

Full Length Research Paper

Assessment of livestock feed resources and feeding systems in Haramaya district, Eastern Ethiopia

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The study was conducted in east Hararghe zone of Oromia regional state, eastern Ethiopia to assess the major available livestock feed resources. A total of 150 households with experience in livestock keeping practice for at least two years were selected. All respondents indicated that shortage of feed resources, dominance of unpalatable forages and low nutritive values of usable forages were the major feed problems. Overall, 73% of the respondents used cut and carry system as a grazing system and 93% indicated that feeding hay, crop residues and concentrates were the methods used to combat feed shortages. The major feed resources were crop residues, natural pastures and fodder trees/shrubs. Sorghum and maize were the main sources of crop residues, whereas leaves of *Cordia Africana*, *Veranonia amygdalina*, *Erythrina burana*, *Combretum molle*, *Casimiroa edulis* and *Olea Africana* were the major indigenous fodder trees used to supplement livestock species in the dry season. Adequate conservation, improvement and utilization of hay and crop residues as well as the introduction of potential forage production (e.g. planting multipurpose fodders and producing improved forages), and use of animal source as supplement need to be practiced to overcome feed shortage and optimize production. Regulation policies of land use need to be employed in the area to ensure land units for livestock feed production, which will allow the livestock sector contribute to poverty eradication and encourage smallholder farmer to be a food secured household.

Key words: Feed resource, crop residues, fodder tree, forage production.

INTRODUCTION

Ethiopia is known to be the African country with the richest livestock resources. About 62% of the total land surface in the country is suitable for grazing (Hogg, 1997; Alemayehu, 1998a, b). Livestock industry is an important and integral part of the agricultural sector in Ethiopia. Moreover, livestock farming is vital as a supply of meat and milk, being a source of additional income both for

smallholder farmers and livestock owners (Ehui et al., 2002).

In a smallholder livestock production system, animals are dependent on a variety of feed resources that can vary both in quantity and quality. For optimum livestock production, feed resource available should match with the number of animals in a given area. Feed resources as

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reported by Tolera et al. (2012) can be classified as natural pasture, crop residue, improved pasture forage and agro-industrial by-products, of which the first two are the most important contributors. Animals depend mainly on natural pastures for their feed requirements. In Ethiopia, there are extensive areas where keeping of livestock on the natural vegetation is the only possible types of land use (Coppock, 1994).

Natural pastures which provide more than 90% of the livestock feed are generally very poorly managed. Nowadays, the rangelands of Ethiopia are being extensively damaged both in quantity and quality (Belaynesh, 2006). Due to the poor management and overstocking of natural pastures, which are highly overgrazed and result in severe land degradation, loss of valuable species and dominance by unpalatable species (Alemu, 1998).

Fibrous agricultural residues is the most important contributor in livestock feed, especially in the populated countries where crop cultivation of land is prioritized. Tolera et al. (2012) reported that crop residues contribute to about 50% the total livestock feed supply in Ethiopia. Livestock production constraints could vary not only among agro-ecological zones, but also among production systems. For example, different animal species are bred by the urban and peri-urban farmers which are regulated by the demand of products such as milk and availability of the supplemental feeds.

The peri-urban and urban farmers usually purchase basal feeds (grasses and crop residues) from the rural area. However, the supply of feeds to the urban farmers depends on the availability of feed resources in the rural area. Therefore, it is necessary to assess livestock feed resources and constraints that cause feed inadequacy in the rural livestock production systems. Such information will be used to develop policies in order to minimize the problems that could be generated. There is very little information which assesses the availability and utilization of feed resources in Haramaya district specially in the three selected peasant associations (PAs) of Haramaya district namely Damota, Tuji Gabisa and Tinike. Feed resource assessment is important to diagnose the problems and suggest intervention measures to be taken by farmers and policy makers.

MATERIALS AND METHODS

Description of the study area

The study was conducted in three of the 33 peasant associations existing in Haramaya district of east Hararghe zone, Oromia regional state that surrounds Haramaya University namely Tuji Gabisa, Tinike and Damota. Eastern Hararghe is one of the 18 zonal administrations and comprises 19 districts, out of which four districts are pastoral and the rest 15 are mixed crop-livestock systems (EHOARD, 2013). Haramaya district comprise a total area of 55,000 ha located in latitude 9°9' to 9°32'N, and longitude 41°50' to 42°05'E, between 1600 and 2100 m.a.s.l. high. It is located 15 km to the North of Harar city. According to CSA (2007), the

population of Haramaya district is 215,140 (26,129 urban and 189,011 rural) and the district is the most densely populated area from the zone (the estimated density is 335.16 persons per km²). The minimum and maximum temperatures are 5.2 and 24° C, respectively (EHOARD, 2013) and the mean annual rainfall is 492mm ranging from 118 to 866 mm. The area has a bimodal rainfall pattern, with small rains from March to May and main rains from June to September (EHOARD, 2013).

Sampling techniques

The three PAs of Haramaya district that surrounds Haramaya University were purposively selected as the PAs are in short supply of animal feed resources in the district. Based on the aforementioned criteria, the selected rural peasant associations from Haramaya district were Tuji Gabisa, Tinike and Damota. First, a total of 150 households who had an experience in livestock species keeping practice for not less than two years (with an adequate livestock husbandry skill), 50 from each peasant association, were selected.

Types of data and methods of data collection

Data were collected both from primary and secondary sources. Secondary sources consisted on data about climate, human population, livestock population and livestock production constraints, and were collected by reviewing different literatures conducted so far in the district. Primary data (household size, land utilization pattern, major feed resource, household herd size; seasonality of feed resources) were collected through a survey during the course of the study. Primary data were collected using semi-structured questionnaire starting from March to April, 2015. The questionnaire was first pre-tested before in the beginning of the survey. A total of 150 individuals, 50 from each peasant association, were selected as respondent to be involved in the survey convey.

Statistical analysis

Primary data from surveyed households and relevant secondary data were organized, summarized and analyzed using excel spread sheet 2007. Mean and percentage values of different parameters were compared among the PAs.

RESULTS AND DISCUSSION

Household characteristics

Among the interviewed households in Damota, Tinike and Tuji Gabisa PAs, 23(46%), 27 (54%) and 40 (80%) were husbands, respectively. The rest of respondents were spouses. Thus, representing the 60% of all interviewed were husbands and 40% were spouses (Table 1). In each PA, the proportion of illiterate respondents was higher than 50% with the highest proportion (66%) in Tuji Gabisa PA. This might be attributed to the age of respondents that participated in the interview program which is on average 44.15 years. It is evident that schools were not well distributed before 40 years in the rural parts of Ethiopia which impedes the literacy rate. The proportions of those who can only read

Table 1. Respondent's status, education background, current occupation and occupation five years ago in the different PAs of Haramaya district.

Variable	Damota PA		Tinike PA		Tuji Gabisa PA		Total	
	HHC	Percentage (%)	HHC	Percentage (%)	HHC	Percentage (%)	HHC	Percentage (%)
Respondent status	N=50		N=50		N=50		N=150	
Husband	23	46	27	54	40	80	90	60
Spouse	27	54	23	46	10	20	60	40
Education background of respondents								
Illiterate	27	54	27	54	33	66	87	58
Read only	17	34	7	14	7	14	31	21
Elementary	0	0	13	26	7	14	20	13
Junior secondary	0	0	0	0	3	6	3	2
Secondary	6	12	3	6	0	0	9	6
Current Occupation								
Mixed farming	50	100	50	100	50	100	150	100
Livestock rearing only	0	0	0	0	0	0	0	0
Crop production only	0	0	0	0	0	0	0	0
Occupation 5 years ago								
Mixed farming	33	66	43	86	47	94	123	82
Livestock rearing only	0	0	0	0	0	0	0	0
Crop production only	17	34	7	14	3	6	27	18

HHC=household count.

and reached secondary school were highest for Damota PA. However, the proportion of respondents who reached elementary school was highest for Tinike PA. The low level of educational status in the district was similar to other areas in rural Ethiopia (Coppock, 1994; Alemu, 1998). This situation may show an adverse impact on technology transfer and hamper the productivity of the interventions being made in the district. The result is in line with the case reported by Teshome (2007). As far as the major occupation of the

households were concerned, all of them (100%) were practicing mixed farming agriculture (that is, crop-livestock system) whereas 18% indicated that they have been practicing solely crop production during the last five years.

Household land holding and ownership

Average land holding for crop land per household for Damota, Tinike and Tuji Gabisa PAs was 0.83

ha (ranging from 0.5 ha to 2 ha), 0.7 ha (ranging from 0.1 ha to 1 ha), and 0.43 ha (ranging from 0.1 ha to 1 ha), respectively (Table 2). Average land devoted for communal grazing area was 0 ha, 0.007 ha, and 0.05 ha for Damota, Tinike and Tuji Gabisa PA, respectively. Fallow land was only practiced in Tinike PA. The overall average land allotted for crop, communal grazing and fallow land was 0.654 ha, 0.019 ha, and 0.003 ha, respectively (Table 2). This result is coincident with a previous study by Estefanos et al. (2014)

Table 1. Average land holding and livestock ownership per household in the three PAs of Haramaya district.

Land use types (ha)	Peasant association (PA) name			Overall average for the three PAs
	Damota (N=50)	Tinike (N=50)	Tuji Gabisa (N=50)	
Crop land	0.83	0.7	0.43	0.654
Communal grazing area	0	0.007	0.05	0.019
Kalo (enclosure making)	0	0.009	0	0.003
Livestock species (no.)				
Cattle	3.33	2.93	2.6	2.95
Sheep	1.87	1.53	1.6	1.67
Goat	2	2.67	2.13	2.27
Donkey	0.87	0.73	0.93	0.84
Poultry	5.33	3.8	4.13	4.42

for crop land in Haraghe highlands who reported 0.78 ha for overall average land allotted for crop land. This indicated that land is one of the scarce resources for animal production in the study district. Communal grazing area was exercised in Tinike and Tuji Gabisa PAs with an area of 0.007 ha and 0.05 ha per household, respectively. Kalo (standing hay preservation/enclosure making) was only practiced in Tinike PA with an average of 0.009 ha per household. The criteria they used to make Kalo was its accessibility.

Livestock holdings and composition

The mean number of cattle holding per household in Damota, Tinike and Tuji Gabisa PA was 3.33, 2.93 and 2.6, respectively with an overall average of 2.95. More poultries were reared in Damota PA than in the other two PAs. Overall mean number of sheep, goat, donkey and poultry was 1.67, 2.27, 0.84 and 4.42, respectively. With regard to livestock composition of the area, poultry were the dominant, followed by cattle, goat, sheep and donkey in that order. Therefore, we can conclude that possession of the farmers were higher for poultry than large ruminants in the study area. The result is also similar with the findings reported by Abdi et al. (2013) and Estefanos et al. (2014). Any farmer in the study area has no more than 10 cattle, which imply that all the interviewed farmers were smallholders. The low number of large ruminant per household could be attributed to the small size of land holding of the household.

Livestock feeding systems

In each PA, most of the respondents used cut and carry system (zero grazing) as a type of grazing system with the highest proportion in Tinike PA (80%) as indicated in Table 3. Tethering was only practiced in Tinike and Tuji Gabisa PAs. Tethered grazing was practiced at higher

rate in wet season than dry season because most of the lands were more free from crop production in dry season than in wet season, supporting the previous study by Estefanos et al. (2014). All the respondents in Damota and Tuji Gabisa PAs practiced haymaking, purchasing concentrates and using crop residues as a means to combat livestock feed shortages.

However, most of the respondents (80%) in Tinike PA practiced hay making, purchasing concentrates and using crop residues as a means to combat livestock feed shortages, whereas the remaining 20% used only concentrates which was purchased from the local market. Therefore, feed conservation practice in the form of hay making was exercised fully in Damota and Tuji Gabisa PAs. These results are coincident with the reports made by Freweini et al. (2014) who showed that hay making is highly practiced in Haramaya than Gursum district. All the respondents in Damota and Tuji Gabisa PAs harvested forages for haymaking after the blooming/flowering stage. Only in Tinike PA, 40% and 60% of the respondents harvested forages for haymaking before flowering and after flowering stage, respectively. Most of the respondents in Damota PA (66%), Tinike PA (86%) and Tuji Gabisa PA (72%) used forage legumes, grasses and both forage legumes and grasses as the types of forages for haymaking, respectively (Table 3). All respondents in each PA used haymaking as the only cattle type of livestock species.

Overall, 73% of the respondents used cut and carry system as a means of grazing system and the 93% feeding hay, crop residues and concentrates were the methods used in order to combat feed shortages. The present result is in line with the finding made by Teshager et al. (2013) who reported that most of the respondents fed their animal with hand feeding/cut and carry system. Similarly, most of the respondents (87%) harvested forages for hay making after flowering of forages, whereas 44% used grasses for haymaking. All respondents indicated that feed shortage from its source, dominance of unpalatable forages and forages with low

Table 2. Types of grazing system, methods for combating feed shortage and hay making characteristics in the three PAs of Haramaya district.

Variable	Damota PA		Tinique PA		Tuji Gabisa PA		Total	
	N=50	Percentage	N=50	Percentage	N=50	Percentage	N=150	Percentage
Types of grazing systems								
Cut and carry system	33	66	40	80	36	72	109	73
Tethering	0	0	10	20	7	14	17	11
Rotational grazing	17	34	0	0	7	14	24	16
Methods for combating feed shortage								
Using concentrates only	0	0	10	20	0	0	10	7
Hay making only	0	0	0	0	0	0	0	0
Using crop residues only	0	0	0	0	0	0	0	0
All of the above	50	100	40	80	50	100	140	93
Stages of harvesting hay								
Before blooming	0	0	20	40	0	0	20	13
At blooming	0	0	0	0	0	0	0	0
After blooming	50	100	30	60	50	100	130	87
Types of forages used for hay making								
Grasses	17	34	43	86	7	14	67	44
Legumes	33	66	0	0	7	14	40	27
Both	0	0	7	14	36	72	43	29

nutritive values were the major feed problems in the study area in that order. The problem of feed shortage in the district is also reported by Estefanos et al. (2014) who stated that farmers in Tuji Gabisa illegally penetrate into Haramaya University's pasture land to graze their animal due to the critical feed shortage.

Similarly, all the respondents pinpointed that overgrazing, grazing pressure, moisture deficit, shrinkage of grazing lands due to cultivation and environmental degradation were the major likely causes of feed shortages in the study area in that order. Due to the very limited communal grazing area available resulting from the increase of the

human population and intensive cropping, some overgrazing or overstocking of pasture exists during almost all of the year. This is in line with the case reported by Estefanos et al. (2014) in the same district. Furthermore, it was the mind of all the respondents that donkeys, goats, sheep and cattle tolerated feed shortages in that order.

Major livestock feed resources of the study area

Major livestock feed resources of the PAs are shown in Table 4. All the respondents reported

that crop residues and natural pasture were their main livestock feed resources. The main sources of crop residues in the study areas were sorghum and maize, as it has been observed in previous reports by Estefanos et al. (2014) and Freweini et al. (2014). Fodder trees (leaves and pods) were only used in Damota and Tuji Gabisa PAs. Leaves of *Cordia africana*, *Veranonia amygdalina*, *Combretum molle* and *Olea africana* are the major indigenous fodder trees used to supplement livestock species in the dry season which is agreed with findings made by Belay, (2013). The use of *Erythrina burana* and *Casimiroa edulis* leaves were also used commonly in eastern

Table 3. Percentages of respondents indicating the major feed resources in three PAs of Haramaya district.

Major feed resources	Damota PA		Tinike PA		Tuji Gabisa PA		Total	
	N=50	Percentage	N=50	Percentage	N=50	Percentage	N=150	Percentage
Crop residues	50	100	50	100	50	100	150	100
Kalo (enclosure)	0	0	27	54	0	0	27	18
Fodder trees	50	100	0	0	36	72	86	57
Natural pasture	50	100	50	100	50	100	150	100
Agro-industrial byproducts (concentrates)	20	40	13	26	23	46	56	37

Table 4. Seasonal calendar of livestock feed resources.

Feed source	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Communal grazing (natural pasture)	x	-	-	-	-	-	-	-	-	x	x	x
River side grazing	x	-	-	-	-	-	-	-	x	x	x	x
Cut-and carry	x	x	-	x	x		x	x	x	x		x
Crop residues	-	-	-	-	x	x	x	x	x	-	-	-
Browses(pods and leaves)	-	-	-	-	x	x	x	-	-	-	-	-
Roots and tubers	x	-	-	-	-	-	-	-	-	x	x	x
Concentrates	x	-	-	-	-	-	-	-	-	x	x	x
Hay	x	-	-	-	-	-	-	-	-		x	x

Haraghe zone as reported by Freweini et al. (2014). No fodder trees except 'chat' were practiced in Tinike PA. However, Kalo (enclosure making) was only practiced in Tinike PA with an average occupied area of 0.009 ha. According to the respondents, *Kalo* is practiced for the purpose of feed preservation for drought times and is made mainly for cattle. Agro-industrial by products was practiced in the three PAs, with the highest proportion found in Tuji Gabisa PA (46.67%). Agro-industrial byproducts are not common due to availability and cost, being wheat bran the only byproduct used as feed. This finding is in line with the previous study of Freweini et al. (2014) who reported that around 92% of the respondents

have used wheat bran in Haramaya district. Overall, the major feed resources in the study area were crop residues and natural pastures which agrees with the studies by Tolera et al. (2012) and Estefanos et al. (2014) who reported natural pasture and crop residue to be the major feed resources for highlands of Ethiopia and highlands of Hararghe, respectively.

Feeding calendar and seasonal availability of feed resources

Information about the seasonal availability of livestock feed resources in the areas of study was

obtained from group discussions and observations during the field work. Table 5 above shows the result. It was shown that the pattern of availability of feed resources in the district is influenced by similar factors which are also reported by other researchers for the highland areas (Gryseels, 1988; Ahmed, 2006).

Conclusions

The increase of human population and small land holdings have resulted in feed shortage and overgrazing. The feed deficit observed in the study area could be one of the contributing factors

affecting livestock productivity. Improved forage production and conservation are not practiced and the availability of agro-industrial byproducts is inadequate in the study area. It is necessary to do a big effort to overcome feed shortage through proper conservation and utilization of hay and crop residues. Therefore, introduction of potential forage production, improvement of the feed resource through different techniques and supplementing the livestock with other feed resources should be practiced to optimize production. There should exist a land use policy regulation in the area which could secure land units for livestock feed production to make the livestock sector contributes to poverty eradication and encourage smallholder farmer food secured household. Chemical compositions for available feed resources are not included due to financial limits. However, it would be necessary if a deeper research is investigated on the chemical composition of available feed resources to get a full picture of the livestock feed resources of the district.

Conflict of Interests

The authors have not declared any conflict of interests.

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