Feed Resource Assessment and Utilization in Baresa Watershed, Ethiopia

Mergia Abera[1], Adugna Tolera[2], Getnet Assefa[3]

[1]Department of Animal Science Research Case Team, Southern Agricultural Research Institute, Hawassa Agricultural Research Center, P.O. Box 06, Hawassa, Ethiopia

[2, 3]Department of Animal Production and Rangeland management, Hawassa Agricultural University, P.O. Box 05, Hawassa, Ethiopia

Abstract: ***A survey was conducted in Baresa watershed in Meskan Woreda, Gurage zone, Southern Nations, Nationalities and People Regional State, Ethiopia in 2008/9. The objective of the study was to assess the available feed resources, estimate the amount of feed that can be produced per-annum and relate with the annual requirement for the existing livestock population, thus to design strategies fulfilling the dietary requirement of the animals and proper feed production and management systems.. The survey was conducted using a semi-structured questionnaire and participatory rural appraisal. In addition, group discussions were held with elders, key informants and development agents. The survey showed that the major feed resources in the area are natural pastures, crop residues, aftermath grazing and weeds. The estimated quantity of these feed resources was below the annual requirement of livestock in the study area. The available feed dry matter was estimated to cover about 69.9% of the total maintenance requirement of the livestock in the area. This figure is low were the animals may have access to other feed resources such as leaves and pods of trees and various household and horticultural wastes that are not included in the calculation because of lack of conversion factors; that would have been included in the calculation of available feed resources. The findings also indicated seasonal variability of feed availability; relatively feed is in good supply during June to September. The farmers preserve crop residues for dry season; however, the way of conservation is not generally appropriate and used for other purposes; silage making is not known; hay making is not practiced due to scarcity of grazing land, despite that, available grasses used for roof cover. Also there is limited experience in treatment and processing methods for improving the nutritional quality of crop. Thus this study revealed that effective collection, conservation and proper utilization of crop residues and hay making might be increase the available feed; and looking for other alternatives options such as use of urea treatments, nutrient block, silage making, and scale-up of improved forage species with participatory approach will improve the nutritional quality of available feed for dry season in Baresa watershed.***

Keywords: feed resources, participatory, biomass, watershed, dry matter.

1. Introduction

Livestock keeping is an important component of the Ethiopian agriculture (Getnet and Inger Ledin, 1999). It provides the major traction power in agriculture, manure for fuel and fertilizer, milk, meat and cash income to farmers. Livestock and livestock products, such as meat, skin and hides are the major sources of foreign currency earnings. Livestock have an important contribution to crop production through provision of traction power and manure. Thus, crop/livestock are interdependent (Solomon, 1999; Romney *et al.,* 2003; Tilahun and Kirkby, 2004).

In Baresa watershed, similar to other part of the country, livestock play an important role in livelihoods of rural people. However, the livestock production is constrained by feed shortage in terms of both quantity and quality. The feed resources are natural pasture, crop residues and weeds from cropland. Productivity of natural pasture is gradually decreasing due to rapidly increasing human population pressure, cropping is expanding and grazing areas are shrinking , leading to a shortage of livestock feed (Adugna, 2007). The area is characterized by food insecurity, land degradation, land shortage and poor soil fertility (Tewoderos *et al.,* 2007).As a result animals are not able to satisfy their nutrient requirements and very often lose weight and productivity.

About 1.5 and 19 million tons of crop residues are annually available for livestock feed in Southern Nations, Nationalities and People Regional state and Ethiopia, respectively (Seyoum, 2007). Crop residues play a key role in promoting integrated farming system, knowledge of their production, management and utilization is of paramount importance to identify intervention for efficient utilization and assessments of available feeds resources and utilization helps not only to arrive at realistic estimations but also to identify constraints that may limit improved utilization (Hailu and Fekede, 2007). So far, there is no information of the available feed resource and utilization system in Baresa watershed. This study, therefore, was designed to assess the available feed resources, estimate the amount of feed that can be produced per-annum and relate with the annual requirement for the existing livestock population to improve livestock feed supply in *M*eskan woreda, Gurage zone, southern Nations, Nationalities and People Regional State

2. Materials and Methods

2.1. Characteristics of the study area

The study was conducted in Baresa watershed, Meskan Woreda of Gurage Zone in Southern Nations, Nationalities and Peoples Regional State (SNNPRs), Ethiopia. The watershed is sited at 38° 22` E and 8o o7` N about 180 km east of Hawassa the capital city of SNNPRs or 138 km west of Addis Ababa, capital city of Ethiopia, at an altitude range between 1964 and 2200 meter above sea level. Topography is characterized by steep, undulating slopes divided by v-shaped valleys of seasonally intermittent streams and

characterized by clay silt in soils texture and with p^H value of 6.3. The small rainy season (*belg*) extends from middle March to April while the main rainy season (*meher*) extends from June to early October. The month of July and August receive the highest rainfall and cause soil loss. In when this experiment was conducted, the annual rainfall was 1029 mm. However; there is a marked year to year fluctuation in the pattern of rainfall distribution. The average annual minimum and maximum temperature of the watershed were 14 ^{o} and 24 ^{o}, respectively. The watershed is characterized by food insecurity, land degradation, feed shortage, land shortage and poor soil fertility.

2.2. Respondent's selection to collect survey data

Ninety two households including women and men were selected randomly from the watershed to participate in the survey. A methodology including survey, conducted using prepared questionnaire which focused on animal feed, group discussions and key informants interview was used to generate necessary data on feed resource availability and use system in the wet and dry season. The group discussions was made using check list, were focused on available feed resources, feeding system, grazing system, seasonality effect on feed availability, feeding calendar, coping mechanism of feed shortage, availability and type of fodder plant and area coverage and yield of crop across the seasons, land use patterns, human and animal population, livestock production management, livestock/crop production system and trend of livestock production system. The group discussions were held twice during "*belg"* and "*meher*" season, respectively and the total of 112 peoples participated in the group discussion. Besides, secondary data was collected from the reports of the Woreda Office of Agriculture and Rural Development to augment primary data.

2.3. Estimation of the quantity of available feed resource

The quantity of feed resource in the stud area was estimated using the information on crop production and land area collected from the respondents. Besides, Secondary data on the area of the land cultivated by annual and perennial crops and the amount of grain produced was collected from the Woreda Agricultural Bureau and *Kebeles* annual report to augment primary data. The amount of crop residues and by-products that are used as source of animal feed was estimated using established conversion factors/multipliers developed by different researchers. The multiplier developed for wheat, barley and teff straw is 1.5 per unit weight grain yield, while the factor for maize and haricot bean are, 2.0 and 1.2, respectively (FAO, 1987; Adugna, 1990). The dry matter (DM) output of grazing pasture was estimated based on FAO (1987) multiplier factor, which is 2.0 tons/ha. Crop aftermath grazing potential was estimated by using a mean of 0.5 tons per hectare.

2.4. Estimation of the available dry matter feed resource and animal requirements

The total available dry mater (DM) feed resource was estimated by summation of DM feed from different feed resources and annual feed DM requirements was estimated based on Yitaye *et al*., (1999a), Using a formula developed by MAFF, (1975). The average DM requirement from major feed resource for one tropical livestock unit (250 kg body weight) was calculated to be 5 kg DM/day for maintenance and according FAO (1986), digestible protein requirement for maintenance and growth was 160 g and 100g digestible protein (DP)/day, respectively for one tropical livestock unit**.** This is 2% of body weight of the animal. To determine the carrying capacity of the area, the available livestock population was converted into tropical livestock unit (TLU). The DM requirement of 250 kg dual-purpose tropical cattle (an equivalent of one TLU) for maintenance according Kear Lc. (1982).The established factors were used to convert each species of domestic animal to TLU are given below in Table 1.

Table1: Conversion factors to tropical livestock unit

No	*Species*	*Conversion factors**
1	Cattle	0.7
2	Sheep and goats	0.1
3	Mules	0.7
4	Horses	0.8
5	Donkeys	0.5

* = Kear Lc. 1982

2.5. Statistical analyses

Survey data, descriptive data was analyzed using SPSS software statistical package.

3. Results and Discussion

3.1. Land holding, human population and household characteristics

The total land size of the watershed is 1250 ha. Total land and cultivated land per household were 0.92 and 0.76 hectares, respectively. Subsistence mixed crop-livestock production system is the major type of agriculture. Maize (37.7%), tef (30.4%), wheat (13.5%), haricot bean (7.8%) and sorghum (6.4%) are the major crops grown in the watershed. of the total land size of the watershed about 82.7% is allocated for annual crop production and 17.3% for perennial crop production, only 1.27% and 9% of the area are covered by forest and grazing land, respectively. About 74% and 26% of the land was owned by men and women headed households respectively. Mean household size was seven. The total household of the study area is 1010 and the total human population is 5536. The education level of 18%, 25%, 22% and 34% of the households was grades 7-12, 1-6, reading and writing and no education (illiterate) respectively.

Only 0.04% of the total land was allocated for improved forage production. In view of the economic situation, it is unlikely that farmers will set aside land for pasture production. However, forages could be grown as hedges around field edges and on soil bund, particularly on the sloping land, intercropped with cereals and alley cropping is also a possibility. Most of the farmers in the study area are educated (66 %); this is also another opportunity for easy acceptance and adoption of the available new animal production and forage technologies.

3.2. Livestock population and utilization

According to the respondents (92 households) the major types of livestock in the watershed were cattle, sheep, goats and donkeys in the order of their total population. 54.7% of the household owned cattle, 22.9% sheep, 12.9% goats and 9.5% had donkeys. Cattle and sheep were the dominant species of livestock kept in the watershed followed by goats and donkeys were least. The average size of livestock holdings per household were 3.3, 1.4, 0.8 and 0.6 for cattle, sheep, goats and donkeys, respectively Most of the farmers in the watershed kept more than one species of domestic animals. Farmers gave different reasons for this. Most of the farmers indicated that, having more number of animals is an indicator of wealth. Others responded that owning more livestock species, especially sheep and goats is the means of risk aversion in case of natural disaster or any incidence of disease outbreak. Some farmers suggested that it is easy to mange and accommodate sheep and goats on a smaller area than large ruminants that is why they prefer to keep them. Almost all farmers in the study area appreciate the importance of small ruminants indicating that keeping them is similar to saving cash in a bank. They can sale the animals to pay the credits for agricultural input (fertilizer and/or improved seeds) and also used to meet emergency cases, payment of taxes and school fees.

3.3. Grazing system

The production system of Baresa watershed area is a mixed crop livestock production system. However, livestock are managed in an extensive management system where communal grazing is practiced during the cropping season, between March/April to October/November. These places are top of the hills and stony land, and are estimated to be 0.5 to 1 km from farmer's residences. During those months, sick animals, lactating cows, unwarned calves, kids, lambs, donkeys and draught animals are managed around homesteads and graze either tethered or on marginal land and roadsides. The grass covered top hill grazing land is generally not efficiently managed and utilized as communal grazing resource. It needs due attention and improved management through participation of community. This grazing land has a potential source of feed for the area, if management is improved such as by enclosing the area of Baresa watershed grazing lands, like other similar watersheds in Galesa and Gnuno watershed of West Shewa Zone and Wolayita Zone, Ethiopia respectively (Shenkut *et al*., 2008).

3.4. Available feed resources and utilization

3.4.1. Feed resources

According to the survey results, the major feed resource for livestock in the Baresa watershed natural pasture, which is estimated to account about 67.5 % of the total feed supply in the watershed followed by crop residues (30.5 %) especially from maize Stover and Tef straw Other feed resources include agro-industrial by products and improved cultivated forage crops in the area comprise only about 1.1 % and 0.9 % of the total feed, respectively.

3.4.2. Natural pasture

According the respondents, ruminant production system in the Baresa watershed is heavily dependent on grazing from natural pasture and crop stubble. These feed resources are generally poor in quality and their productivity and supply is seasonal, particularly a critical problem during the dry season. Currently with the rapid increase in human population and increasing demand for food, grazing lands are steadily shrinking due to the conversion of grazing lands to crop lands, and are restricted to the areas that have little value of farming potential such as hill top areas, rocky land and roadsides. From the total land size of the households, only 9 % of the land is allocated as grazing land in the watershed.

3.4.3. Maize thinning and crop residues

Farmers usually harvest maize residues together with grain and after removing the ear they conserve the Stover to be used during periods of feed shortage. Maize is more available than other feed resources. During the rainy season thinning of maize is the common practice in the area to be used as feed for livestock. This is the practice of uprooting some of the maize plants from densely grown population, which is normally practiced at the stage of about one meter growth height. For this practice farmers use high seeding rate of maize at planting so that maize population is high enough for thinning to be used as a feed source. After maize harvest the total crop residue produced is not utilized only as animal feed. Some proportion is used for other purposes including fuel, house and grain storage construction; and sale. The survey result showed that about 70.5% of the residue is used as feed, while the remaining, is used for fuel (24.8%), construction (10.1%) and for sale (5%). From the Tef straw produced, about 86.8 are used as animal feed, 8% for construction and 5.5% for sale to generate income. Therefore; these issues need due attention to design strategies to maximize the use of crop residues as feed than other alternative uses, such as by introduction of multipurpose trees as a source of fuel and construction wood, and animal feed.

3.4.4. Agro – industrial by products

Concentrates and protein supplements are sometimes used by some farmers in the watershed (21.7%), which is normally purchased from the nearby town, Butajera. The types of agro industrial by-products are wheat bran and molasses. However, 78.3% of the respondents were not using agro industrial by- product to supplement their animals. Maize grain is used by few farmers to a very limited level. 1.1% of the respondents were not using agro industrial by- product due to limited availability of products, 74% of the respondents were not using agro industrial by product due to limited financial capacity and 1.1% lack of awareness Farmers who provide supplements to their animals prioritize to working oxen, fattening oxen, lactating cow, calves and donkey in the order of importance.

3.4.5. Improved forage production

There were little adoption and availability of improved forage crops grown in the watershed, which is introduced by the Operational Research Project in collaboration with the woreda agriculture office. However, according to the respondents only 44.6% of the households planted improved forage crops; the remaining 55.4% of the households did not

cultivate improved forage crops. Moreover, the proportion of land allocated for cultivated forage crops was too small, which is less than 1% of the total cultivated land of the area. According to respondents, the reason for not using cultivated forage crops in the study area in order of shortage of land, lack of awareness of farmers on benefits of cultivating forage crops and shortage of availability of forage seed and planting material in decreasing order of importance.

Different forage species such elephant grass, vetch, *Sesbania sesban*, and *Cajanus cajan* have been tested and were found to be well adapted, productive and accepted by the farmers. In addition to the forage species various forage technologies such as hedgerow, backyard, soil band particularly associated with the natural resource conservation has been demonstrated. However, the adoption rate of the forage technologies in the study area is found to be very low due to weak extension support, which mainly emphasized on food crops. There is generally less emphasis by research and extension on livestock and forage development. Forage development strategies such as hedges around field edges and on soil bunds, particularly on the sloping land, intercropped with the cereals and alley cropping have a chance of better acceptance by the community.

3.5. Month of feed availability and feeding calendar

Seasonal feed availability and feeding calendar is shown in Table 2. 96.7% of the respondents were say that feed is in short supply during December to May and 100% of the respondents were say that very critical during the month of April to May. During this period all preserved crop residues will be exhausted and grazing grasses also become extremely poor. The farmers strategies used to cope with the feed shortage in the months were supplementing livestock with any available dry crop residues and tree leaves.

Table2: Relative feed availability of the major feed resources over the months of the year

Feed type	*Months of the year*											
	J	F	M	A	M	J	J	A	S	O	N	D
Pasture	-	-	-	-	-	x	xx	xx	xx	x	x	-
Maize thinning (green)	-	-	-	-	-	-	xx	xx	xx	-	-	-
Maize Stover	x	x	-	-	-	-	-	-	-	xx	xx	x
Tef and other crop residues	x	x	x	-	-	-	-	-	-	xx	xx	x
Weeds from cultivated crop fields	-	-	-	-	-	x	xx	xx	xx	-	-	-
Aftermath	-	-	-	-	-	-	-	-	-	xx	xx	-

x = months fairly in availability of feed, xx = .months, good in availability of feed and – month, not in availability of feed

However, the extreme feed shortage that is month of April to May this problem might be uncorrected and also there is limited experience in treatment and processing methods for improving the nutritional quality of crop residue. The farmers preserve crop residues for dry season; however, the way of conservation is not generally appropriate. Silage making is not known in the area and also hay making is not practiced due to scarcity of grazing land, despite that, available grasses used for roof cover. Relatively feed is in good supply during the months of June to September, during this period there is better growth of pasture, maize thinning and weeds grown in annual and perennial crops are available. Thus, the effective collection, conservation and proper utilization of crop residues and hay making might be increase the quantity of available feed, and looking for other alternatives options such as use of urea treatments, nutrient block, silage making, and scale-up of improved forage species with participatory approach will improve the nutritional quality of available feed for dry season in Baresa watershed.

3.6. Feed quantification

3.6.1. Estimated available major feed resource

The main feed resource for livestock in the study area were found to be natural grazing lands, crop residues and cultivated forages species (*Sesbania sesban, Cajanus cajan*, Elephant and Guatemala grasses). The type and amount of DM obtainable from available major feed resource is presented in Tables 3 and 4. Crop residues were found to be the major feed resources with the estimated production of 250.42 tones DM in the watershed annually, while grazing natural pasture, stubble grazing and improved forage contributed 33.9, 35.1 and 0.2 tones DM, respectively. Other less available feed resources such as maize grain, Noug cake and wheat bran and cut grass estimated from the daily feed allocation data provide about seven tones DM per year. Therefore, the total feed DM obtainable from the major and minor available feed resources in the watershed was estimated to be 326.6 tons per year.

Table3: Area coverage and estimated productivity of grazing lands, stubble grazing lands and cultivated forage crops in Baresa watershed in 2008

Feed Sources	*Area (ha)*	*Conversion factor*	*Total DM t/year*
Natural grazing land hold as Private	6.4	2.0*	12.8
Communal natural grazing land	10.6	2.0*	21.1
Stubble grazing land	70.3	0.5*	35.1
Improved forage	0.03	8.0**	0.2
Total			69.2

* = Conversion factor (FAO, 1987).and ** = Alemayhu Mengistu, 2002

Table 4: Area of major crops grown, their estimated grain and crop residue produced

Parameter	*Major crops*						
	Maize	Tef	Sorghum	Wheat	Barely	H. bean	Total
Cultivated area (ha)	26.5	21.8	4.5	9.4	1.3	5.5	70.3
Proportion from the total cultivated area (%)	37.7	30.4	6.4	13.5	1.8	7.8	
Grain yield (t/ha)	2.6	1.2	2.0	2.8	1.6	2.6	
Total grain yield (t/year)	68.9	26.2	9.04	26.3	2.02	14.3	
conversion Factor*	2.0	1.5	1.5	1.5	1.5	1.2	
Residues yield DM (t/ha)	5.2	1.8	3.0	4.2	2.4	3.1	
residues yield DM (t/year)							
residues yield DM (t/year)	137.8	39.3	13.6	39.5	3.02	17.2	250.42

* = Conversion factor of grain yield to residues yields (FAO, 1987)

3.6.2. Estimated dry matter & digestible protein requirement for livestock

The estimated amount of maintenance feed required to the total livestock population by the 92 respondents is presented in Table 5. The amount of feed ingested, digested and metabolized by animals is used for maintenance and production (growth, work and reproduction). Van Soest *et al.*, (1985)) underlined the importance of determining digestible protein (DP) and required energy (ME), as they are the first two limiting factors for livestock productivity. Hence, nutrient requirements per TLU were calculated for the two major requirements; that is DP and ME. The amount of DM required by given TLU were calculated based on ME (MJ) required per TLU per day and converted into requirement of the total livestock biomass per year. In the calculation of the average ME the average value of the major feed resources was used, while the other less available feed resources were not considered in the estimation, due to their insignificant contribution.

Table 5: Estimated dry matter requirements for total population of 92 respondents

Requirement	*Total TLU*	*Daily DM for one TLU (Kg)*	*Daily DM for total TLU (tone)*	*Yearly DM for total TLU (tone)*
DM for maintenance	256	5 *	1.28	467.2

* = Yitaye et al., 1999a

Table 6: Estimated digestible protein (DP) requirements of animals

Physiological State	*TLU*	*Daily DP, in DM base for one TLU (g)*	*Daily DP in DM base for total TLU (tones)*	*Yearly DP in DM base for total TLU (tones)*
Maintenance	256	160*	0.04096	14.95
Growth	128**	100*	0.0128	4.67
Total				19.62

* = FAO, 1986

** =.50% of the total TLU was assumed to grow in computing the DP requirements for growth

3.6.3. Dry matter required for maintenance of livestock

The average energy requirement energy content of the major feed resource was about 6.3 MJ/kg DM. (Yitaye *et al.*,1999a),Using a formula developed by MAFF, 1975, and the energy requirement for maintenance for one TLU (250 kg body weight) calculated to be 32.1 MJ/day or 5 kg DM/day. This is 2% of body weight of the animal. Accordingly a yearly feed requirement for maintenance of the indicated livestock population was estimated to be 467.2 tons DM/year.

3.6.4. Digestible protein required and supplied for livestock

The amount of digestible protein required to the total livestock population owned by the 92 respondents is presented in Table 6. According FAO (1986), digestible protein requirement was 160 g DP/day for one tropical livestock unit (250 kg live weight). Therefore, accordingly a yearly digestible protein requirement for the indicated livestock population was estimated to be 19.6 tons/year for Baresa watershed. However, total available feed in the area was 326.6 tons/DM/year and being the major feed sources are crop residues and natural pasture. These feed resource are very low in crude protein which is 67 g/kg (Seyoum *et al.,* 2007) thus, CP was estimated to be 21.9 tons DM then to determine DP using the formula suggested by FAO (1986) (DP = 0.929 * CP – 3.52 where, DP is expressed in % DM) accordingly a yearly supplied digestible protein for the indicated livestock population was estimated to be only 16.8 tons/year.

3.6.5 Feed balance between the amount of dry matter required and supplied

The difference between dry matter available and required was measured by balancing the amount of feed required by the total livestock population and the amount of feed supplied. During the calculation, metabolize able energy and digestible protein requirements were taken as the major limiting constitutes for animal maintenance and production. The total estimated dry matter requirement was 467.2 tons while the amount supplied was about 326.6.tons Thus, the available feed resource was not enough even to cover the maintenance requirement of the livestock population. The total required amount of feed in the study area could cover only about 69.9% of the total dry matter requirement of animals. But some of dry matter requirement might be compensated by supplementation of weed, tree leaves (that is not included in the estimation because of lack of conversion factors), by moving their animal away from the watershed to other areas where feed is available, purchasing feed from other nearby *Keble's* and obtained feed freely from other areas (their relatives who have no livestock). As observed during the study period, the decreased body condition of animals year round, especially during the dry season is an indicator of feed shortage in watershed area and reduction of animal productivity from time to time and season to season is again another indicator for being below maintenance requirement, which suggests that livestock production in the watershed is largely constrained by feed shortage. On the other hand, the digestible protein animal requirement was 19.62 tons on dry matter bases while the amount supplied was about 16.8 tons / year on dry matter bases, cover only about 85.6% of the total digestible protein requirement of animals.

3.7. Constraints and opportunities for livestock production

Major livestock production constraints, potential solutions, and farmers coping strategy is presented in Table 7. The Principal livestock production challenges in Baresa watershed according to their importance are lack of animal feed in quantity and quality, animal disease, lack of improved breed, shortage of land, lack of awareness on the improved forage production, unavailability of forage seeds/cutting and oxen shortage in decreasing order of importance. The opportunities were high demand for livestock products, high price for livestock and livestock products, and better marketing access.

Table7: Major livestock production constraints, potential solutions, and farmers coping strategy in the study area

Constraints/Problems	*Farmers strategies to cope with the problems*	*Possible solutions*
Feed shortage	1. Use of tree leaves 2. Effective utilization of crop residues 3. Use of weed in crop fields as feed 4. Use maize thinning as feed	1. Distribution and scale-up of improved forage species with participatory approach 2. Training on the production and utilization of improved forage production 3. Use of urea treatment, nutrient block etc 4. sailage making and hay preservation
Animal disease	Use of traditional/local medicine from local available tree species for different prevailing disease	Veterinary services support from extension and other development organizations
Grazing land Shortage	1. Keep small grazing land from cultivation land. 2. Reduce the number of livestock.	Use of intensification (Different forage developments strategies such as under sowing, backyard, hedgerow planting, etc…)
Lack of improved Breeds	Locally purchased bulls, which have better performance for breeding purposes.	Government and NGOs should support and facilitate supply of improved breed with improved forage crops.
Oxen shortage	Sharecropping, ox sharing among farmers and Hiring	Oxen credit should be made available
Lack of forage Planting materials	Farmers to farmers exchange	Enhance improved forage planting materials production in the community base through giving incentive and with finding market linkage

3.8. Farmers' Perceptions on Livestock Production

Farmers indicated that livestock holding per household has been decreasing over the last 10 to 15 years due to lack of grazing and pasture land. Priority is given to food crops than forage crops in order to feed the increased human population. Also consumption of animal products is showing a decreasing trend due to reduced animal production and productivities. The farmers reported that the price of animal and animal product have increased due to reduced animal production and increased human population.

4. Conclusion

The survey results showed that the major available feed resources in Baresa watershed are natural pasture and crop residues. Estimation of the available feed resources shows shortage of feed supply in the watershed. The estimated DM requirement was 467.2 tons, while the estimated supply was 326.6 tons on DM bases, which covers only about 69.9% of the total DM requirement. On the other hand, the DP requirement was 19.6 tons on DM bases, while the amount supplied was 16.8 tons on DM bases, covering 85.6% of the digestible protein requirements of animals. Hence, both energy and protein are the major limiting factors for livestock productivity in the Baresa watershed.

5. Future Opportunities

The availability of feed is seasonal; feed is in short supply during December to May and very critical during the month of April to May. However; relatively feed is in good supply during June to September. The farmers preserve crop residues for dry season; however, the way of conservation is not generally appropriate and used for other purposes such as fire fuel, construction; silage making is not known; hay making is not practiced due to scarcity of grazing land, despite that, available grasses used for roof cover. Also there is limited experience in treatment and processing methods for improving the nutritional quality of crop residue. Therefore, this study revealed that effective collection, conservation and proper utilization of crop residues and hay making might be increase the available feed; and looking for other alternatives options such as use of urea treatments, nutrient block, silage making, and scale-up of improved forage species with participatory approach will improve the nutritional quality of available feed for dry season in Baresa watershed.

5.1. The following points are recommended for future research and development directions based on the findings of the present study

- (1). Production of forage crops in integration with cereal crops and integration with natural resource management activities has prospect in the watershed.
- There is large grass covered hill top area (60 ha) in the study area but not efficiently managed and utilized as an important feed source. Therefore, it need due attention to improve management as an area closure with participation of communities.
- Study on effective utilization of available feed resources such as use of urea treatments, nutrient block and silage making will improve the quality of feed for dry season in Baresa watershed.
- Need due attention to design strategies to maximize the use of crop residues as feed than other alternative uses, such as by introduction of multipurpose trees as a source of fuel and construction wood, and animal feed

6. Acknowledgements

Numerous individuals and groups have been instrumental in the conduct of our research and make the result ready for use. First of all, we would like to acknowledge development agents of the Baresa watershed who made the research to bear fruit. Their participation, hospitality and household survey we also thank the Southern Agriculture Research Institute (SARI) for their co-operation and praiseworthy support and back-ups in many ways and Operational Research Project for financial support.

References

[1] Adugna Tolera, 1990. Animal production and feed resource constraints in Welayita Sodo and the

supplementary value of Desmodium intortium, Stylosanthes guianenisis and Macratyloma axillare when fed to growing sheep feeding on a basal diet of maize Stover. M.Sc. Thesis Agricultural University of Norway. 133p.

[2] Adugna Tolera, 2007. Feed resources for producing export quality meat and livestock in Ethiopia. Ethiopia Sanitary and Phytosanitary Standards and Livestock and Meat Marketing project (SPS-LMM). 77p.

[3] Alemayehu Mengistu, 2002. Forage Production in Ethiopia: A case study with implications for livestock production Ethiopian Society of Animal Production (ESAP) Addis Ababa, Ethiopia

[4] FAO, (Food and Agriculture Organization of the United Nations), 1986. Ethiopian highland reclamation study. Final report. Vol. 1, FAO, Rome.

[5] FAO, (Food and Agriculture Organization of the United Nations), 1987.Master Land Use Plan, Ethiopia: Range /Livestock Consultancy. Report Prepared for the Government of the people's Democratic Republic of Ethiopia based on the work of L. Mayer, AG/ETH/82/010 Technical Report, FAO, Rome.

[6] Hailu Beyene and Fekede Feyissa, 2007. Crop Residue Utilization and Management in Different Farming Systems of Ethiopia. **In:** Bayeh Mulatu Getachew Agegnehu and Angaw Tsigie (eds). Utilization of crop residues. Ethiopia Institute of Agricultural Research, Addis Ababa. p. 101.

[7] Kear LC, 1982. Nutrient requirement of ruminant in developing countries. International Foodstuffs Institute. Utah Agricultural Experiment Station. Utah State University, Logan Utah.

[8] MAFF, (Ministry of Agriculture, Fish and Food) united kingdom, 1975. Energy allowances and feeding systems for ruminants. Reference book 433.London her majesty's stationary office. A. Bonnaccorsi, "On the Relationship between Firm Size and Export Intensity," Journal of International Business Studies, XXIII (4), pp. 605-635, 1992. (journal style)

[9] Romney, D.L., P., Thorne, B., Lukuyu and P.K., Thornton, 2003. Maize as food and feed in intensive small holder system: management option for improved integration in mixed farming system of east and southern Africa. Field Crop Research, 84:159-168.R. Caves, Multinational Enterprise and Economic Analysis, Cambridge University Press, Cambridge, 1982. (book style)

[10] Slomon Mengistu, 1999. Forage management options for smallholder highlands of Ethiopia. EARO. Paper presented at the in-service training on on-farm research for extension experts. 20-23 January, 1999. Kombolcha Training Centre, Ethiopia.

[11] Seyoum Bediye, Zinash Sileshi and Dereje Fekadu, 2007. Chemical composition and nutritive values of Ethiopian feeds. Ethiopian Institute of Agricultural Research. Research report No.73.

[12] Seyoum Bediye, 2007. Livestock Feed Potential of Crop Residues in Ethiopia: Opportunities and Challenges. In: Bayeh Mulatu, Getachew Agegnehu and Angaw Tsigie (eds).Utilization of crop residues. Ethiopia Institute of Agricultural Research. Addis Ababa. p. 74.

[13] Shenkut Ayele and Zenebe Admassu, 2008. Managing linkage between communal rangelands and private cropland in the highland of Eastern Africa: contribution to participatory integrated watershed management: Society and natural resource. 21:134-151.

[14] Tewodros Tefera, Kebebe Ergano and Waktola Tiki, 2007. Operational Research and Capacity Building for Food Security and Sustainable Livelihoods. Proceeding of Irish Supported Operational Research Project review Workshop. 2007. Hawassa

[15] Tilahun Amede and R., Kirkby, 2004. Guidelines for Integration of Legume Cover Crops into the Farming Systems of East African Highlands. Pp 43 - 64. In: Bationo, A., 2004. 14. Managing nutrient cycles to sustain soil fertility in Sub-Saharan Africa. Academic science publishers. 608 pp.

[16] Tilley J.M.A. and R.A., Terry 1963. A two-stage technique for the in-vitro digestion of forage crops J. Br. Grassland Soc., 18:104.

[17] Van Soest, P.J. and J.B., Robertson, 1985. Analysis of forage and fibrous foods. A laboratory manual for animal science 613.Cornell University, Ithaca, New York, U.S.A.

[18] Yitaye Alemayhu, Azage Tegegne and Mohammed Yusuf Kurtu.1999 a. Chemical composition and nutritive values of major available feed resources in three peasant associations of the Hawassa woreda, Southern Ethiopia. In proceedings of the 8th annual conference of the Ethiopian Society of Animal Production (ESAP), 24-26 August 2000, Addis Ababa, Ethiopia. P. 115.

Author Profiles

Mergia Abera Beyene received the B.Sc. degree in Plant Science and M.Sc. degree in Animal nutrition from Hawassa Agricultural University in 2004 and 2010 respectively. He has twenty years of research experience in the animal feed and feeding. Know he is working as associate researcher in the livestock research case team in southern agricultural research institute Hawassa research center, Ethiopia.