ORIGINAL ARTICLE

Assessment of feed resources feeding systems and milk production potential of dairy cattle in Misha district of Ethiopia

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ABSTRACT

A study with the objectives of assessing and documenting the feed recourses and feeding system utilization practices of different feed resources was carried out in Misha district of Hadiya zone, of Ethiopia. The study was undertaken using group discussions, structured questionnaire and personal observations. The study was aimed at assessing the available feed resources and feeding system in the district, Purposive and random sampling techniques were used to select the village and households, respectively. Field observation and focus group discussions were also held. The commonly used feeding practices were tethering and free grazing (25.20% and 46.70%) and the remaining (22.20% and 5.90%) of the respondents are depending on semi-grazing and zero grazing respectively, in both altitudes which are mid altitude (1500–2500 m.a.s.l and high altitude (>2500 m.a.s.l)]. The major feed resources in the area were natural pasture, crop residues, crop aftermath, non-conventional feed, agro industrial by product and improved forage in both agro ecologies. The available feed resources ranked by respondents were natural pasture, crop residues and crop aftermath from first to third, respectively. The dry matter content of crop residues were above 90%, in both altitudes. The average annual utilizable feed DM produced was estimated to be 12.09±0.49tonnesDM and15.13±0.51tonnesDM per households for highland and midland altitudes, respectively and overall average dry matter supply was 13.62 tonnes per households. On the other hand, the average actual DM requirements of animals was 19.18 tons per year for highland and 22.21 tonnes per year for midland altitude and overall mean dry matter requirements was 20.69 tons per year per households. Therefore, the annual utilizable feed dry matter satisfied about 63%and 68% of the livestock maintenance requirement for highland and midlands, respectively. Therefore, feed shortage is a serious problem for cattle production in the study area and feed resource development should be top priority.

Key words: feeding practice; feed resource; feed balance; dairy cattle performance

INTRODUCTION

An adequate supply of livestock feed is crucial to the livelihoods of millions of people across the developing world, and not just for smallholders, but also for pastoralists and the large number of landless who depend mainly on common land for grazing (Sanford and Ashly,2008). With the present trend of rising feed stuff prices and global inflation, livestock production is increasingly constrained by feed scarcity and its high cost. In developing countries, Smallholder dairy farmers are facing many constraints such as feed quality and quantity, poor storage facilities for conservation as well as insufficient water supply. However, inappropriate feeding of livestock continues to pose many problems due to lack of information on composition and utilization of locally available feed resources. The use of cheap and readily available local feed resources has great potential to increase livestock productivity (Lukuyu et al., 2011). In Africa and other developing countries feeds and feeding comprise 60-70% of total production costs. Shortages of feeds and forages are especially acute during the dry season.

Livestock feed resources in Ethiopia are mainly obtained from natural and improved pastures, crop residues, forage crops, agro-industrial by-products and non-conventional feeds. The contribution of these feed resources, however, depends up on the agro-ecology, the type of crop produced, accessibility and production system (Ahmed et al., 2010). Natural pasture is the major source of livestock feed in Ethiopia. However, its importance is gradually declining because of the expansion of crop production into grazing lands, re distribution of common lands to the landless and land degradation. Additionally, due to poor management and overstocking, natural pastures are highly overgrazed resulting in severe land degradation, loss of valuable species and dominance by unpalatable species (Alemu, 1998).

Ethiopia is known for cereal crop production and the resulting crop-residues could be used as potential feed source for feeding dairy cattle to improve milk production. Though, the country is estimated to have huge supply of crop-residues, there may be mishandling and lack of awareness about crop-residue improvement. As a result, utilization efficiency of the residues may be low. Much research attention has been devoted to feed problems and optimal feeding practices (Lukuyu et al., 2009), but there has been relatively little systematic consideration had been taken to solve the constraints that the smallholders are facing, coping the indigenous technical knowledge of the farmers with scientific knowledge of managements of their livestock will help the farmers improve productivity and their livelihood as well.

Understanding the type of available feed resources and its nutritional quality, designing appropriate livestock feeding strategies and feeding systems are important for improving productivity of dairy cattle and providing appropriate knowledge to smallholder farmers. The Misha district is characterized by the high concentration of livestock in general and cattle population in particular. The favorable climatic condition and the relatively disease-free environment has made the area convenient for livestock production. However, the available feed resources, their nutritional value, feeding system/practice and related farmer's preferences have not been adequately studied and feed related challenges and opportunity of dairy cattle have not been identified. Therefore, the researcher was initiated to assess the available feed resources and feeding systems and determine the supply and demand balance of dry matter of dairy cattle in Misha district Hadiya Zone, Southern regional state of Ethiopia.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Misha woredas of Hadiya Zone, Southern Ethiopia. It is located 248km away from Addis Ababa, capital city of Ethiopia. The Woreda has both highland (45% of the area) and midland (55% of the area) altitude. It is situated at 1800-2950 meters above sea level and has an average temperature ranging from 21^{o}c to 25^{o}c. The annual rain fall is 2371 mm. More than 95% of the population was engaged in agriculture. The district has 32 rural and 3 urban kebeles with a total human population of 157,911 (Males=76903; Females=81008). The total cattle population of the district was 112,186 of which 108826 were local dairy cattle and 3360 were crossbred dairy cattle (MWAO, 2012).

Methods of Data Collection and Sampling Technique

Sampling techniques

Both purposive and random sampling techniques were used to select the village and households, respectively. The district was stratified in to two agro-ecological zones i.e. [mid altitude having (1500–2500 m.a.s.l) and high altitude (>2500 **m.a.s.l)]**. Then, three (3) kebeles (Geja, Anteta and Homboya) from mid-altitude and three (3) kebeles (Morsito, Wesgebeta and Dilbare) from highland were purposively selected based on the livestock population and crop production. Thus, 67 respondents from the highland and 68 respondents from mid-altitude making a total of 135 respondents were randomly selected using probability proportional sample size technique Cochran (1977).

Data collection

Both primary and secondary data were collected and group discussions were made with key informants. Primary data were collected from the selected respondents by using semi- structured questionnaires. Secondary data was collected from different literatures

and other relevant offices. Structured questionnaire was prepared to collect data on demographic and farming system characteristics of households, livestock and dairy cattle herd size and composition, objective of cattle keeping, feeding systems/feeding practice, available feed resources in terms of type, quantity, seasonal variability of feed resources, conservation practices and coping mechanism to feed shortage and constraints. The questionnaire was prepared and pretested before the actual survey was carried out. One focus group discussion was held at each *Kebele*.Each group had 8 individuals of the key informants selected from the study area, encompassing the elders and those who have better experience with dairy cattle production practices. Field observation was made to enrich the data about available feed resource and feeding practices, utilization and management of communal grazing land and crop-residues.

Estimation of quantities of available feed resources

The quantity of feed resource in the study area was estimated using the information collected from the respondents on crop production/yield and area coverage. The quantities of feed DM obtained from different feed resources were estimated to calculate the balance between feed supply and requirements for the livestock population in the study area. The quantity of feed DM obtained from fallow land used for grazing was multiplied by 1.8 t/ha, communal grazing by 2t/ha, private grazing land by 3.0 t /ha, crop after math by 0.50 t/ha, improved forages by 8 t/ha. The quantity of DM obtained from irrigation practices were estimated by multiplying the irrigated land size by 0.3 t DM/ha/seasons de Leeuw(1997).

The quantity of DM basis of concentrates (supplements) and non-conventional feed resources available was estimated by interviewing the farm owners regarding the frequency and quantity purchased per month. The amount of crop residues and byproducts that were used as source of animal feed were estimated using established conversion factors.

The quantity of DM output from major crop residues were estimated by conversion of grain yields to fibrous residues using multipliers of 1.5 for wheat, barley and teff straw and 1.2 for field pea and faba bean straw and for estimation of stover DM output from maize, a multiplier of 2 was used (de Leeuw, 1997).

Estimation of requirement and feed supply balance

Annual DM produced from natural pasture, crop residues, crop aftermath, non-conventional feed and concentrates was compared to the annual DM requirements of the livestock population in the sampled households. For comparisons, the number of livestock population was converted into tropical livestock units (TLU). The DM requirements of the livestock population was calculated according to the Kearl (1982), where the daily DM requirements for maintenance of 1 TLU (250 kg dual purpose tropical cattle) which consumes 2.5% of its body weight is 6.25 kg DM/d.

Data Analysis

Data collected was entered into Microsoft Excel (2007) using SAS (2002). Statistical and descriptive statistics such as mean, frequency and percentage were used to analyze the data using SPSS, version.20. Descriptive Statistics was employed to describe the various variables in livestock production system including land use, herd size, production parameter, and available feeds and feeding systems and an index was calculated to provide overall ranking for categorical data. For performance of dairy cattle and quantity of available feed resource data, the Generalized Linear Model (GLM) Procedures of the Statistical Analysis System SAS (2002) was carried out. A fixed effect model was fitted, where for dairy performance study fixed effects of breed type (indigenous and crossbreds) and altitude (Highland and midland) were included in the model. For quantity of feed available, altitude (highland and midland) was fitted.

RESULTS AND DISCUSSION

Farming system characteristics

In Misha district the dominant farming system is mixed crop-livestock production system. Livestock production is just for subsistence- and it is an important component of the mixed farming system and is well integrated with crop production. Land use is dominated by mixed smallholder rain fed agriculture producing cereals, pulses and livestock. The major cereal crops grown in the study area were wheat, barley, teff and maize in both ago ecologies. Faba bean and field pea are pulses growing in high altitude areas. *Enset (Ensete Ventricosum)* is also cultivated in both highland (76.1%) and mid altitude (54.4%) areas and represented the major root and tuber crops of the study district. As more and more land is put under crop production, livestock feed becomes scarce and crop residues particularly cereal straws remain the major feed source for the animals particularly during the dry period of the year (which spans from February to May).

Purpose of keeping cattle

All the sampled households primarily keep cattle, in their order of ranking for milk production, draught power, source of income (animals or animal products), meat production and as a source of manure in both high and mid altitude areas (Table 1). Similar results on the purpose of keeping cattle were reported by Bedassa,

(2012) in the highlands of the Blue Nile Basin of Ethiopia, by (Zewdie, 2010) in the highlands and Central Rift Valley of Ethiopia, and by (Asaminew, 2007), in Bahir Dar milk shed area.

Table 1. Number of respondent and rank the purpose of dairy cattle keeping in study district.

Altitude	Purpose	Rank(n)						
		1st	2nd	3rd	4th	5th	Index	Rank
Highland	Milk production	45	7	6	7	2	0.29	1
	Draught power	2	42	13	3	7	0.23	2
	Meat production	0	2	39	13	13	0.16	4
	Source of income	3	10	9	38	7	0.17	3
	Source of manure	17	6	0	6	38	0.15	5
Midland	Milk production	45	8	6	7	2	0.29	1
	Draught power	2	42	13	3	8	0.23	2
	Source of income	0	2	40	13	13	0.16	3
	Meat production	3	10	9	39	7	0.17	4
	Source of manure	18	6	0	6	38	0.15	5

n=number of respondents

Performance of dairy cattle

The overall average daily milk yields of crossbred cows was 7.88±0.089liters, whereas for indigenous cows it was 2.84±0.062 liters. Similar results have also been reported for crossbred population (Asaminew and Eyasu, 2009; Belay et al., 2012), and for indigenous cows (Zewudu, 2004) in different parts of Ethiopia. The overall average lactation lengths of crossbred and indigenous cow's were 10.07±0.14 and 7.34±0.09 months, respectively. The lactation length for indigenous cows in this study is comparable with the results of (Terefe, 2007) who reported 7.11 months for indigenous cows.

The overall mean age at first calving was 42.18±0.17 and 50.89±0.100months for crossbred and indigenous cattle (Table 2). The result was comparable with the value reported by (Demissu et al., 2014) of 42.2±11.45months and was higher than the 37.32 months and 36 months reported by (Belay et al., 2012), for crossbred cows. The average value of calving interval in the study area was 16.58±0.106 months for crosses and 21.49±0.222 months for indigenous. The number of services per conception was 1.90±0.12 and 2.46±0.11 for crosses and indigenous cows, respectively. In general, the crossbred cows had higher milk yield and longer lactation length than the indigenous cows. The age at first calving, calving interval and number of services per conception were smaller for crossbred cows than indigenous cows (Table 2). The current finding indicated that there was no ($P<0.05$) difference between the two agro ecologies in performance of both cross and indigenous bred dairy cows.

Challenges for successful dairy cattle production

The major constraints to dairy cattle production were common in both agro ecologies, and included feed shortage, shortage of land, disease prevalence, low improved breed and low milk yield ranked from 1st to 5th (Table 3). Inadequate supply of feed in both quantity and quality has also been reported as the most important problem for low livestock productivity by various workers (Dawit et al., 2013). Farmers indicated that expansion of crop land at the expense of grazing land, has caused the shortage of land for forage production.

Table 2. Performance of dairy cattle in study district (LSMean±SE)

Breed type	Altitude	N	MY/D	LL/M	AAFC/M	CI/M	NS/C/t
	Highland	67	2.85±0.09	7.14±0.147	50.80±0.141	21.34±0.300	2.56±0.166
Indigenous	Midland	68	2.84±0.08	7.52±0.129	50.98±0.142	21.64±0.329	2.36±0.157
	Overall	135	2.84±0.062	7.34±0.099	50.89±0.100	21.49±0.222	2.46±0.114
	Highland	67	7.92±0.129	10.17±0.207	42.13±0.243	16.58±0.156	1.96±0.178
Crossbred	Midland	68	7.84±0.124	9.97±0.215	42.23±0.239	16.58±0.145	1.84±0.176
	Overall	135	7.88±0.089	10.07±0.149	42.18±0.170	16.58±0.145	1.90±0.125

SE= standard error, N=number of households, MY/D=milk yield per day, LL/M= lactation length per months, AAFC =Age at first calving, CI=calving interval, NS/C/t = Number of services per conception per

Major feed resources in the study area

The major feed resources in the area were natural pasture, crop residues, crop aftermath, non-conventional feed (*Enset*, banana and sugar topes), agro industrial by product (wheat bran) and improved forage in both agro ecologies (Table 4). The findings of the present study are in agreement with previous reports (Abera et al., 2014), who indicated that natural pasture, crop residues, aftermath grazing, hay, agro-industrial by-products, commercial concentrate and non-conventional feeds were the most important feed resources used in different parts of Ethiopia.

Natural pasture

Grass-based dairying is best described as a method of marketing forage through milk products. Success with grass-based dairy farming requires a high level of management, observation, and skill in growing and grazing high-quality forages—and enough of them to meet the dry-matter intake needs of lactating cattle. It requires livestock that are adapted to grazing and a high-forage diet. Grass-based producers ensure that forages provide the energy and protein needed to produce milk by providing high-quality pasture during the grazing season and enough stored digestible forages in the dormant season. In the wet tropical environment, there is no distinct seasonal moisture deficiency and the foliage is green throughout the year. The potential production of tropical forage both native and improved species, in terms of protein, metabolisable energy and milk production, has been favorably assessed (Lane and Mustapha, 1983; Luxton, 1983). The tropical dairy breed, which is basically a Bos indicus animal, has a low potential for milk production which is between 500–950 kg/lactation (Samuel, 1974; Sivarajasingam, 1974), whereas the milk production potential of the crossbred (Bos taurus × Bos indicus) is improved, giving 1,200–1,900 kg/lactation (Sivasupramaniam and Nik Mahmood, 1981). Due to the overall feed constraint and environmental stress, purebred dairy cows such as Friesian and Jersey are merely able to produce half of their milking potential (1,150–2,200 kg/lactation) (Wan Hassan et al., 1981; Sivasupramaniam and Nik Mahmood, 1981), compared to those of similar breeds in a drier environment. The expected milk yield is estimated to be 2,700–4,000 kg/lactation for the Friesian and Jersey (Cowan et al., 1975), Hence, the genetic expression of milk production of the dairy cow is confounded by tropical environments.

The primary feed resources available to livestock in the study districts included natural pasture from communal grazing land, private grazing pastureland, fallow land, roadside, cultivated land borders and marginal lands. These feed resources are generally poor in quality and their productivity and supply is seasonal, particularly during the critical time of the dry season. Currently due to the rapid increase in human population and associated demand for food, grazing lands are steadily shrinking as result of the conversion of grazing lands to crop lands. There by, natural pastures are restricted to the areas that have little value of farming potential such as hilltop areas, rocky land and roadsides.

Table 3. Number of respondents and ranks of major constraints of dairy cattle

Altitude	Constraints	Rank					Index	Rank
		1st	2nd	3rd	4th	5th		
Highland	Feed shortage	55	7	5	0	0	0.32	1
	Lack of land	10	47	5	5	0	0.27	2
	Disease prevalence	1	4	42	10	10	0.18	3
	Lack of improved breed	1	5	6	41	14	0.14	4
	Low milk yield	0	4	9	11	43	0.11	5
Midland	Feed shortage	52	13	3	0	0	0.31	1
	Lack of land	8	45	2	13	0	0.25	2
	Disease prevalence	5	9	40	11	3	0.21	3
	Lack of improved breed	2	0	9	32	25	0.12	4
	Low milk yield	1	1	14	12	40	0.11	5

Index=the sum of (5 times First order +4times second order + 3times third order + 2 times fourth order + 1 times fifth order) for individual variables divided by the sum of (5 times First order +4 times second order + 3 times third order + 2 times fourth order + 1 times fifth order) for all variables.

Crop residues

There are two types of agricultural crop residues. Field residues are materials left in an agricultural field or orchard after the crop has been harvested. These residues include stalks and stubble (stems), leaves, and seed pods. Determinants of the use of cereal and pulse residue for livestock feeding and soil mulching among smallholder farmers in the mixed farming system were analyzed. Crop residue (CR) is dual-purpose resources in the mixed crop–livestock systems of the Ethiopian highlands

Crop residues were ranked as the second most important feed resources in the area in both altitudes (Table 4). Crop residues were the main source of feed during the dry season when pasture from grazing area were not able to provide reasonable quantity of feed in the study districts. The major crop residues used as dairy cattle feed in the study area were teff straw, barley straw, wheat straw, pulse straw in both agro ecologies and maize Stover in midland agro ecologies. Teff straw and wheat straw were equally preferred next to barley straw while pulses straw and maize stover was the last choice when other residues are not available at required quantity. Residues from cereal crops were collected and stacked under shade around homestead after threshing the crop.

The availability of crop residues varied according to the type of crops grown across the agro-ecologies. More maize and teff were produced in the mid altitude than in the highlands with respective higher crop residues production. On the other hand, more wheat straws and barley straws were produced in the highlands than in the mid altitude areas.

Improved forage

The main improved forage species widely distributed in the study area were elephant grass, desho grass, rhodes grass, sesbania and leucaena with their decreasing order of availability, respectively in both agro ecologies. As reported by the respondents, only a small area of land was allocated for forage development. Apart from utilizing forages as feed, a few farmers also use improved forage species for soil and water conservation (desho grass), fencing and as a wind break (Sesbania and Luciana).

Elephant and Desho grass either separately or together with improved forage were the major feed types that were mostly used by majority of farmers in the area. Growing of improved forages was not a common practice in the study area because of shortage of land, lack of awareness about the benefits of the improved forage and shortage of forage seed. This result is in agreement with report of (Afele, 2014), in southern Ethiopia and (Abate et al., 1993), in the central highlands of Ethiopia.

Quantity of available feed resource in the study area

The mean annual utilizable dry matter produced from different available feed resources were presented in Table 5. The mean DM yield produced from available feed resource was 13.62±0.38DM tons per households (12.09±0.49DM tons per households in highland and 15.13±0.51DM tons per households in midland altitude). The value was significantly higher ($p < 0.05$) for midland than that of feed DM produced in highland kebeles. The greater DM production in midland kebeles might be due to the potential of the area for crop production and high productivity of crops

The mean DM produced from crop residues per household was 7.88±0.26 tonnes for highland and10.37±0.35 tonnes for midland and overall average DM was 9.14±0.26 DM tonnes per households. This was significantly higher (P<0.05) for the mid-altitude than the highland area due to the larger areas covered by maize cultivation yielding larger biomass than other cereal crops per hectare in midland than highland area. The majority (67%) of DM originated from crop residues. This was higher than the result of (Abera *et al.*, 2014), who reported 30.5 % DM from crop residues in Gurage Zone of Southern Ethiopia. As high as 88% DM from crop residues have also been reported (Terefe, 2007), in Sululta area of Ethiopia. The present study indicated that crop residues and aftermath grazing contributed to 74.56% of the total annual feed dry matter supply per household.

The total amount of DM obtained from private grazing pasture per household was 1.69± 0.36 tones for highland and 2.09±0.21tones for midland area and overall average DM obtained from private grazing pasture was 1.89 ±0.21 tonnes/ha/year. The annual mean DM produced from communal grazing was 0.79±0.16 DM ton/ha/year (0.58±0.22DM tons/ha/year in highland and 1.00±0.23DM ton/ha/year for midland) in the study area. On the other hand, the contribution of supplements (wheat bran) to the total annual DM in this study was 0.46±0.12 ton for highland and 0.15±0.03 ton for midland area. An overall average was 0.28±0.065 tone which was much lower than the report by (Terefe, 2007), which accounted for 6.53 tons per household in the Sululta District, North Shoa Zone of Oromia. The estimated DM from supplement feed was significantly (P<0.05) higher in highland than midland altitude due to lack of access related to distance, absence of supplies and high cost of byproducts in midland area. The total amount of feed dry matter obtained from different sources per TLU in the sampled households was 13.62 tonnes of DM per annum per households, where 67% was obtained from crop residues and the rest (37%) were obtained from grazing land, crop aftermath, fallow land and industrial by-product. This satisfies only 65.7% of the maintenance DM requirement of animal per annum in the study area.

Estimation of requirement and feed supply balance

Feed resources used to calculate feed supply for livestock in the study area were crop residues, private grazing land, communal grazing pasture, crop aftermath, fallow land, wheat bran and improved pastures. Based on the suggested estimation by (Karl, 1982)

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Table 4. The major feed resources based on availability in the study area

Altitude	Feed	Rank(%)						Index	Rank
		1st	2nd	3rd	4th	5th	6th		
Highland	Natural pasture	50	12	5	0	0	0	0.27	1
	Crop residues	7	40	10	10	0	0	0.22	2
	Crop aftermath	10	10	35	10	2	0	0.20	3
	Improved forage	0	0	0	10	17	40	0.07	6
	Non-conventional feed	0	5	7	33	15	7	0.13	4
	Agro industrial by-product	0	0	10	4	33	20	0.09	5
Midland	Natural pasture	51	10	5	2	0	0	0.27	1
	Crop residues	7	37	9	10	5	0	0.21	2
	Crop aftermath	5	11	34	11	2	5	0.18	3
	Improved forage	0	7	2	8	10	41	0.09	6
	Non-conventional feed	5	0	7	33	16	7	0.14	4
	Agro industrial by-product	0	3	11	4	35	15	0.11	5

Index=the sum of (6 times First order +5 times second order + 4 times third order + 3times fourth order + 2 times fifth order + 1 times sixth order) for individual variables divided by the sum of (6 times First order +5 times second order + 4 times third order + 3 times fourth order + 2 times fifth order + 1 times sixth order) for all variables.

The annual feed DM requirements for maintenance for highland and midland areas was 19.1748 and 22.21tonnes DM per year, respectively, with overall mean dry matter requirement being 20.69 tons per year (Table 6). The average annual utilizable feed DM produced was estimated to be 12.09±0.49tDM and15.13±0.51tonnesDM per households for highland and midland altitude, respectively and overall average dry matter supply was 13.62 tonnes per households.

The average actual DM requirements of animal was 19.1748 DM tonnes per year per households for highland and 22.21DM tonnes per year for midland altitude and overall mean dry matter requirements was 20.69 DM tonnes per year per households in the study district. Furthermore, the result showed that about 7.0834 DM tonnes and 7.08 DM tonnes per household per year additional DM was needed to fulfill actual requirements of animal for highland and midland, respectively (Table 7). Therefore, the annual utilizable feed dry matter satisfied about 63% and 68% of the livestock maintenance requirement for highland and midland altitude, respectively implying negative feed balance in the study area. Similar negative feed balances were reported by (Tolera and Said, 1994), in WolayitaSodo, (Admassu, 2008), in (Alaba special Wereda and Wondatir ,2010),in central Rift Valley of Ethiopia.

The feed balance of some feed sources is difficult to evaluate; For example, homemade by-products and tree leaves are often utilized by smallholder farmers which is not easy to quantify. Additionally, alternative use of crop residues is very common. For example, farmers use crop residues as a source of cash, firewood, construction material, mulching and mattress. Therefore, there could be overestimation or under estimation of the values obtained.

Table 5. The estimated total DM available per annum per household per tons in the study area

Variable	High land (N=67)	Midland (N=68)	Overall mean (N=135)	Sig	Percentage
Crop residues	7.88±0.26	10.37±0.35	9.14±0.26	0.030	67
Crop aftermath	1.02±0.03	1.03± 0.04	1.03±0.02	0.828	7.56
Private grazing	1.69±0.36	2.09±0.21	1.89±0.21	0.345	13.9
Communal grazing	0.58±0.22	1.00±0.23	0.79±0.16	0.192	5.8
Fallow land	0.10±0.01	0.15± 0.02	0.18±0.01	0.166	1.3
Improved forage	0.36± 0.06	0.30± 0.05	0.33±0.03	0.925	2.4
Wheat bran	0.46±0.12	0.15±0.03	0.28±0.065	0.051	2
Total DM	12.09± 0.49	15.13±0.51	13.62±0.38	0.004	100.00

N=number of households, M=mean, SE=standard error.

Dairy cattle feeding practice

Cattle in the study area were herded together on communal or private natural grazing, roadsides and marginal lands. It was noted that draft animals and lactating cows were herded around crop lands or tethered. The commonly used systems of grazing in the highland and midland altitude, respectively were free grazing(41.8% and 51.5%), tethering (29.9% and 20.6%), semi grazing(20.9% and 23.6%) and zero grazing (7.5% and 4.4%). As can be seen, free grazing on communal or private grazing was the dominant feeding practice in the study area. This was similar to the report of (Kechero et al., 2010) and (Tesheger et al., 2013), who stated that, free grazing on natural pastureland was the most dominating feeding system for the cattle. Cattle spend most of the day on pasturelands and are supplied with crop residues and wheat bran mixed with *Enset* leaf and stem during morning and evening. However, most farmers do not supplement their cows with concentrates due to perceived high cost. According to the respondents, the main sources of feed especially during dry season were natural pastures and crop residues. According to field observation and survey results, there was grazing of cattle on communal and private pastureland, roadside, swampy area and around homestead either free or tethered.

Table 6. Mean actual TDM requirements for maintenance of animal per households in the area

Altitude		Livestock unit (TLU)						Total
		Cattle	Sheep	Goats	Horse	Donkey	Mule	
	TLU	7.007	0.082	0.069	0.768	0.435	0.049	8.41
Highland	DM Req/Y/1TLU	2.28	2.28	2.28	2.28	2.28	2.28	2.28
	DM/Y	15.96	0.187	0.157	1.75	0.99	0.11	19.17
	TLU	8.421	0.078	0.094	0.568	0.405	0.175	9.741
Midland	DM Req/Y/1TLU	2.28	2.28	2.28	2.28	2.28	2.28	2.28
	DM Req	19.20	0.18	0.21	1.30	0.92	0.40	22.21
Overall	TLU	7.714	0.08	0.0815	0.668	0.42	0.112	9.0755
	TDM Req	17.59	0.18	0.186	1.52	0.957	0.2553	20.69

TLU=Total livestock unit, DM Req/Y/1LU=Dry matter requirements per year per one livestock unit, DM req/Y = Dry matter requirements per year

Table 7. Estimated feed supply and requirement balance in the study area

Altitude	TLU	DM Req	DM Pro	Balance	Percent
Highland	8.41	19.17348	12.09	-7.08348	63.05585
Midland	9.741	22.21	15.13	-7.08	68.12247
Overall	9.0755	20.69214	13.62	-7.07214	65.82209

TLU=Total livestock unit, Req=requirements, Pro=produced, DM= Dry matter

CONCLUSION

The major feed resources in the area were natural pasture, crop residues, crop aftermath, non-conventional feed (Enset), agro industrial by product (wheat bran) and improved forage in both agro ecologies. The commonly used systems of grazing in the study area were free grazing, tethering, semi grazing and zero grazing in both agro ecologies. Cattle spend most of the day on pasturelands and were supplemented with crop residues, wheat bran, and *Enset* leaf and stem during morning and evenings. However, most farmers do not supplement their cows with concentrates due to the high cost. The availability of grazing land is decreasing from year to year due to expansion of farmland and settlement. It is known that grazing land which is communally owned is poor in quality due to its effect on the re-growth of the grasses. This leads to the insufficiency of feed availability from such sources. The DM produced from all feed resources in the area does not satisfy the actual DM requirement of livestock. This resulted in low growth, production and reproduction performance of cattle. Therefore, dairy development programs in the area should address the chronic feed shortage through integration of forage production into crop farming system, sustainable conservation and proper utilization of available feed resources. Additionally, measures that could enhance improved feeding management techniques such as rotational grazing should be sought.

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ISSN 2220-9325 (Online), ISSN 2203-5802(Print)