeding length were 2 months (5.6%), 3 months (56.3%), 4 months (14.6%), 5 months (2.8%) and 6 months (20.9%) of the respondents. Hence, the mid agro ecology used 85.7% for 3 months feeding length were more economical than the two ecologies.

In the upper land, respondents mentioning the methods of feeding as free grazing (51%), stall feeding (35.4%), mixed (13.7%) and tethering was not practiced. Whereas, in the midland ago ecology respondents were using 7.2%, 85.7%, and 7.2% of as free grazing, stall feeding and mixed feeding methods respectively. In the lower land ecology; 18.1%, 7.4%, 56.1% and11.1% of respondents were using free grazing, tethering, stall feeding and mixed feeding method, respectively. Comparably, tethering was practiced by 79, 57.5 and 54.4% of interviewed households higher in Alaba, Dale and Gomma PLWs, respectively (IPMS, 2010). The common feeding practice of fattening animals in the study area is tethering, and fattening animals are fed selected crop residues. According to Shigdaf Mekuriaw *et al.* (2012), the main feed resources for sheep in the study area were natural grazing pasture (70.6%), crop residue (15.4%), improved forage (5.2%), aftermath (9.8%) and concentrates (5%). Feeding methods of the current fattening practice were discussed based on the three altitudes. In moist production systems, agro-ecologies and geographic regions, extensive free grazing in communal grazing lands and stubble grazing are the most common practices of feeding sheep, while browses are used for goat flocks by almost all farmers and pastoralists (IPMS, 2010). It is estimated by Alemayehu Mengistu (2003), natural pasture provides from 80–90%, and crop residues 10–15% of the total livestock feed intake in Ethiopia and supplemented with oil seed meal and flour milling byproducts and salt (Gizat Teshale, 2012). As described above, tether feeding method was mostly practiced in the lower land agro ecology due to the availability of maize and grass pea crop cultivation in dry season. The major reasons for tethering were to save labor, avoid irrigation crop damage and to attain live-weight gain in the short period of time due to the availability of maize thinning and grass pea crop used for fattening. Similarly, Belete Shenkute (2009) also reported the importance of tethering are to avoid crop and vegetation damage, protect from predator, to save labor and to reduce aggressiveness in case of male animals and to utilize marginal land. According to Bedasa Eba (2012), 35.5% of respondents mix legumes straws with small cereals straws and provide to animals. Similarly in this study, 11.1% of respondents smaller than Bedasa finding mix legumes and cereals straws and feeding sheep increase the intake of crop residues rather than feeding alone. Hence, mixing of legumes and cereals may improve the palatability and the intake of feed.

In areas with small flock sizes, tethering and supplementary feeding is a common practice. In wet highland perennial crop system, 92% and 33% of the households supplement all breeding females and castrates during the dry and wet seasons, respectively. Supplemental feeds include household food leftovers, atela from local *areke* and *tella*, grains, enset from tuber-pseudo stem to tip part of leaves, banana leaves and stem, sweet potato vine, haricot been residue, maize from early stage to postharvest, wheat bran (20% households), fruit leaves mainly

avocado and banana (*Musa paradisiaca),* and Chat (*Catha edulis*) leftovers (IPMS,2010). Similarly, in all agro-ecologies all interviewed fatteners supplement their sheep like atela from local grains *areke*, rice bran, oil seed cake, mill flour and fruit house left over, but type of supplement feed were different according to availability. For example, rice bran was mostly supplemented in the lower agro ecology due to rice crop production potential. The rest were not as such supplement rice bran due to low awareness and less availability in the area. The feeding sequence of fattening sheep in the study area were basal feeds first and supplemental feeds next 29%, supplemental feeds first and basal feeds next 3.2%, supplemental feeds at the middle 1.6% and there is no predetermined sequence of feeding 66.2%of the respondents practiced. Feeding supplemental feeds first and basal feeds next may reduces the micro flora of the rumen. In comparable, reported by Mengistie Taye *el al*. (2010), the supplements are grass-pea straw, sprouted bean, local brewery by product "*atela*" and salt. The DM, TDN, CP, CF contents of rice bran is 91, 70, 13 and 12 %, respectively (Belete Anteneh, 2006).

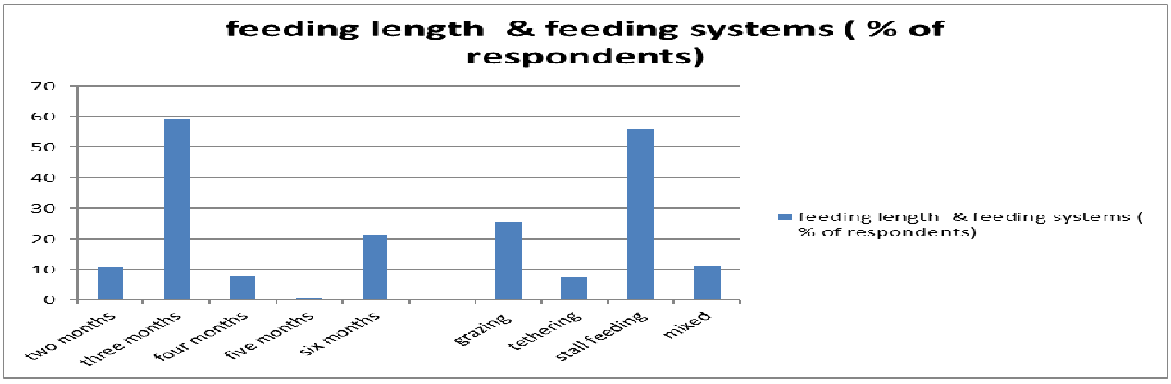

Figure 4.3: Length of feeding for fattening sheep in the study areas

Free grazing

crop residue stall feeding

Tether feeding

free grazing

Stubble grazing

Figure 4.4: The different sheep feeding practice of Fogera district

Table 4.12: Feeding length and feeding systems of fattening sheep in Fogera district

Activities		Upper land					Midland							Lower land					
		Chalma		Alember		ST	Woji awuranba		Diba sifatra		Quhar michael		ST	Abua Kokit		Nabega		ST %	Total %
		N	%	N	%	%	N	%	N	%	N	%	%	N	%	N	%		
The average length of feeding	For 2 months	1	7.1	2	18.2	12.7	0	0	2	28.6	0	0	12.8	0	0	2	11.1	5.6	10.8
	For 3 months	1	7.1	7	63.6	35.4	0	0	5	71.4	4	100	85.7	5	62.5	9	50	56.3	59.1
	For 4 months	0	0	2	18.2	9.1	0	0	0	0	0	0	0	1	12.5	3	16.7	14.6	7.9
	For 5 months	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5.5	2.8	0.9
	For 6 months	12	85.8	0	0	42.9	0	0	0	0	0	0	0	2	25	3	16.7	20.9	21.3
Feeding systems of fattening sheep	Free grazing	13	92.9	1	9.1	51	0	0	1	14.3	0	0	7.2	2	25	2	11.2	18.1	25.4
	Tethering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	44.4	22.2	7.4
	Stall feeding	1	7.1	7	63.6	35.4	0	0	5	71.4	4	100	85.7	4	50	8	44.4	47.2	56.1
	mixed	0	0	3	27.3	13.7	0	0	1	14.3	0	0	7.2	2	25	0	0	12.5	11.1

*N=number of respondents; ST=subtotal percentages

Water Resource for Fattening Sheep

Respondents' used five types of water sources identified in the study area were in the upper river, spring, hand dug well, well and temporary water; in midland hand dug well, spring, well, river and temporary water; and in the lower agro-ecology well, hand dug well, temporary water, river and spring water sources in the order of their rank Table 4.13. Similarly, the majority of surveyed farmers in IPMS PLWs (96.3% in Bure, 84% in Atsbi-Womberta, 85.6% in Metema, 56.9% in Gomma, 51.3% in Fogera, 55.2% in Alaba, 44.7% in Alamata, and 66.7% in Dale) responded that rivers are the major source of water for the most part of the year (IPMS, 2010). Comparably, reported by Belete Anteneh (2006) in Fogera district 48.75% use water for their cattle from ground wells, 47.2 % from rivers, 3 % near Lake Tana, 2.29% from the ponds and 0.2 % from tap water. The respondents revealed that fattening sheep have got access to the water source water at home (51.3%), <2km distance (29.7%) and the rest19% used 2-4km distance in the dry season. However, watering at home increases live-weight of fattening sheep or livestock water productivity. The respondent also estimated in wet season sheep have got access to water point at home (30.9%), <2km distance (66.1%) and 2-4km (3%). Analysis of variance showed that, considering distance and type of water source, fattening sheep getting water was water at home had high significance difference ($P<0.05$) live-weight change than other sources of water which were relatively distant water sources. This decreases sheep water productivity.

Livestock watering frequency varies with season and agro-ecology. Sheep are commonly watered every three days and goats every 3–5 days during the dry season as nearby water sources dry-up (Alaba PLW) (IPMS, 2010). With relation to watering frequency, in the study area about 21.7%, 23.2%, 32.4% and 18.7% of the respondents offered drinking water for their fattening sheep *add libutum*, three times per day, two times per day and once per day in the dry season, respectively. Comparably, most of the farmers in Gondar Zuria watering small ruminants and cattle twice daily followed by *add libitum* and once in a day watering was reported by (Gizat Teshale, 2012). There was no any respondent offered drinking water once per two days. In contrast, in Dale PLW, animal are watered once in two days in moist lowlands and once a day in moist highlands (IPMS, 2010). Analysis of variance showed that, considering distance and watering frequency, had high significance difference ($P<0.05$) of drinking water for fattening in dry season.

In wet season 60.6% of the respondents were mostly offered water *addlibutum* and 3%, 8.4%, 21.9%, and 6.1% offered three times per day, two times per day, once per day and once per two days, respectively (Table 4.14). In general, watering frequency decreased as the distance to water accessing point increased and vice versa (Kassahun Awgichew *et al*., 2008). There was a significant difference ($P<0.05$) effect of watering frequency on the live-weight change of fattening sheep. This may be due to the fact that most of the time sheep fattening activity were done during the time when the majority of their feed was derived from seasonally available green feed and thus the fattening sheep could fulfill their water requirements from the feed.

Table 4.13: Ranking of major sources of water for sheep in Fogera district (rank of respondents)

Agro-ecologies	Water source	Rank of respondents (%)												
		1		2		3		4		5				
		M		M		M		M		M		Sum	Index value	Rank
		N	Fre	N	Fre	N	Fre	N	Fre	N	Fre			
Upper land	Well	0	0	1	4	1	3	6	12	0	0	19	0.068	4
	River	14	70	10	40	1	3	0	0	0	0	113	0.404	1
	Spring	10	50	14	56	1	3	0	0	0	0	109	0.389	2
	Hand Dug Well (Pipe)	1	5	0	0	9	27	2	4	0	0	36	0.129	3
	Temporary Water	0	0	0	0	0	0	0	0	3	0	3	0.011	5
Midland	Well	3	15	0	0	2	6	1	2	0	0	23	0.207	3
	River	0	0	2	8	2	6	2	4	0	0	18	0.162	4
	Spring	3	15	4	16	0	0	0	0	0	0	31	0.279	2
	Hand Dug Well (Pipe)	5	25	1	4	2	6	1	2	0	0	37	0.333	1
	Temporary Water	0	0	0	0	0	0	0	0	2	2	2	0.018	5
Lower land	Well	9	45	8	32	3	9	1	2	0	0	88	0.345	1
	River	0	0	3	12	1	3	1	2	0	0	17	0.067	4
	Spring	0	0	0	0	0	0	1	2	0	0	2	0.008	5
	Hand Dug Well (Pipe)	5	25	7	28	11	33	0	0	0	0	86	0.337	2
	Temporary Water	13	45	3	12	1	3	1	2	0	0	62	0.243	3

*Fre=frequency; M=weighted frequency; N= total number of respondent**;** **Index for all agro-ecologies for water source = sum of single water source parameter ranked in each agro-ecology i.e. 5*1st ranked water source parameter + 4*2nd ranked water source parameter + 3*3rd ranked water source parameter + 2*4th ranked water source parameter + 1*5th ranked water source parameter /sum of all weighted water source parameters described by the respondents in each agro-ecology

Table 4.14: Watering distances and frequency for fattening sheep at different season (% respondent)

Watering Distances and frequency at different season		Agro-ecologies						Total %
		Upper land		Midland		Lower land		
		N	%	N	%	N	%	
Traveling in dry season	Water at home	3	12	8	72.7	18	69.2	51.3
	<2km	10	40	2	18.2	8	30.8	29.7
	2≤X≤4km	12	48	1	9.1	0	0	19
	4<X≤6km	0	0	0	0	0	0	0
	>6km	0	0	0	0	0	0	0
Traveling in wet season	Water at home	0	0	3	27.3	17	65.4	30.9
	<2km	25	100	7	63.6	9	34.6	66.1
	2≤X≤4km	0	0	1	9.1	0	0	3
	4<X≤6km	0	0	0	0	0	0	0
	>6km	0	0	0	0	0	0	0
Drinking in dry season	*Adlibutum*	5	20	2	18.2	7	26.9	21.7
	Three time per day	3	12	3	27.3	11	42.3	23.2
	Two times per day	3	12	6	54.5	8	30.8	32.4
	Once per day	14	56	0	0	0	0	18.7
	Once per 2 days	0	0	0	0	0	0	0
Drinking in wet season	*Adlibutum*	12	48	5	45.4	23	88.5	60.6
	Three times per day	0	0	1	9.1	0	0	3
	Two times per day	4	16	1	9.1	0	0	8.4
	Once per day	9	36	2	18.2	3	11.5	21.9
	Once per two days	0	0	2	18.2	0	0	6.1

*N=number of respondents

Housing of Fattening Sheep

In the current study, out of the four types of housing system three of them were identified for fattening sheep; separated room in the family house (61.3%), separated house (37.4%), and enclosed barn or shed (1.3%) the least user of the respondents. Agro ecologies, 72.7% of midland respondents were used separated house type where as upper land and lower land using 72% and 84.6% of Separated room in the family, respectively. Similarly, Judish Mosses (2006) reported that the highland sheep and goat in Amhara Region were housed within the family house in lightless, unventilated holding rooms attached to the house. There were no respondents used open without enclosure housing type across agro-ecologies.

Generally, the housing condition of the study area was poor in quality except the types of house separated room in the family were observed. According to Belete Shenkute (2009) 39.4%, 38.2% and 22.5% of households shelter their animals in adjoin house, separately constructed house and main house with a family respectively. Similarly, this study shows that separate housing was practiced for sheep fattening. In contrast, within human residential house, sheep and goats were tethered on pole or kept in a small protected woodlot since no separate house is built for small ruminants in Alaba reported by (Deribe Gemiyu, 2009). Sheep were always housed together with other livestock, in a barn constructed as an expansion of the main houses or separately in and around the family house (Shigdaf Mekuriaw *et al.,* 2012). Sheep house usually built adjacent to the family house reported by (Mengistie Taye et al, 2010). Comparable to this study, reported by Sisay Tilahun *et al.* (2006) approximately, 79 and 96% of the respondents in Jijiga and Shinile zone respectively housed their sheep and goats in the open kraal at night together with the other species of animals**.** Housing usually comprised an enclosed shed attached to or separated from the owner's residence. Correspondence analysis of chi-square (X^2) test showed that separated house conditions were mostly preferred across agro-ecology. This may be associated with good awareness and income to construct livestock house per household across altitude. However, except separated house in the family the types of housing condition had no significant effect ($P>0.05$) on sheep fattening in the different agro ecologies.

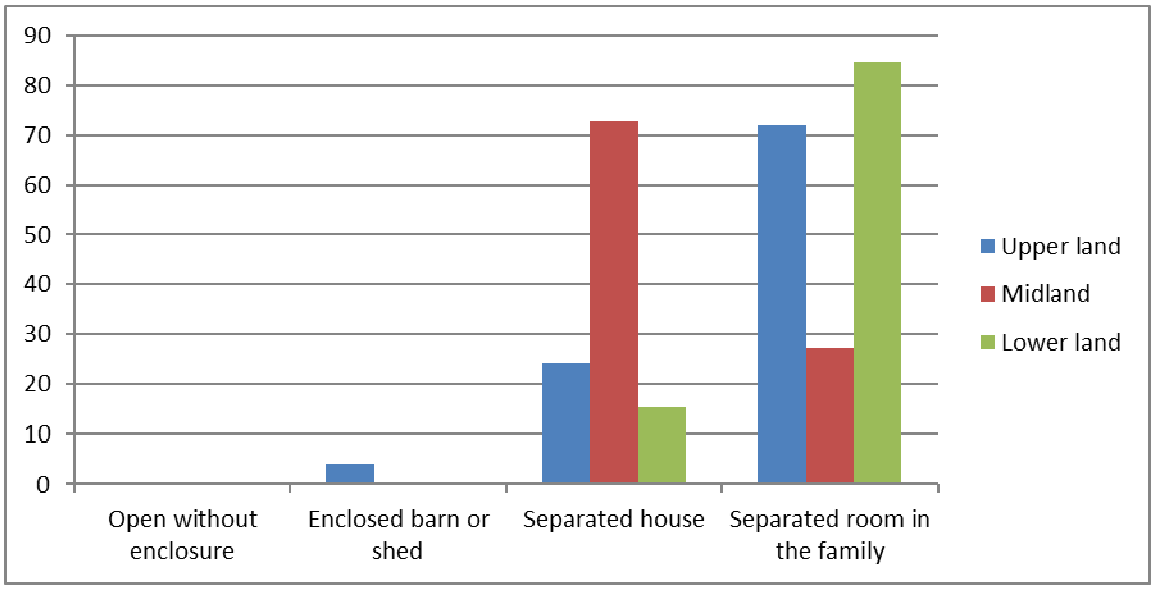

Figure 4.5: Types of housing for fattening sheep across the study area

Figure 4.6: Separated sheep house attached to the family house and separated room

Division of labour

The current study had shown that in Table 4.16, the divisions of sheep fattening activities by different members of households were engaged in almost all activities of sheep fattening. Herding and watering of fattening sheep were mainly for children (<15 years) and other members adult (>15years) and hired were the 2nd and 3rd responsible persons as ranked below. Activities that are feed collection, barn cleaning, health care, breeding, buying of sheep for fattening and selling of fattened sheep mostly done by adult males and female (>15years); whereas; hired person had no as such responsible for all sheep fattening activities in order of their rank. Comparably, herding is mainly undertaken by boys (37.7%) followed by husbands (29.6%) and hired labors share the least (0.6%) in herding (Belete Shenkute, 2009). Also reported by (Derbie Geyimu,2009), children were the most responsible (80%) for herding, while women were the most responsible (58.8%) for harvesting grasses, cleaning barn and milking does. Health care and prescribing traditional treatment is carried out by the household head (95%), male and female. Household heads, particularly males, had 96.7% right of selling and 100% decision making on income obtained from the sale of small ruminants in Alaba.

Table 4.16: Responsible persons for the different activities of sheep fattening (rank1, 2, and 3)

Different activities	Responsible person	Rank of respondents (%)								
		1		2		3		sum	Index value	rank
		M		M		M				
		N	Fre	N	Fre	N	Fre			
Herding	Children (<15 years)	54	162	4	8	0	0	174	0.582	1
	Adult (≥15 years)	4	12	49	98	0	0	110	0.368	2
	Hired	4	12	1	2	1	1	15	0.05	3
Feed collection	Children (<15 years)	15	45	38	76	0	0	121	0.407	2
	Adult (≥15 years)	45	135	14	28	1	1	164	0.552	1
	Hired	1	3	4	8	1	1	12	0.04	3
Watering	Children (<15 years)	44	132	13	26	0	0	158	0.515	1
	Adult (≥15 years)	15	45	44	88	1	1	134	0.436	2
	Hired	4	12	1	2	1	1	15	0.049	3
Barn cleaning	Children (<15 years)	28	84	24	48	0	0	132	0.451	2
	Adult (≥15 years)	30	90	29	58	1	1	149	0.509	1
	Hired	2	6	3	6	0	0	12	0.041	3
Health care	Children (<15 years)	2	6	35	70	0	0	76	0.297	2
	Adult (≥15 years)	58	174	2	4	0	0	178	0.695	1
	Hired	0	0	1	2	0	0	2	0.008	3
Breeding	Children (<15 years)	8	24	31	62	0	0	86	0.377	2
	Adult (≥15 years)	41	123	8	16	0	0	139	0.61	1
	Hired	1	3	0	0	0	0	3	0.013	3
Buying of sheep for fattening	Children (<15 years)	1	3	22	44	0	0	47	0.206	2
	Adult (≥15 years)	59	177	1	2	0	0	179	0.785	1
	Hired	0	0	1	2	0	0	2	0.009	3
Selling of fattened sheep	Children (<15 years)	0	0	23	46	0	0	46	0.201	2
	Adult (≥15 years)	59	177	2	4	0	0	181	0.78	1
	Hired	0	0	1	2	0	0	2	0.009	3

*Fre=frequency; M=weighted frequency; N= total number of respondents; **Index for all agro-ecologies for responsible person = sum of single responsible person parameter ranked in each agro-ecology i.e. 3*1st ranked responsible person parameter + 2*2nd ranked responsible person parameter + 1*3rd ranked responsible person parameter /sum of all weighted responsible person parameters described by the respondents in each agro-ecology

Health Care of Fattening Sheep

The accessibility of veterinary service were provided better for mid altitude (100%) which increases livestock water productivity; whereas the upper and lower agro ecologies have not got enough veterinary services decreases livestock water productivity (Table 4.17). For all *kebeles* 63.8% of the respondents were accessed to veterinary services and 36.2% of the respondents had no accessibility for veterinary services. However, 49.5% of respondents had experience for deworming their fattening sheep to kill the internal parasites and 43.3% of the respondents were practiced sheep vaccination. The reason was some of the upper and lower Agro-ecology *kebeles* are distant to the center of veterinary clinics. Similarly, reported by (Shigdaf Mekuriaw *et al.,* 2012), in areas where vet clinics are unavailable, farmers travel long distances to get veterinary services during which many animals die before reaching the clinic.

The most important diseases of sheep in the moist highland zones (represented by Fogera and Bure PLWs) are pasteurellosis, fasciolosis, coenerosis, orf, anthrax and sheep pox (IPMS, 2010). According to (Shigdaf Mekuriaw *et al.,* 2012) major diseases reported were pasturellosis, fascioliasis, gastro-intestinal parasites and sheep pox, in order of their importance. Similarly this study, identified diseases such as pastuarollosis, contagious eczema (orf), sheep and goat pox; and anthrax, parasites such as fasciola, lung worm, mange, ticks, and lice; and Haemonchus in their order of importance. In comparable, major diseases of sheep were affected by fasciolosis (32.39%), pasteurellosis (30.33%) and sheep pox (27.87%) of respondents in lay-armacheho district reported by (Nibret Moges and Basaznew Bogale, 2012). In the study area farmers put a solution were open veterinary clinic close to the village and supplied with necessary medicine, protect animal from grazing thorny weed called *Asracantha longifolia*, avoid open grazing (free grazing) and minimize mixing animal with different stocks to reduced contracting disease from other stock. If difficult to build veterinary clinic the government get permission to those experienced farmers to provide simple cases.

In comparable, reported by Shigdaf Mekuriaw *et al.* (2012), in addition to taking sick animals to vet Health clinics, farmers treat their sick sheep by themselves using different traditional knowledge. Farmers, during the discussion, emphasized that it would be of great help for them if veterinary clinics are established in the vicinity. If this is difficult, they suggested provision of short term training to some innovative farmers to handle simple cases. The farmers also explained that supplies of drugs are not adequate at government clinics and the drugs purchased from private drug vendor were ineffective.

Table 4.17: Health care of fattening sheep in Fogera district

Health care of fattening sheep		Upper land				Midland						Lower land				Total %
		Chalma		Alem ber		Woji awuranba		Diba sifatra		Quhar michael		Abua Kokit		Nabega		
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Veterinary services	yes	0	0	10	90	0	0	7	100	4	100	3	37.5	10	55.6	63.8
	No	14	100	1	10	0	0	0	0	0	0	5	62.5	8	44.4	36.2
Deworming	yes	1	7.1	1	9.1	0	0	4	57.1	4	100	5	62.5	11	61.1	49.5
	No	13	92.9	10	90.9	0	0	3	42.9	0	0	3	37.5	7	38.1	50.5
Vaccination	yes	0	0	3	27.3	0	0	5	71.4	4	100	4	50	2	11.1	43.3
	No	14	100	8	72.7	0	0	2	28.6	0	0	4	50	16	88.9	56.7

N= total number of respondents

Marketing of Fattening Sheep

Marketing practices of fattening sheep is presented in Table 4.18. In the selected *kebeles*, months to start sheep fattening were mainly October to December (51.3%) and January to March (44.3%) and this is largely targeting of Ethiopian Christian holyday festivals. Few number of farmers preferred sheep fattening time July to September (1.2%) and April to June (3.2%) due to length of feeding period that were not attain their weight in short period of time. Respondents sell their fattened sheep 88.7% and 11.3% of by considering rate of live- body weight change and; anticipating the current and future price, respectively.

According to Amare Haileslassie *et. al*. (2011) the major selling months were December to January (Ethiopian Christmas and Epiphany), August to September (Ethiopian New year) and April (Ethiopian Easter) accounted for 34.2%, 18.5% and 18.3% of the total sheep annual sell respectively. Similarly, following to fattening preference, based on Ethiopia calendar (months grouped as quarterly) the demand for fattened sheep were high mostly in the months of April to June (66.6%) in the Easter holyday. Contrarily, demands for fattened sheep become low during the months of July to September (65.4%) and January to march (29.3%) due to fasting period.

The marketing places of sheep in all selected *kebeles* of the study area, the traditional markets are dominantly used for selling fattened animals. The majority of the farmers (93.4%) sell their animals in the district market and few (6.6%) sell in the village and no farmers sell neighboring district Table 4.18. The markets are located in the upper land (alember kebele) and lower land (woreta town). The farmers also buy animals for fattening purpose mainly from local market and the neighboring district. The average distance for marketing of fattening sheep mostly takes place 5-10km (43.9%), 10-15km(30.5%) and 4.2% of the respondent farmers buy fattening sheep at distance of >20km from the neighboring market (Farta and Dera) districts. Farmers are strategically synchronizing sheep marketing with availability of better feed quality and quantity and associated weight gain. Traditionally Ethiopian New Year (in September), Ethiopian Christmas (in January) and Ethiopian Easter (in April) are key marketing seasons (Amare Haileslassie *et.al,* 2012).

Figure 4.7: Typical example of sheep marketing in Fogera district

Table 4.18: Major marketing practices, the distance and marketing places of fattening sheep of the selected kebeles of Fogera district

Sheep Fattening activities		Upper land				Midland				Lower land				Total
		Chalma		Alember		Woji awuranba		Diba sifatra		Quhar michael		Abua Kokit		Nabega		
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	%
Months prefers to start sheep fattening	July to Sept	1	7.1	0	0	0	0	0	0	0	0	0	0	0	0	1.2
	Oct to Dec	13	92.9	3	27.3	0	0	3	42.9	2	50	4	50	8	44.4	51.3
	Jan to march	0	0	8	72.7	0	0	3	42.9	2	50	4	50	9	50	44.3
	April to June	0	0	0	0	0	0	1	14.2	0	0	0	0	1	5.6	3.2
High demands	July to Sep	1	7.1	0	0	0	0	0	0	0	0	0	0	0	0	1.2
	Oct to Dec	2	14.3	1	9.1	0	0	0	0	0	0	0	0	4	22.2	7.6
	Jan to march	3	21.4	1	9.1	0	0	1	14.3	0	0	2	25	14	77.8	24.6
	April to June	8	57.2	9	81.8	0	0	6	85.7	4	100	6	75	0	0	66.6
Low demands	July to Sep	0	0	10	90.9	0	0	3	42.9	4	100	6	75	15	83.3	65.4
	Oct to Dec	2	14.2	0	0	0	0	0	0	0	0	1	12.5	0	0	4.5
	Jan to march	11	78.6	1	9.1	0	0	4	57.1	0	0	1	12.5	3	16.7	29.3
	April to June	1	7.2	0	0	0	0	0	0	0	0	0	0	0	0	0.8
Marketing place	Village	0	0	1	9.1	0	0	0	0	1	25	0	0	1	5.6	6.6
	District market	14	100	10	90.9	0	0	7	100	3	75	8	100	17	94.4	93.4
	Neighbor district	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
The average distance for marketing	<5km	2	14.3	9	81.8	0	0	0	0	0	0	0	0	0	0	16
	5-10km	8	57.2	2	18.2	0	0	4	57.1	2	50	6	75	1	5.6	43.9
	10-15	3	21.4	0	0	0	0	3	42.9	1	25	0	0	17	94.4	30.5
	15-20	1	7.1	0	0	0	0	0	0	1	25	0	0	0	0	5.4
	>20km	0	0	0	0	0	0	0	0	0	0	2	25	0	0	4.2

*N=Number of respondents

The household survey of the study area showed that the mean price trend of the three consecutive years

before and after fattening are described in Table 4.19. In the year 2002 E.C the mean average price before fattening sheep was about 399.3 birr and ranged from 312 birr to 515 birr and after fattening the price is 679.8 birr and ranged from 537.7 birr to 853.8 birr. In the year 2003EC the mean average price before fattening was 473 and ranged from 380 birr to 593.8 birr and after fattened was 809.7 birr and ranged from 645.3 birr to 1050.5 birr. In the recent year the mean average price before fattening was 562.4 birr and ranged from 462.6 birr to 701.5 birr and after fattened was 984.3 birr and ranged from 764.6 birr to 1359 birr. Participant farmers sell their fattened sheep for individuals 85.5, local butcher 9.7%, middlemen 3.2% and big trader 1.6% in the study area. Similarly, Shigdaf Mekuriaw *et. al.* (2012) reported that the price of sheep fluctuates over the year according to the timing of fasting periods, religious holidays, festivals and crop failures season. It was found high in holidays such as Easter, Christmas, and Muslim holidays and the Ethiopian New Year and low during the wet and drought season due to feed shortage and different disease occurrences in Farta and Lay-Gayent district. Generally, the average marketing price of sheep before and after fattening in the three consecutive years demands were an increasing rate in the study area.

Table 4.19: Average marketing prices of sheep before and after fattening in Fogera district

		Years		
		2002E.C	2003E.C	2004E.C
Average marketing price of sheep		Mean ± SD	Mean ± SD	Mean ± SD
	Minimum	312.3±79.4	380.0±90.3	462.6±97.2
	Average	399.3±102.9	473±111.5	562.4±111.4
Before fattening	Maximum	515.8±131	593.8±157.5	701.5±148.5
	Minimum	537.7±142.5	645.3±160.8	764.6±155.0
	Average	679.8±155.7	809.7±203.2	984.3±231.8
After fattening	Maximum	853.8±207.4	1050.5±329.9	1359.0±419.6

Motives for Sheep Fattening Activity

In the study area, respondents have got information /motives about sheep fattening and marketing from agriculture extension agents, nearby fattening farms or markets, mass media and farmer association or cooperatives in the order of their rank in Table 4.20. From selected farmers few started sheep fattening since 1985 EC and now a day many of individuals started sheep fattening practices. From the interviewed farmers 24.2% have taken short term training and the rest 75.8% haven't taken any training about sheep fattening. Of which, 9.7% participants on sheep fattening were assisted by Ethio-wet land and natural resource association organization and agriculture office. To enhance the performance of sheep fattening activity in the district, some development interventions were made like credit service; supplement feed (oil seed cake, rice bran), extension for sheep housing and how to use feeding and watering troughs.

Table 4.20: Respondents got information about sheep fattening and marketing in Fogera district

Information about sheep fattening and marketing	Rank given by respondents (%)										
	1		2		3		4				
	M		M		M		M			Index	
	N	Fre	N	Fre	N	Fre	N	Fre	Sum	value	Rank
Mass media	4	16	5	15	13	26	32	32	89	0.164	3
Farmer association	1	4	5	15	13	26	32	32	77	0.142	4
Agri. Extension agent	43	172	16	48	0	0	0	0	220	0.405	1
Nearby fattening farms	13	42	31	93	9	18	4	4	157	0.289	2

*Fre=frequency; M=weighted frequency; N= total number of respondent**;** **Index for all agro-ecologies to get information = sum of single to get information parameter ranked in each agro-ecology i.e. 4*1st ranked to get information parameter + 3*2nd ranked to get information parameter + 2*3rd ranked to get information parameter + 1*4th ranked to get information parameter /sum of all weighted to get information parameters described by the respondents in each agro-ecology

The Major Livestock Development Constraints and Opportunities

Constraints

Table 4.23 shows the major constraint are feed shortage, disease, land, breed, capital, house, market and water in the order of their rank. In addition, respondents indicated that problem like invasion of grazing land with weeds like kinche imported weed *(partinium hysteroplorus)* and amekala (*Asracantha longifolia)*, flooding of the area, inadequate extension support and grazing land changed to arable land decreased livestock productivity. In comparable, the major constraints to sheep production were feed shortage (44%), animal health problems (28%),

labour shortage (15%) and occurrence of drought (13%) in Farta and Lay-gayent districts reported by (Shigdaf Mekuriaw *et. al.,* 2012). Similar agreement in Gondar Zuria district reported by Gizat Teshale (2012), feed shortage, lack of well organized marketing condition, insufficient availability of capital for the enterprise, inadequate availability of labor, lack of well organized infrastructure and water scarcity were major constraints in their order of importance.

According to Ayele Abebe (2012), the major constraints are feed shortage, livestock diseases, and shortage of initial capital, poor genetic makeup of the livestock, lack of drinking water, limited information on animal husbandry practices, labor shortage and poor market access, predators and flooding were reported in Fogera district. Inadequate feed supply is one of the major constraints hampering market-oriented livestock development in the Amhara National Resgional State in particular and in Ethiopia in general (Firew Tegegne and Assefa Getnet, 2010). Inadequate feed quantity and quality solutions are fodder trees, urea treatment of crop residues, use of agricultural by-products as concentrates, hay making, fodder storage, mixing residues of cereals with leguminous residues (Descheemaeker *et al.,* 2012). Generally, livestock production and productivity are affected by different factors.

Disease is the second important constraint in the study area. Health problems cause high mortality and reduce live weight gain resulting in reduced output per animal. For all *kebeles* 63.8% of the respondents had accessed to veterinary services and 36.2% of the respondents had no accessibility for veterinary services. However, 49.5% of respondents were experienced for deworming for their fattening sheep to kill the internal parasites and 43.3% of the respondents were practiced sheep vaccination to protect external parasites. Hence, very few veterinary clinics and veterinary services coverage, accounted for the increased losses of animals. The poorest ratio of veterinarian and Animal Health Technicians 1 DVM and 8 Animal Health Technicians and to high number of *Kebeles* (28) and vast livestock population in the area put the livestock disease prevention and control efforts at low level.

Grazing land size is diminishing due to the expansions of arable land and land putting nutritional stress on livestock investment in general and small ruminants in particular. But, producers shall be looking for the cost benefits of the livestock sector and crop production before implementations. Actually, it is important to more concern on livestock sector because of high return without any visible risk when compared to crop production. Breed was the fourth constraints for fattening purposes. Respondents were agreed that Washera sheep breed have better growth and live weight gain than the local Farta breed. But, market inaccessibility of Washera breed source hindered the need of farmers fattening practices.

Lack of capital was the fifth important constraint that hindered the performance of sheep fattening activity in the study area. To alleviate lack of capital, credit services are available from Amhara Credit and Savings Institution (ACSI), but farmers do not access it because they are unable to fulfill credit requirement such as organizing themselves in groups and also farmers are expected to get married to become entitled to the services. Housing for livestock is the sixth constraint in the area. Most farmers used sheep housing within the family which may favorable to zoonotic disease transmissions like tuberculosis. Respondents raised questions that the problems to build separated sheep house is money and low awareness of fattening investment in the area.

Marketing for fattening sheep is the seventh constraint in the area. Fluctuation of local market for fattened sheep was hindered continues fattening program of the producers. Actually, the study area have suitable environment for livestock investment. But, the focus of government for modern livestock production is low and biased to crop production to satisfy the need of human food in short term rather than integration. The diversified resource of the district like high potential of livestock, crop residue, huge grazing land and agro industrial by products utilization were not efficiently used due to lack of extension and policy supports (e.g. free grazing, crop residue management inputs and output markets). In comparable, the other constraints listed by farmers for sheep production include lack of improved forages species, inadequate feed conservation practices and absence of infrastructures (Shigdaf Mekuriaw *et al.,* 2012).

Water provision is generally the least constraint in the district. It was not as such a constraint in the area, which have a good potential of ground water and rivers. However, having a potential of ground water table which may exposed internal parasite for sheep that lowers live weight gain of sheep. Watering frequency affect the daily feed intake of animals and lead to reduced productivity.

Table 4.23: Livestock production constraints assessment of Fogera district

Constraints	Rank given by respondents (%)																		
	1		2		3		4		5		6		7		8				
	M		M		M		M		M		M		M		M			Index	
	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	Sum	value	Rank
Feed	100	800	17	119	14	84	2	10	2	8	1	3	0	0	0	0	1024	0.268	1
House	1	8	10	70	11	66	24	120	15	60	4	12	1	2	0	0	336	0.088	6
Disease	14	112	66	462	20	120	13	65	7	28	2	6	0	0	0	0	793	0.207	2
Breed	9	72	8	7	25	150	31	155	25	100	2	6	1	2	0	0	541	0.141	4
Land	12	96	16	112	43	258	14	70	9	36	1	3	2	4	0	0	579	0.151	3
Capital	2	16	13	91	16	96	15	75	15	60	10	30	3	6	0	0	374	0.098	5
Market	1	8	2	14	2	12	5	25	7	28	6	18	12	24	1	1	130	0.034	7
Water	0	0	5	35	0	0	2	10	0	0	0	0	1	2	0	0	47	0.012	8

*Fre=frequency; M=weighted frequency; N= total number of respondent**;** **Index for all agro-ecologies for constraints= sum of single constraint parameter ranked in each agro-ecology i.e. 8*1st ranked constraint parameter + 7*2nd ranked constraint parameter + 6*3rd ranked constraint parameter + 5*4th ranked constraint parameter + 4*5th ranked constraint parameter + 3* 6th ranked constraint parameter +2*7th ranked constraint parameter +1*8th ranked constraint parameter /sum of all weighted constraints parameters described by the respondents in each agro-ecology

Feed shortage mitigation mechanisms are presented in Table 4.24. During feed shortage farmers used different techniques to solve feed problems. In the upper agro-ecology, storing the available feed at the time of surpluses, hay making, using browse trees, destocking and traveling long distance were used in the order of their rank. Among the interviewed farmers, purchasing of feed supplement is not practiced. In the mid land agro ecology, storing the available feed at the time of surpluses, hay making, using browse trees, destocking traveling long distance, and purchasing of feed supplement were used to mitigate feed shortage. Also in the lower agro-ecology, storing the available feed at the time of surpluses, destocking, hay making, traveling long distance, purchasing feed supplement, and using browse trees were the major feed alleviation techniques in the order of ranking. In all agro ecologies; storing the available feed resources at the time of surpluses was the major practice to mitigate feed shortage. But, as shown in figure 4.9 there are wastage of crop residues during surpluses in the study area was observed. Therefore, it needs timely proper collection and storage.

Figure 4.9: Wastage of crop residue during surpluses in the study area

Table 4.24: Feed shortage mitigation mechanisms in Fogera district ranking

Agro-ecologies	Feed shortage mitigation mechanisms	Rank given by respondents (%)												Sum	Index value	Rank
		1		2		3		4		5		6				
		M		M		M		M		M		M				
		N	Fre	N	Fre	N	Fre	N	Fre	N	Fre	N	Fre			
Upper Land	Storing the available feed	32	192	4	20	1	4	0	0	0	0	0	0	216	0.341	1
	Using browse trees	2	12	10	50	14	56	3	9	0	0	0	0	127	0.201	3
	Destocking	0	0	6	30	3	12	13	39	3	6	0	0	87	0.137	4
	Hay making	4	24	15	75	11	44	2	6	1	2	0	0	151	0.239	2
	Purchasing feed supplement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Traveling long distance	0	0	0	0	1	4	7	21	13	26	1	1	52	0.082	5
Mid Land	Storing the available feed	35	210	7	35	1	4	1	3	0	0	0	0	252	0.324	1
	Using browse trees	3	18	5	25	11	44	11	33	7	14	1	1	135	0.174	3
	Destocking	2	12	10	50	9	36	4	12	5	10	1	10	121	0.156	4
	Hay making	1	6	20	100	13	52	2	6	0	0	0	0	164	0.211	2
	Purchasing feed supplement	2	12	0	0	3	12	4	12	5	10	1	1	47	0.060	6
	Traveling long distance	1	6	1	5	0	0	10	30	4	8	10	10	59	0.076	5
Lower Land	Storing the available feed	31	186	2	10	2	8	1	3	0	0	0	0	207	0.366	1
	Using browse trees	2	12	0	0	0	0	0	0	3	6	0	0	18	0.032	6
	Destocking	2	12	18	90	8	32	0	0	0	0	0	0	134	0.237	2
	Hay making	2	12	4	20	12	48	1	3	2	4	0	0	87	0.154	3
	Purchasing feed supplement	0	0	2	10	6	24	3	9	0	0	0	0	43	0.076	5
	Traveling long distance	0	0	5	25	4	16	10	30	2	4	1	1	76	0.135	4

*Fre=frequency; M=weighted frequency; N= total number of respondent:

Opportunities

Fogera district has better land resources, water resource, productive and high cattle population, and emerging of high sheep populations. At present sheep population in the district are at increasing rate where farmers looking for the availability of seasonal feed resource like grass pea residue, rice bran, other crop residues and the adaptability behavior of sheep production rather than goat production. These indigenous resources are highly expanding to response the optimum sheep fattening profit.

In the stratified agro-ecologies especially lower and mid land (water logging area) fatteners seasonally buy animals and feed their own products to utilize resources efficiently. Within the availability of feed sources; mixing of cereal with legume crop residue, rice bran with *atela* or oil cake are important feeding methods to intensify sheep fattening in the dry season. These locally available feed resources supplementation have high crude protein and energy content used to attain good live weight gain of the animals. The upper agro-ecology also used that resources found in the local markets have low cost; in addition to having the potential of fodder trees to alleviate feed problems and supplement animals during fattening period by cut and carry feeding system which helps to increase the live weight of the animal. The local fattening practices of the area create the demands of the buyers in the local market through holidays (Easter) due to having good body conditions of the fattened animals.

The communal grazing land were changed to crop land owned by individuals illegally especially the lower land agro ecology create nutritional stress to their livestock in general and for sheep in particular in both seasons. However, some of the opportunities that used to solve feed shortages which establishing community based grazing land management for efficient utilization of the resource including the removal of the pasture thorny weed in the marshy areas, enhancing the forage production and fodder conservation in the farmers homestead, implementing of the nutritive value of improvement of crop residues (like chopping, mixing, urea treatment, pelleting), timely collection and preservation of animal feed and use gazing land/ reservation hay making.

The Government of Ethiopia includes livestock fattening in the five years Growth and Transformation Plan and committed to increase export of meat market. Recently, the Amhara National Regional State has given emphasis to the development of livestock sector by considering the huge numbers of livestock in the region. Amhara region has established a livestock agency under the Bureau of Agriculture in order to provide all the necessary support (e.g. supply different inputs, planned to establish health centers in each *kebeles*) to the development of the sector. However, high demands of sheep in the local market due to the expansion of restaurants, hotels and butchers can be considered as an opportunity for sheep producers. Landless people and other members of society can be engaged in fattening activities that makes them benefited as a result locally available of high agro-industrial by products that having high energy and crude protein content of the feed that reduce the production cost, high market demand and higher price of the current and future market. As the study

area found the T-point of Gondar, Bahir Dar and Debre Tabor towns, the presences of meat processing factory in Bahir dar 55km from the study area and other institutions in the towns have create a good opportunity that encourages the producer to sell their fattened sheep. The attitude of the consumer is leading to a change towards a more meat focused diet especially in large towns and cities. Thus it will be advantageous to improve the consumers' health and to enhance the producers' economic return.

CONCLUSION

Conclusion

Sheep fattening practice is an important farming activity in the study area. The overall practices of sheep fattening in the study area out of 140 respondents 44.3% farmers were practiced. The source of fattening sheep in the study area were own production and immediate purchasing at the time of fattening. The major available livestock feed resources identified in the study area were natural pasture, crop residue, stubble grazing, hay, fodder trees and improved forages and agro industrial by products. Available feed resource utilization (non-conventional like *atela* and rice bran) or improvement such as mix cereals and legumes residue, formulation of rice bran with *atela* and crop residue treatment with urea would also share the burden of grazing area which is at alarmingly decreasing both in size and productivity. The five feeding lengths have been identified in the study area such as for 2 months, 3 months, 4 months, 5 months and 6 months of the respondents in the study area. Three months of feeding fattening sheep was reported by majority of HHs. Five types of water sources were identified in the study area such as river, spring, hand dug well, well and temporary water. The accessibility of veterinary service provided better for mid land which increases livestock water productivity; whereas the upper and lower land have not got enough veterinary services due to their distance. The three type of housing system were identified which used to keep the fattening sheep separated room in the family house, separated house and enclosed barn or shed. Majority of the respondents used separated room in the family house for sheep fattening. Therefore, all management aspects of fattening sheep require more attention for sustainable sheep fattening in the study areas. The major constraints such as; feed shortage, disease, land, breed, capital, house, market and water in the order of importance. In addition, during discussion problems like; invasion of grazing land with weeds like kinche imported weed *(partinium hysteroplorus)* and amekala (*Asracantha longifolia)*, flooding of the area, inadequate extension support and grazing land changed to arable land. Sheep fattening opportunities also pointed out in this study area for intervention.

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