

Full Length Research

Feed resources and its utilization practices by smallholder farmers in Meta-Robi District, West Shewa Zone, Oromiya Regional State, Ethiopia

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The study was carried out in Meta Robi district, West Shewa Zone, Oromia Regional State, Ethiopia. Secondary data collection, field observation, key informants discussion and respondents interview were carried out. The district was stratified into upper, mid and lower altitudes and a total of 90 respondents (upper=30, mid=30 and lower=30) were randomly selected and individually interviewed. The result of the study revealed that, the major feed resources were natural pasture (58.9%), wheat straw (42.4%), barley straw (30%) and hay (21.1%). During the dry season, 90% of the respondents fed their animal crop residues followed by hay (55.6%) and stubble grazing (35.6%). Natural pasture was the dominant feed source during the wet season. September, October and November were classified as months when feed available relatively in excess. Feed was adequately available in the months of December, January, June, July and August whereas February, March, April and May were classified as feed shortage months. In the study district, 22.2, 37.8, 36.7, and 3.3% of the respondents fed their animals in indoor, group feeding, let to graze and tethering, respectively. Among the grazing systems, continuous grazing, deferred grazing, and zero grazing systems were practiced by 62.2, 36.7 and 1.1%, respectively. About 74.4% of the sampled households in the district did not produce improved forage mainly due to shortage of land (41.1%), shortage of forage seeds (23.3%) and lack of awareness (24.4%). Only 30, 20 and 20.6% of the respondents in upper, mid and lower altitudes manage their grazing land for better production. About 69% of the respondents in the district were transporting livestock feeds to their back yard for their livestock feeding. Feed conservation in upper, mid, lower altitudes and the study district was in the order of 96.7, 96.7, 56.7 and 83.3%, respectively. Generally, in the study district, the production, productivity, transportation, storage and utilization efficiency of the available feed were low and therefore, further research and development works should be designed to reverse the existing situation.

Key words: Feed resources, management practices, Meta-Robi

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INTRODUCTION

Ethiopia has the largest livestock population in Africa. Despite the highest population, the productivity of Ethiopian livestock is low, and compared to its potential,

the direct contribution to the national economy is limited (Belay et al., 2013). The productivity of the sector is low mainly due to factors such as poor genetic makeup of

local animals, poor nutrition and poor veterinary care among which poor nutrition is the major limiting factor (Yeshitila et al., 2008). Feed is the most important input in livestock production and its adequate supply throughout the year is an essential prerequisite for any substantial and sustained expansion in livestock production (Samuel et al., 2008). These feed resources can be classified as natural pasture, crop residue, improved pasture and forage and agro industrial by-products of which the first two contribute the largest share (Tolera et al., 2012). The role of natural pasture grazing as a major livestock feed resource is diminishing from time to time due to shrinking grazing land size (Yayneshet, 2010). In addition natural grasslands as a source of feed for livestock is low in production of dry matter and the availability of herbage for the grazing animal is restricted to four or five months of the wet season over most of the natural grasslands (Ulfinia et al., 2013). In the past, the use of communal grazing lands, private pastures and forest areas as feed resources has declined while the use of crop residues and purchased feed has generally increased (Benin et al., 2003). Though increased utilization of agro-industrial by-products has been reported, they are not available, affordable or feasible for most of the farmers in the highlands of Ethiopia (Benin et al., 2004). According to Zewdie (2010) the quantity and quality of available feed resources in relation to livestock requirement has not been yet well addressed in most livestock production areas of the country. In highlands of Ethiopia, the annual DM production could satisfy only two-third of the total DM requirements of the livestock due to this, during the dry season animals lose their condition which is an indicator of feed shortage and suggests that livestock production and productivity are constrained by feed scarcity (Funte et al., 2010). Natural pasture and crop residues are the major feed sources for livestock in Meta Robi district of west shewa zone, Ethiopia where this study was conducted. There is lack of information regarding the availability, sources and feeds management practices in the district. With this background, this study was carried out to assess the types of livestock feeds and its management practices by small holder farmers.

MATERIALS AND METHODS

Description of the study area

The study was carried out in Meta Robi district, West Showa Zone, Oromia Regional State, Ethiopia. The district is located at 101 km west of the capital city of the country. The altitude of the district ranges from 1,376–2,904 meter above sea levels (masl). The total land area of the district is about 93,769 ha (crop land = 51,762.9 ha, grazing land = 11,775.94 ha, forest land = 6,792.75

ha and land used for other purposes= 23,437.4) (Meta Robi district Agricultural Office annual report, 2013/14).

Climatic condition and topography

The minimum and maximum temperatures of the district are 15 and 31⁰C, respectively. The district receives average annual rainfall ranging from 750–1,300 mm. The main rainy season is from June to end of September. The topography of the district is characterized to be flat land (60%), valley (8%), mountains (9%) and ups and downs (23%).

District, Kebeles and Respondents selection

The district was selected due to the presence of relatively large number of animals, availability of large grazing and crop lands and marginality of the district to most technological interventions as compared to the neighboring districts. Out of 41 rural kebeles, 9 kebeles representing upper altitude (3 kebeles), mid altitude (3 kebeles) and lower altitude (3 kebeles) were selected using a stratified random sampling method in consultation with the districts' livestock expert based on the Ethiopian agro-ecological classification (Dereje and Eshetu, 2011). A total of 90 households from 9 kebeles (10 hh from each kebele) were selected randomly and interviewed independently.

Assessment of feed resources and its management practices

To determine feed types, sources and its management practices in the district, data were collected both from primary and secondary sources. Secondary sources of data on climate, soil type and characteristics, topography, agro-ecology, livestock population and crop production potential of the district were collected by reviewing different documents from relevant district offices like livestock production and health agency, agriculture and land management. This was followed by group discussions with key informants containing 8-12 individuals including men, women and young households, livestock expert and development agents. One group discussion was carried out in each agro-ecology of the study district. Based on the outcomes of the two (literature review and group discussions) a semi-structured questionnaire was prepared to elicit information from the sample households. Primary data on household size, household herd size, land holding and utilization pattern, major feed resources, production of grain and crop residues, seasonality of feed resources, constraints in feed production, conservation,

transportation and supply were obtained from the questionnaire survey during the course of the study. Conversion factor was used to convert total livestock population to TLU (Jahnke, 1982).

Statistical analysis

The survey data was stratified into altitude zones, coded and analyzed using the Statistical Package for Social Sciences (SPSS version 17). Mean, percentages and standard error of various parameters were calculated for each altitude zones of the district.

RESULTS AND DISCUSSION

Land holding and land use pattern of the households

In the study district, the average total land owned by the households was 3.8 hectares ranging from 0.5 to 12 ha (Figure 1). The average land holding of the respondents in the study district was higher than the average national land holding size (0.96 ha/hh) and Oromia region (1.15 ha/hh) (CSA, 2011). The average land size allocated for crop production varied between 1.66 to 2.27 ha while that of grazing land was 0.77 to 1.45 ha. In general, the households in the study district allocated about 2.05 ha (53.1%) for crop production and 1.22 ha (31.60%) for grazing. Bedasa (2012) reported that the amount of land size allocated for crop production was 1.7 ha (70%) and grazing land was 0.4 ha (16.6%) in Jeldu district west shewa zone. The land allocation differences in these neighboring districts might be due to differences in the size of the land and farming system.

Livestock population and herd composition

The total populations of livestock in the district were estimated to be 171,177.88 TLU. As shown in table 1, cattle comprised 82.11% of the total TLU of the livestock population in the district. About 36.32% of the cattle were cows followed by oxen (27.19%), heifers (20.39%) and bulls (16.08%). In agreement to the current study, in the highland production system of the country, cattle comprised 92% of the total TLU and about 37% of the cattle herd was cows and steers (18%) (Funte *et al.*, 2010). The overall average of TLU of livestock per household in the study district was 7.97, 0.74, 0.46, 0.78, 1.44, 0.8 and 0.07 for cattle, sheep, goats, donkeys, horses, mules and poultry, respectively (Table 2 and 3). The large number of sheep (0.74 TLU) than goats (0.46 TLU) owned per HH might indicate the fitness of these animals in the production system as the area is suitable for sheep production.

Major livestock feeds in the district

The feed resources in the district are natural pasture grazing, crop residues such as wheat straw and barley straw, hay, local alcohol waste and crop aftermath (Table 4) which are similar to the feed resources in most highlands of Ethiopia (Lemma *et al.*, 2002; Alemayehu, 2003; Tolera *et al.*, 2012). Generally, natural pasture and crop residues were the dominant feed resources in the study district but agro-industrial by products such as noug seed cake, linseed cake, molasses, brewery by products, non-conventional feed and improved forage were uncommon and rarely used. The major feed types in the upper altitude of the district are natural pasture, wheat straw, *teff* straw, maize stover and hay whereas in mid altitude natural pasture, *teff* straw, wheat straw and barley straw in their descending order. In lower altitude *teff* straw, wheat straw, sorghum and maize stover contributed the most in their descending order.

Feed resources during dry and wet seasons

In the study district, during dry season, 90% of the respondents use crop residues as number one feed source followed by hay (58.8%) and stubble grazing (56.1%) (Table 5). Contrary to the current study, Tesfaye (2008) reported that the major dry season feed resources for cattle in Metema district were natural pasture (55.7%), crop residues (20.7%), stubble (14.3%) and hay (9.3%) and this differences is mostly due to agro-ecological and farming systems differences between the two districts. In wet seasons, all the respondents in the three altitude zones use natural pasture and to some extent hay and crop residues to feed their animals.

Seasonal availability of feeds

The respondents classified months of the year according to feed availability (Figures 2). According to this study in overall study area, animal feed was relatively available in excess in the months of September (86.7%), October (86.7%) and November (74.4%). This excess availability of feeds during these months was associated with the availability of natural pasture, hay production, crop residues and aftermath grazing. Feed was adequately available in the months of December (52.2%), January (54.4%), June (46.7%), July (52.2%) and August (51.1%). This can be related to the availability of hay, crop residues and aftermath grazing in the months of December and January and natural pasture in the months of June, July and August. Tesfaye (2008) reported as the shortage of feed begins from the end of November, and the months of January, February and March are the driest months when the productivity of the

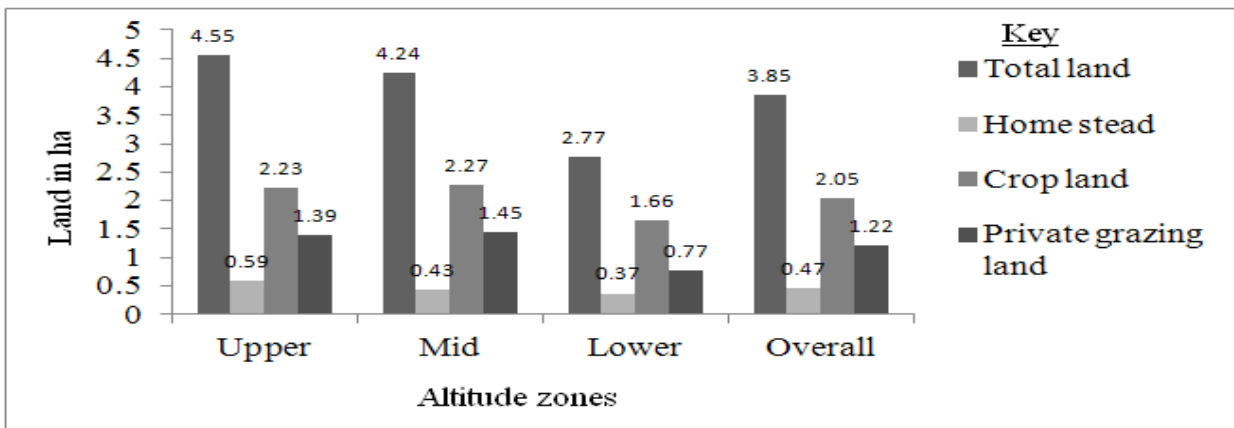


Figure 1: Land holding and use patterns of the sampled households in Meta Robi district

Table 1: Livestock population in Meta Robi district

Animals species	Population	TLU equivalent *	Total TLU
Cattle			140,561.3
Cow	72,944	0.7	51,060.8
Oxen	38,222	1	38,222
Heifer	57,333	0.5	28,666.5
Bulls	22,612	1	22,612
Sheep	59,321	0.1	5932.1
Goat	58,105	0.1	5810.5
Donkey	11,181	0.5	5590.5
Horse	15,213	0.8	12,170.4
Mule	590	0.7	413
Poultry	70,008	0.01	700.08
Bee Colonies	20,182	-	-
Total			171,177.88

* Jahnke (1982)

Source: Current survey result.

natural pasture dwindles. In the current study, 83.3%, 95.6%, 96.7% and 96.6% of the respondents indicated that February, March, April and May were classified as feed shortage months, respectively. In these months, the availability of natural pasture, hay, crop residues and aftermath grazing is reduced. The same result was reported by Tessema *et al.* (2003) in which the critical feed shortage months in Belesa Woreda were from January to the end of June.

Livestock feeding and grazing systems

In the study district, 22.2, 37.8, 36.7, and 3.3% of the respondents fed their animals in indoor, group feeding, let to graze and tethering, respectively (Figure 3). In Jeldu district 94.5, 4.4 and 1.1% of the respondents practiced let to graze, cut and carry and tethering, respectively

(Bedasa, 2012). As indicated above, large percentage of farmers practiced group feeding system and in this feeding system all age categories of animals fed together so that it is difficult for younger animals to satisfy their daily dry matter requirement as some of the animals can consume more than the others. Similarly, the percentage of farmers allowing their animals to grazing land were also high (36.7%) and in this feeding system, the farmers could not know either the daily dry matter requirement of the animals is fulfilled.

Among the grazing systems, continuous grazing, deferred grazing and zero grazing systems were practiced by 62.2, 36.7 and 1.1%, respectively (Table 6). In the upper and mid altitudes, only continuous and differed grazing was practiced. Generally, in the study district, the percentage of respondents practicing continuous grazing were the highest (62.2%) which indicate that the grazing land could be over grazed and

Table 2: Mean local cattle holding size of the sampled households in the three altitude zones of Meta Robi district in TLU

Altitudes	Oxen		Cows		Bulls		Heifers		Calves	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	mean	SE
Upper	3.00	2.13	2.33	1.51	1.92	1.29	1.05	0.5	0.5	0.3
Mid	2.63	1.35	2.17	1.14	1.74	0.93	1.27	0.56	0.32	0.2
Lower	2.36	0.91	1.35	0.7	2.09	0.83	0.93	0.5	0.3	0.16
Overall mean	2.66	1.54	1.95	1.23	1.92	1.05	1.09	0.55	0.35	0.24

Table 3: Small ruminants and Equine holdings of the respondents in TLU

Species	Upper		Mid		Lower		Overall mean	
	Mean	SE	Mean	SE	Mean	SE	mean	SE
Sheep	0.98	0.82	0.65	0.25	0.31	0.09	0.74	0.95
Goats	0.37	0.26	0.45	0.32	0.47	0.32	0.46	0.31
Donkey	0.85	0.32	0.77	0.29	0.72	0.36	0.78	0.33
Horses	1.67	0.97	1.12	0.76	1.00	0.4	1.44	0.9
Mule	1.19	0.45	-	-	0.8	0.00	0.8	0.00
Poultry	0.06	0.03	0.04	0.02	0.08	0.03	0.07	0.03

Table 4: Major feeds supplied to livestock in Meta Robi district

Types of feed	levels								Rank
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	
Pasture grazing	58.9%	10%	6.7%	2.2%	1.1%	1.1%	-	-	1 st
Wheat straw	15.6%	42.4%	14.4%	4.4%	2.2%	1.1%	-	-	2 nd
Barley straw	-	5.6%	30%	12.2%	3.3%	-	-	-	3 rd
Hay	4.4%	13.3%	8.9%	21.1%	3.3%	-	-	-	4 th
Atella	-	1.1%	-	6.7%	18.9%	12.2%	7.8%	5.6%	5 th
Crop aftermath	-	-	5.6%	10%	11.1%	7.8%	7.8%	1.1%	6 th
Maize stover	-	5.6%	6.7%	14.4%	7.8%	3.3%	3.3%	-	7 th
Sorghum stover	1.1%	2.2%	6.7%	4.4%	5.6%	4.4%	1.1%	1.1%	-
Teff straw	20%	20%	15.6%	12.2%	12.2%	2.2%	1.1%	-	-
Wheat bran	-	-	1.1%	-	2.2%	-	1.1%	2.2%	-
Oats	-	-	-	-	8.9%	-	3.3%	2.2%	8 th
Noug cake	-	-	-	-	1.1%	1.1%	-	-	-
Molasses	-	-	-	-	3.3%	7.8%	2.2%	-	-

Table 5: Dry and wet seasons feeds in the study district

Feed type	Dry season				Wet season			
	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th
Crop residues	90%	8.25%	-	-	-	30.6%	20%	-
Hay	10%	58.8%	21.05%	-	-	36.7%	31.4%	-
Fodder	-	3.52%	3.5%	9.5%	-	8.16%	21.70%	13.3%
Stubble grazing	-	24.7%	56.1%	9.5%	-	2.04%	-	-
Concentrates	-	2.35%	7.01%	23.8%	-	-	2.85%	6.66%
Natural pasture	-	-	1.75%	-	100%	-	-	-

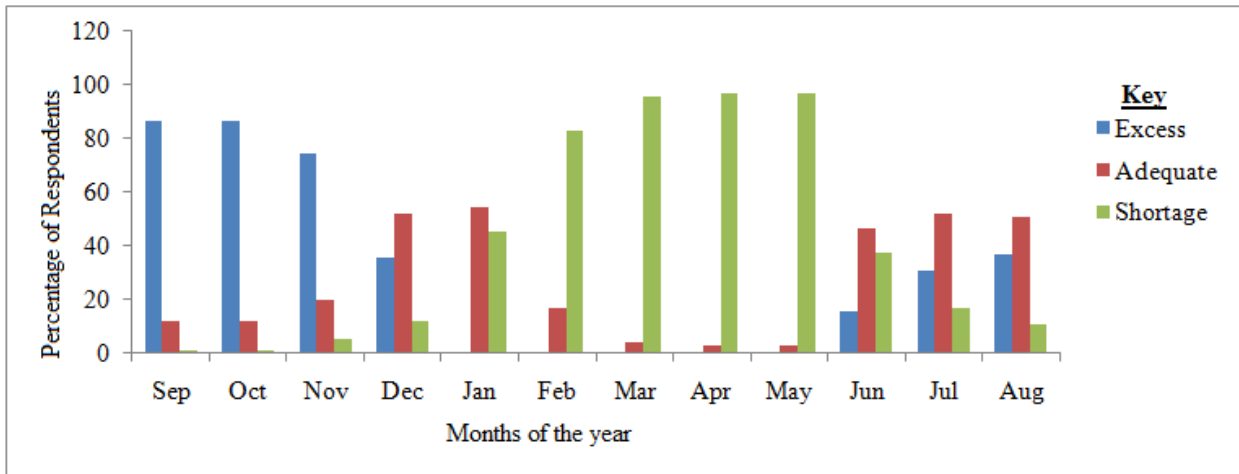


Figure 2: Responses of the sampled households regarding feed availability by months

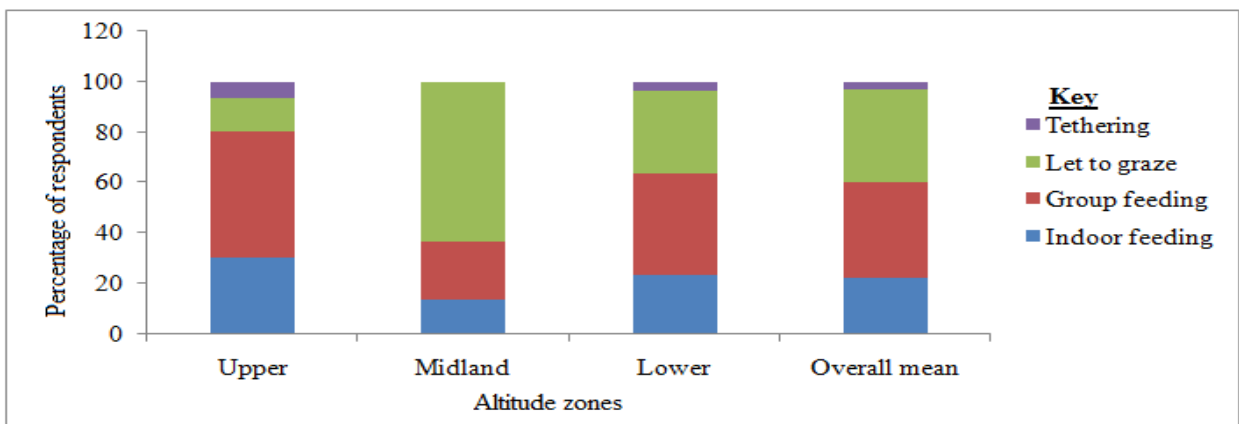


Figure 3: Livestock feeding systems in Meta Robi district

Table 6: Grazing systems practiced in the district

Types of grazing	Upper altitude	Mid altitude	Lower altitude	Overall mean
Continuous	43.3%	60%	83.3%	62.2%
Differed	56.7%	40%	13.3%	36.7%
Zero grazing	-	-	3.3%	1.1%

Table 7: Watering systems and frequency of watering in district

Watering system	Upper Altitude	Mid Altitude	Lower altitude	Overall mean
Group watering	83.3%	100%	80%	87.8%
Individual watering	-	-	16.7%	5.6%
Both system	16.7%	-	3.3%	6.7%
Frequency of watering				
Once in a day	48.27%	3.3%	66.7%	39.42%
Twice in a day	51.72%	93.3%	13.3%	52.77%
<i>Ad libitum</i>	-	3.3%	20%	7.8%

Table 8: Improved forage production and factors influencing its production and utilization in Meta-Robi district

Parameter	Upper altitude	Mid Altitude	Lower altitude	Overall areas
Reasons for not planting improved forages				
Shortage of land	29.62%	53.3%	43.3%	41.1%
Shortage of forage seed	18.51%	36.7%	16.7%	23.3%
Unevenness of rainfall	-	-	16.7%	5.6%
Lack of awareness	48.14%	10%	20%	24.4%
Lack of interest	3.70%	-	-	1.1%

Table 9: Grazing land management techniques in the study district

Management techniques	Upper Altitude	Mid Altitude	Lower altitude	Overall Mean
Application of fertilizer	-	14.28%	16.67%	9%
Application of manure	44.44%	42.85%	-	31.81%
Removal of weeds and unpalatable plants	-	-	16.67%	4.54%
Manure application and weeding	55.55%	42.85%	66.67%	54.54%

degraded through time unless correction measures are taken.

Watering system, source of water and watering frequency

The watering systems in the upper, mid and lower altitudes were almost similar where 83.3, 100 and 80% of the respondents practicing group watering system, respectively (Table 7). In the study district in general, the majority (87.8%) of the respondents practiced group watering system and livestock get water from the river (97.8%) and pond (2.2%). In the present study, livestock get water on average distance of 1.4 km. Getting water sources at the nearest distance can save their energy that is otherwise wasted in searching water. In the study district, 52.77% of the respondents water their animals twice a day, 39.42% once a day and 7.8% *ad libitum*. This indicates that water availability and sources was not a major problem

Improved forages, shrubs and trees production and utilization

About 74.4% of the sampled households in the district did not produce improved forages, shrubs or trees on their farm land as animal feed source (Table 8). Belay *et al.* (2012) also reported that all households (100%) interviewed in Dandi district did not cultivate improved forage species for their livestock production. The major

reasons for not planting improved livestock feeds in the study district include shortage of land (41.1%), shortage of forage seeds (23.3%) and lack of awareness of the respondents (24.4%) (Table 8). This shows that farmers do have an interest to grow improved forage crops but other factors were hindering its production.

Mineral supplementation

In the study district, (96.7%) of respondents provided salt for their animals as a mineral source. However, the amount provided and the species of animals that are provided with this mineral need further investigation for appropriate ration formulation. Similar to this study, Belay *et al.* (2012) reported that all respondents in Dandi district supplement their livestock with common salt. The percentage of respondents supplying other mineral sources other than salt was 46.7, 26.7 and 10% in the upper, mid and lower altitudes, respectively. In the study district in general, 72.2% of the respondents were not providing natural soils as mineral sources for the animals due to lack of mineral soil in the area, not knowing the mineral itself and lack of awareness of the respondents.

Non- conventional feeds

In the study district, utilization of non-conventional feeds other than local alcohol waste (Atella) was very low. Based on the result of this study, these feed types were not common in upper altitude whereas only 3.3 and 6.7% of the respondents in mid and lower altitudes were using non-conventional feeds, respectively.

Table 10: Feed transportation mechanisms and transportation problems in Meta Robi district

Transporting mechanism	Upper	Mid	Lower	Overall
Human back	41.37%	41.37%	57.14%	45.07%
Donkey and horses	55.17%	58.62%	42.85%	54.17%
Car	3.44%	-	-	1.38%
Transporting problems				
No road access	55.17%	23.3%	63.3%	47.19%
Bulkiness	-	-	13.3%	4.49%
Absence of transport facilities	44.82%	76.7%	23.3%	48.31%

Table 11: Time of feeding hay and crop residues in Meta-Robi district

Feeding crop residues	Upper	Mid	Lower	Over all
Soon after collection	40%	36.7%	66.7%	47.8%
One month after	10%	13.3%	23.3%	15.6%
Two months after	13.3%	33.3%	6.7%	17.8%
Over two months	36.7%	16.7%	3.3%	18.9%

Grazing land management

Grazing land management practices were relatively less common in all areas of the study district in which only 30, 20 and 20.6% of the respondents in upper, mid and lower altitudes manage their grazing land for better production, respectively. In overall surveyed areas, 76.4% of the respondents did not manage their grazing lands and only 23.6% apply some management techniques on their grazing lands. Among the management techniques, a combination of weeding and manure application (54.54%), manure application alone (31.8%), fertilizer application (9%) and weeding alone (4.5 %) were practiced (Table 9). The current finding is in agreement with the finding of Fekede *et al.* (2013) who reported that 22.5% and 77.5% of the respondents in central highlands of Ethiopia were managing their pasture land and not managing their pasture lands, respectively. According to this investigator, 14.8% and 51.8% of the sampled households were applying fertilizer and manure on grazing lands, respectively.

Transportation, storage and utilization of feeds

About 68.9% of the respondents in the study district were transporting livestock feeds to their back yard for their livestock feeding. Feed transportation in the lower altitude is very low (20%) as compared to the upper (93.3%) and mid (93.3%) altitudes. The common means of transportations are human back (45.07%) and donkey and horse's back (54.17%) (Table10). The problems

raised in transporting livestock feeds were absence of transporting facilities (48.31%), lack of road access (47.19%) and bulkiness of the feed (4.4%).

According to respondents, feed storage during high production season was one of the coping mechanisms for feed shortage. Feed conservation in upper, mid, lower altitudes and the study district was in the order of 96.7, 96.7, 56.7 and 83.3%, respectively. In the lower altitude, significant percentage (43.3%) of respondents are not conserving feed due to factors like inadequacy of the feed, labor shortage and lack of awareness of respondents .

Utilization of hay and crop residue was started soon after collection (47.8%), one month after collection (15.6%), two months after collection (17.8%) and stay conserved over two months (18.9%) (Table 11). Fekede *et al.* (2013) also reported a similar result that farmers in the greater Addis milk shade, central highlands of Ethiopia fed stored feed to their animals soon after collection (45.5%), one month after collection (19.2%), two months after collection (24.7%) and stay conserved over two months (10.3%).

Feed marketing

In the district, feed marketing along the value chain was a weak practice. Of the total respondents in the upper, mid, lower altitudes and the district in general, 40, 70, 86.7 and 65.5% replied that they did not buy agro-industrial by products and other feed types for their animals, respectively. The rest of the sampled households

purchase feed from local farmers and these feed types were mostly natural pasture and hay but commercial feeds were not available in the area. In agreement to the current study, Zewdie (2010) reported that 80 and 55% of the farmers at Jimma and Sebeta, respectively, indicated that agro-industrial by products are not available sufficiently in the market. In the study district farmers travel on average 9.7 km to purchase molasses or other agricultural inputs from agricultural office of the district. Feed processors and retailers are not totally present in the district so that livestock producers could not get agro-industrial by products from the nearby market.

CONCLUSIONS

The major feed resources in the district were natural pasture grazing, crop residues such as wheat straw and barley straw, hay, *Atella* and aftermath grazing. During dry season, 90% of the respondents use crop residues as number one feed resource followed by hay (58.8%) and stubble grazing (56.1%) while during wet season all respondents (100%) in all altitude zones use natural pasture. Crop residues accounted for 76.72% of the livestock feed share in the district and it is expected to increase in the future therefore, efficient utilization of this feed should be designed. Among the feeding systems group feeding and let to graze were commonly practiced by most respondents. The percentage of respondents practicing continuous grazing are the highest (62.2%) which indicate that the grazing land could be over grazed and degraded through time unless correction measures are taken. About 74.4% of the sampled households in the district did not produce improved forages, shrubs or trees on their farm land as animal feed source mostly due to shortage of land (41.1%), shortage of forage seeds (23.3%) and lack of awareness (24.4%). In overall surveyed areas, 76.4% of the respondents did not manage their grazing lands. Feed transportation in the lower altitude is very low (20%) as compared to the upper (93.3%) and mid (93.3%) altitudes mostly due to lack of awareness of the farmers, small amount of feeds or lack of transporting facilities. Lack of feed marketing was the other problem in the district that hinders livestock production which was aggravated by absence of feed processors and retailers.

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