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# Assessment of Seasonality Availability of Livestock Feed Resources and Feeding System in Bahir Dar Zuria District of Amhara Region, Ethiopia

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## Abstract

This study was conducted in Bahir Dar Zuria District, Ethiopia with the objective of assessing livestock feed resources. The study was conducted using survey (semi-structured questionnaire) from five rural kebeles. The data were analyzed by using SPSS software. Seasonal availability of livestock feed resources were assessed natural pasture (89.2%) is mainly available during the wet season; crop residues (97.9%), hay (92.5%), and improved forage (71.4%) were available and more utilized in the dry season while browse trees/shrubs (100%), agro-industrial by-products (61.3%), and attela (75.0%) were found in both seasons. Shortage of feed (0.34) was the first production constraint followed by disease (0.27) for all livestock species. Although crop residue is the major feed in the study area farmers are not treating it to improve its nutritional value thus giving training about crop residue treatment is necessary.

**Keywords:** Bahir dar zuria; Constraint; Feed resources; Feeding priority; Livestock

## Introduction

The livestock sub-sector plays a significant role in the Ethiopian economy at both national and household levels. Its contribution to both agricultural and national Gross Domestic Product is substantial [1]. According to the estimates of the Central Statistical Agency of Ethiopia [2], there are 59.5 million cattle, 30.70 million sheep, 30.2 million goats, 8.44 million donkeys, 0.41 million mules, 1.21 million camels, and 56.53 million poultry in the country. The current productivity of livestock, however, is low as compared to huge livestock [3].

Factors for low production and productivity of livestock identified from review of previous studies in Ethiopia includes shortage and poor quality of feed, scarcity of water, lack of appropriate livestock extension services, diseases, low genetic potential of the indigenous livestock, traditional husbandry practices, absence of marketing infrastructure, and lack of improved technologies. Feed shortage is the major constraint that hinders livestock production. Recurrent drought, prolonged dry period and uneven distribution of rainfall which affects crop production and re-growth potential of grasses are critical climatic factors causing feed shortage [4]. Moreover, the size of the grazing land in Ethiopia is decreasing across time with the expansion of farmlands, urbanization and land degradation which is a result of an increase in human population [5].

Livestock feed resources in Ethiopia are classified as natural pasture, crop residue, improved pasture and forages, agro-industrial by-products, other by-products such as vegetable refusal, of which the first two contributes the largest share. Natural pasture is generally poor in quality and their productivity and the volume of biomass supply are seasonal, particularly dwindling during the dry season [6]. They are overgrazed during the time when crops are planted from April to December [7]. Holistic grazing land management practices are not well implemented in the country. Consequently, the existing grazing lands are poor in terms of forage species diversity and have low biomass yield and poor nutritive values [5]. Crop residues are important sources of feed in the mixed crop–livestock systems of Ethiopia highlands [8]. However, crop residues have nutritional problems that limit their efficient utilization for livestock feeding. Agro-industrial by-products are good sources of supplement, however they are not easily affordable and accessible to many of the smallholder farmers since they are not adequately produced in the country. Bahir Dar Zuria District (BDZD) production system is characterized as a mixed crop-livestock farming system. Shortage of feed coupled with inefficient utilization of available feed resources they did not full fill the requirements of livestock. Therefore availability of different feeds, feed resource management and utilization practices of farmers need to be assessed for specific geographic regions and agro-ecological so that appropriate intervention strategies can be developed. Therefore, this study was initiated with the following objective to: Assess major feed resources for livestock in Bahir Dar Zuria District.

## Materials and Methods

### Location and description of the study area

The study was conducted in Bahir Dar Zuria District (BDZD) in Amhara Regional state of Ethiopia Figure 1. It is found in West Gojjam Zone, which is bordered on the south by Yilmana Densa District, on the southwest by Mecha District, on the northwest by the Giligel Abay River which separates it from Semien Achefer, on the north by Lake Tana. The area is located about 564 km north-west of Addis Ababa. It is situated at an altitude ranging from 1700-2300 meters above sea level and has area coverage of 151,119 ha. Its extension is between 11°25′N-11°55′N latitude and 37°04′E-37°39′E longitude. The District falls within tepid moist agro-climatic zone. The mean annual temperature is about 20°C, with a maximum temperature slightly above 28.3°C and the minimum about 10.2°C. The annual rainfall

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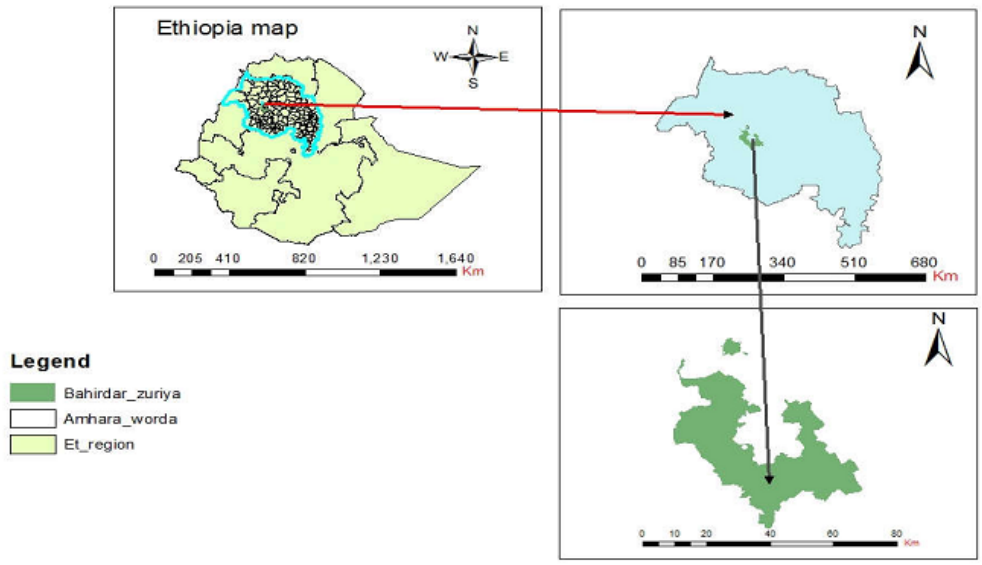


**Figure 1:** Location Map of Bahir Dar Zuria District.

ranges from 800–1250 mm, with a long period of summer rain from May to September [9].

A survey of the land in these district shows that 21% is arable or cultivable, 9% pasture, 8% forest or shrub land, 36% covered with water, and the remaining 26% is considered degraded or others based on data of CSA [10].

The total human population of the District is 227,637 with 116,095 men and 111,542 women. The livestock population of the district is estimated to be 156,909 cattle, 16,999 sheep, 11,011 goats, 19,517 donkeys, 550 mule and 104,759 poultry according to the district office of Agriculture.

### Selection of the study site, sample size and sampling methods

The district has 32 rural Kebeles out of which 5 were selected purposively based on livestock production. Yigoma, Sebatamit, Gombat, Wogelisa and Wonjeta were the selected Kebeles, twenty farmers were randomly selected from each kebele making the respondents total of 100 farmers.

A semi-structured questionnaire was developed and translated into Amharic language to collect survey data on household's structure, income sources, feed resources. Moreover, secondary data were collected from BDZD Office of Agriculture.

### Statistical analysis

Livestock number was converted into Tropical Livestock Unit (TLU) according to [11]. Farm size was estimated by farmers in their local measurement unit, called "kada", which is equivalent to 0.25 ha. Ranking was analyzed and summarized by index method. Index was computed with the principle of weighted average according to the following formula as employed by [12]:

**Index**

$$= \frac{\sum \text{of } (6\times 1\text{st rank} + 5\times 2\text{nd rank} + 4\times 3\text{rd rank} + 3\times 4\text{th rank} + 2\times 5\text{th rank } 1\times 6\text{th rank}) \text{for individual reason}}{\sum \text{of } (6 \text{ for rank } 1 + 5 \text{ for rank} 2 + 4 \text{ for rank } 3 + 3 \text{ for rank} 4 + 2 \text{ for rank } 5 + 1 \text{ for rank } 6) \text{summed over all resons}}$$

The data collected from the survey were analyzed by using descriptive statistics in SPSS statistical software [13].

## Results and Discussion

### Household characteristics

Household characteristics of the interviewed farmers in BDZD are presented in Table 1. The family members' age category lay from 15 to 64, making productive force 61.71% which is good for collection of livestock feed from different sources. The majority of the interviewed farmers were illiterate, and only 6% have completed secondary education. The result of the current study was higher than that found by Selamawit et al. [14]. who reported that household education level to be 27.8%. The level of illiteracy in this study was almost similar to that reported in watersheds of North Achefer District (43.7%) [15]. The result was slightly lower than illiterate rate of 47.38% and 54.4% reported by [16,17], respectively. The low level of literate show the need for improving education since it affects use of technology to improve agricultural productivity.

Average land holding size was 0.98 ± 0.05 ha of which 0.79 ± 0.04 ha is used for crop production while 0.19 ± 0.02 was used for private natural pasture production. The households have smaller landholding size having direct relation on the amount of crop residue produced from the crop land, number livestock reared and size of private grazing lands. Similarly Selamawit et al., observed that household land holding is less than one hectare, and more than 91% of the land owned is cultivated land and the rest was grazing areas in Daro Labu District, Western Hararghe Zone Selamawit [14]. The result was lower than previous work by Freyer and Vaarst, average landholding size of the households 1.7 ha and also by Mushir and Mulugeta overall land holding of 2.18 ha in watersheds of North Achefer District [15,17]. Zewdie et al., noted that the differences in land holding is division of lands between children or because the government had expropriated them from their land and given a financial compensation instead of another property in Zenzelima, Kebele, Bahir Dar Zuria, Ethiopia [18].

### Crop production

Crop production in Bahir Dar Zuria District is presented in Table 2. Most of the interviewed farmers mainly produce *Zea mays* and

| Household characteristics | Percentage |
|---|---|
| Age groups of family member (N=100) | |
| 1-14 | 36.43% |
| 15-64 | 61.71% |
| >65 | 1.86% |
| Gender of family member (N=100) | |
| Male | 55.58% |
| Female | 44.42% |
| Educational status of house hold (N=100) | |
| Illiterate | 43.0% |
| Read and write | 22.0% |
| Religious based | 6.0% |
| Primary school | 23.0% |
| Secondary school | 6.0% |
| Land holding | Mean ± SE (ha) |
| Crop production | 0.79 ± 0.04 |
| Private pasture | 0.19 ± 0.02 |
| Average land holding | 0.98 ± 0.05 |
| N: Number of respondents; ha: hectare; SE: Standard Error | |

**Table 1:** Household characteristics of Bahir Dar Zuria District.

| Crop type | Crop production | |
|---|---|---|
| | Index | Rank |
| Maize | 0.43 | 1 |
| Millet | 0.30 | 2 |
| Teff | 0.14 | 3 |
| Rice | 0.0034 | 8 |
| Niger seed | 0.02 | 5 |
| Chick pea | 0.02 | 5 |
| Grass pea | 0.07 | 4 |
| Faba bean | 0.01 | 7 |
| Index for the crop production in BDZD: Sum of crop production i.e 8*1st ranked crop production+7*2nd ranked crop production+6*3rd ranked crop production+5*4th ranked crop production+4*5th ranked crop production+3*6th ranked crop production+2*7th ranked crop production+1*8th ranked crop production/ranked crop production of all sum ranked crop production | | |

**Table 2:** Crop production in Bahir Dar Zuria District.

*Elusine coracana* with indices value of 0.43 and 0.30, respectively. Teff production is recently reduced due to shortage of land for crop production. *Elusine coracana, Zea mays, Eragoristis tef* and *Guizotia abyssinica* seed were grown in the main rainy season and chickpea, grass pea, rice and faba bean are grown by irrigation. Khat (*Catha edulis*), Coffee (*Coffea arabica),* Gesho (*Rhamnus prinoides* L'Herit), Mango (*Mangifera indica)* and Avocado (*Persea americana)* were reported to be cash crops which are additional sources of income for the households. Similar result was reported by Freyer and Vaarst found similar crop type to be produced in this study area [17]. Muleta et al., reported that in rainy season, major crops grown include maize, finger millet, and teff in Robit Bata kebele [13]. Crops such as tomato, grass pea, chickpea, wheat, maize, khat, mango and coffee are grown by irrigation in the dry season. Interestingly, Khat (*Catha edulis)* has been recently introduced into the farming system and becomes the main cash crop and means of income source for almost all households [19]. Similar work by Bimrew [20] who reported that khat (*Catha edulis)* is the major cash crop cultivated in western Hareraghe Zone. Previous work by Molla et al., noted that, Khat crop can be produced the whole year, thereby becoming a source of continuous revenue for the farmers. Since the area is mixed crop-livestock farming, crop by-products are main source of livestock feeds [21].

## Livestock production

Livestock productions in Bahir Dar Zuria District are presented in Table 3. Among the livestock species kept by farmers, cattle are the most abundant species in the study area as it gives traction and threshing power and are an important component of the farming system. The livestock species kept in the study area was similar to that reported by Molla et al. [21]. The livestock holding in the present study area was higher than reported by Muleta which was 3.5 ± 1.71 TLU in Bahir Dar Zuria District [20]. The livestock holding was smaller than that reported by (15) who recorded overall cattle, sheep, goat, equine and poultry holding per household of 5.54 ± 0.39, 0.27 ± 0.051, 0.36 ± 0.031, 0.49 ± 0.072 and 0.15 ± 0.06 TLU, respectively. The low number of livestock in the study area as compared to results reported for other area might be due to shortage of feed in the study area, as a result of which farmers forced to reduce livestock number, especially cattle. Bimrew noted that small size of TLU might be due to shortage of land to grow feed and lack of knowledge in feeding practices of animals [20].

| Livestock Species | Livestock production | | TLU (± SE) |
|---|---|---|---|
| | Index | Rank | |
| Cattle | 0.51 | 1 | 4.42 ± 0.24 |
| Sheep | 0.25 | 2 | 0.17 ± 0.03 |
| Goat | 0.16 | 3 | 0.12 ± 0.02 |
| Equine | 0.08 | 4 | 0.06 ± 0.01 |
| Total | | | 4.77 ± 0.27 |
| Index for the livestock production in BDZD: sum of livestock production i.e 4*1st ranked livestock production+ 3*2nd ranked livestock production+2*3rd ranked livestock production+1*4th ranked livestock production/ranked livestock production of all sum ranked livestock production | | | |

**Table 3:** Livestock production in Bahir Dar Zuria District.

## Purpose of livestock keeping

Purposes of livestock keeping in Bahir Dar Zuria District are presented in Table 4. In the study area livestock were kept for different purpose such as, meat and milk, as a source for ploughing traction power, as source of income generation and transport. The result was similar with previous studies Muleta et al. and Bimrew who noted livestock provides the major traction power in crop production, dung, milk and meat and cash income to the farmers [13,20]. Cattle mainly kept for use as draft power and milk with indices values of 0.48 and 0.44, respectively. Cattle provide traction power while cows were kept for milk and replacement heifers and young bulls which were similar to the practice of smallholder farmers in other area [15].

Small ruminants were kept as a source of income generation and meat production with an indices value of 0.51 and 0.49, respectively. Small ruminants are sold to get money and slaughtered for meat during holidays and religious celebration. Selamawit et al., noted 0.74 and 0.26 indices values for income and meat production and it is influenced by farmers' objective of rearing small ruminants [14]. Equines were kept for transport (0.97). Equines provide transportation of farm input to home and output to the market and also fetching water from water sources. Similar result was found by Selamawit et al., who noted equines (mainly donkey and mule) to be used for transportation of agricultural inputs from market to home and vice versa, and water transportation [14].

## Constraints of livestock production

The major constraints for livestock production were feed and water shortage (0.52) both in terms of quantity and quality, health problem (0.27) and low genetic potential (0.21) of indices value. The communal grazing lands in the study area are overgrazed and almost non-productive. Similar results were found in South Achefer Woreda, Amhara Region by Molla et al., and Bimrew in Bahir Dar Zuria District and Freweini et al., in Eastern Harerghe Zone [20-22]. These studies showed that the quantity and quality of grazing lands are the main

| Purpose of livestock keeping | Cattle | | Small ruminants | | Equine | |
|---|---|---|---|---|---|---|
| | Index | Rank | Index | Rank | Index | Rank |
| Milk | 0.44 | 2 | 0 | - | 0 | - |
| Draft power | 0.48 | 1 | 0 | - | 0 | - |
| Income | 0.07 | 3 | 0.51 | 1 | 0.03 | 2 |
| Meat | 0.01 | 4 | 0.49 | 2 | 0 | - |
| Prestige | 0 | - | 0 | - | 0 | - |
| Transport | 0 | - | 0 | - | 0.97 | 1 |

Index for the purpose of livestock keeping in BDZD: sum of purpose of livestock keeping i.e 6*1st ranked purpose of livestock keeping+5*2nd ranked purpose of livestock keeping+4*3rd ranked purpose of livestock keeping 3*4th ranked purpose of livestock keeping+2*5th ranked purpose of livestock keeping+1*6th ranked purpose of livestock keeping/ranked purpose of livestock keeping of all sum ranked purpose

**Table 4:** Purpose of livestock keeping in Bahir Dar Zuria District.

constraint to livestock production. The other constraint of livestock production was animal disease such as foot and mouth disease, which is a common cause of animal death in the study area. Internal parasites were serious problems when livestock graze and drink water in the areas which contaminated with wastes from the tannery factory near to water bodies and from Bahir Dar city households in some areas of the district. The livestock sub-sector in the study area was also constrained by very limited and shortage of supply of improved animal breeds.

## Livestock feed resources

Natural pasture (from communal, fallow and private pasture), crop residues, hay, indigenous browse trees/shrubs, crop aftermath, attela and birint, agro-industrial by-product and improved forage are being used as livestock feed resources in the study area. The result agrees with previous work by Bimrew the type of available feed resources in the Bahir Dar Zuria District includes natural pasture, crop residue, hay and some indigenous and improved fodder trees like *Ficus thoningii* tree [20]. Similar type of feed resources was reported by Getachew et al., in Fogera District but the level of their contribution might be different [23].

## Seasonal availability and utilization of livestock feeds

The result on seasonal availability of livestock feed resources in BDZD are presented in Table 5. Natural pasture was available during the wet season (89.2%) while crop aftermath (100%), crop residues (97.9%), improved forages (71.4%) and hay (92.5%) were the major feed resources in the dry season. Browse trees/shrubs (100%), agro-industrial by-products (61.3%), and attela (75.0%) were available in both seasons, however browse trees/shrubs were used mainly during dry season.

Natural pastures provide livestock feed during rainy season from July to October. Similar result was reported by earlier studies done in Haramaya University, Haramaya, Ethiopia, green fodders to be more abundant in the wet season from July to November [19]. However, the size of communal grazing land is decreasing due to expansion of farmland. This study agrees with Gelaynew et al., who reported declining trend of communal grazing land in mixed and shifting cultivation in Gambella Regional State, Southwestern, Ethiopia [24]. Among the interviewed farmers 46% have private grazing land: who added manure and fertilizer to improve productivity and fence their grazing land. Grouping of animal during feeding (27%) pasture from private grazing land is practiced in the study area. Farmers give priority for lactating cows when they feed livestock from their grazing land over oxen, heifer, bull, and small ruminants through cut and carry system.

Among the respondents about 72% purchased natural pasture from school and church compounds and made hay. However 28% of respondents produce hay from their private grazing land. The

| Feed resources | Seasonal availability (%) | | |
|---|---|---|---|
| | Dry | Wet | Both |
| Natural pasture | 5.4 | 89.2 | 5.4 |
| Crop residues | 97.9 | 1.1 | 1.0 |
| Hay | 92.5 | 5.0 | 2.5 |
| Indigenous browse trees/shrubs | 0 | 0 | 100 |
| Crop aftermath | 100 | 0 | 0 |
| Attela and birint | 25.0 | 0 | 75.0 |
| Agro-industrial by-products | 33.8 | 5.0 | 61.3 |
| Improved forages | 71.4 | 8.6 | 20.0 |

**Table 5:** Seasonal availability of livestock feed in Bahir Dar Zuria District (N=100)

contribution of hay for livestock feed is not immense it serves from January to March small amount is produced in the study area. As reported by Solomon et al. [25]. there is growing trend of hay making from natural pasture, especially from school compounds, church yards and other public places. Hay is made during October to December and commonly very late, therefore of poor quality [26].

Crop aftermath utilized soon after crop was harvested November to December. It is contribution for livestock feed is small exhausted shortly after December. As reported by Gelaynew et al. crop aftermath grazing are also other feed resources in the dry season of the year. Crop residues constitutes the largest share of livestock feed in the area [24,27]. Interviewed farmers use crop residue for feeding livestock during the dry season (83%), soon after collection (16%) and during the wet season (1%). The result agrees with the finding of Addisu et al., in southern Ethiopia where similar feeding calendar of crop residues was employed. Similar result reported by Zewdie, Getachew [18,23,28], who noted that crop residues are the major feed resources in Robit Bata Kebele and Fogera District serve almost for the entire dry period (December to June). Crop residues from maize stover, millet straw, teff straw, grass pea straw, chickpea straw, faba bean straw and rice straw were produced in the study area. Among the crop residues, maize stover and millet straw were mainly used for feeding livestock. However, treating crop residues to improve the feed value is not practiced in the study area. Similar result was reported by Zewdie et al., who stated that even though, crop residues represent the largest share of livestock feed, none of the farmers apply either chemical or mechanical treatment methods so as to improve the palatability and quality of crop residues [18]. This might be due to lack of awareness how to improve quality of crop residues; using physical (chopping of crop residues, adding water) and chemical treatments.

Tradesoff of crop residue in Bahir Dar Zuria District are presented in Table 6. Crop residues are primarily used for livestock feed since crop residues are major sources of livestock feed, it is also used as a source of fuel, construction, and selling. The result of the present study

| Tradeoff of crop residue | Maize stover | | Millet straw | | Teff straw | | Rice straw | | Niger seed straw | | Chick pea straw | | Grass pea straw | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Index | R | Index | R | Index | R | Index | R | Index | R | Index | R | Index | R |
| Fuel | 0.22 | 3 | 0 | - | 0 | - | 0 | - | 0.53 | 1 | 0 | - | 0 | - |
| Construction | 0.33 | 2 | 0.25 | 2 | 0.33 | 2 | 0.33 | 2 | 0 | - | 0.28 | 2 | 0.18 | 2 |
| Selling | 0 | - | 0.25 | 3 | 0.22 | 3 | 0.22 | 3 | 0 | - | 0 | - | 0 | - |
| Feed | 0.45 | 1 | 0.50 | 1 | 0.45 | 1 | 0.44 | 1 | 0.47 | 2 | 0.72 | 1 | 0.82 | 1 |

R: Rank: Index for tradesoff of crop residue in BDZD: Sum of tradesoff of crop residue for each crop residue i.e 4*1st ranked tradesoff of crop residue for each crop residue+3*2nd ranked trades off of crop residue for each crop residue+2*3rd ranked tradesoff of crop residue for each crop residue+1*4th ranked tradesoff of crop residue for each crop residue/ranked tradesoff of crop residue of all sum ranked trades off of crop residue for each crop residue

**Table 6:** Tradeoff of crop residue in Bahir Dar Zuria District (N=100).

| Animal type | Crop residue | | Hay | | Supplement in dry season | | Supplement in wet season | | Browse species | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Index | Rank | Index | Rank | Index | Rank | Index | Rank | Index | Rank |
| Cow | 0.24 | 2 | 0.26 | 1 | 0.39 | 1 | 0.35 | 2 | 0.28 | 2 |
| Oxen | 0.25 | 1 | 0.25 | 2 | 0.32 | 2 | 0.36 | 1 | 0.31 | 1 |
| Bull | 0.20 | 3 | 0.19 | 3 | 0.07 | 5 | 0.07 | 5 | 0.16 | 3 |
| Heifer | 0.17 | 4 | 0.16 | 4 | 0.13 | 3 | 0.12 | 3 | 0.13 | 4 |
| Small ruminant | 0.14 | 5 | 0.14 | 5 | 0.09 | 4 | 0.09 | 4 | 0.12 | 5 |

Index for priority in feeding different feed resources in BDZD: Sum of priority in feeding different feed resources i.e 5*1st ranked priority in feeding different feed resources+4*2nd ranked priority in feeding different feed resources+3*3rd ranked priority in feeding different feed resources+2*4th ranked priority in feeding different feed resources+1*5th ranked priority in feeding different feed resources/ranked priority in feeding different feed resources of all sum ranked priority of feeding different feed resources

**Table 7:** Priority in feeding livestock in Bahir Dar Zuria District.

was similar to the report of Bedasa, who found crop residues are used generally for livestock feed, fuel, and constructions in the Blue Nile Basin [26]. Crop residues were stored stacked outside the house in the dry season and under shade during the wet season. Similar method of storage of crop residue was reported in mixed and shifting cultivation in Gambella region by [25].

Except deciduous one browse trees/shrubs were available in both seasons, however their utilization is in main dry season from January to June [29].

Cultivation of improved forage is rarely practiced except a few farmers' plant species like *Sesbania sesban* and elephant grass hence utilization as livestock feed was low. Shortage of land, lack of awareness and forage seeds were the major problems in the study area. Similar work were reported by Muleta et al. and Freweini et al., who noted the reasons for not using cultivated forage crops were shortage of land, lack of awareness on benefits of cultivating forage crops, and shortage of availability of forage seeds [13,22]. This partly may be due to the weak extension support, more emphasized on food crops and shortage of availability of forage seeds. As report of Freweini et al., continuous extension on different forage strategies that can be efficiently integrated into the existing farming system as well as the introduction of more adaptable and early maturing forage varieties needs to be done [22].

In the study area 80% of the respondents provided supplemental feeds like agro-industrial by-products (wheat bran, nug seed cake) purchased from Bahir Dar city, traditional brewery by-products mainly attela when available and minerals/salt/ both in the dry (March to May) and wet seasons (June to August), the rest of the respondents did not supplement their livestock due to shortage of money. Freweini et al., reported in Haramaya District wheat bran is primarily used as supplement during drought season and when additional feed is required for milking animals and during fattening [22]. Other important feed resources in the surveyed area were local brewery by-products namely Atella and Brinti, by-products of the traditional beverages Tella and Arekie, respectively both in wet and dry seasons of the year [29].

There were feed abundance and feed shortage months in the study area. Among the interviewed farmers, 98% said that feed was abundant mainly from December to March. The types of feeds available in these months according to respondents were crop residues (85.6%), natural pasture (10.3%) and both (4.1%). Most of the interviewed farmers (96.9%) stored excess feeds and fed their livestock during feed shortage. Similarly, there were also feed shortage months (98%) which mainly occur from April to October. A crop residue is exhausted and natural pastures are not producing adequate biomass since they are overgrazed at these months. In such case, grasses purchased from church and school compounds, collected weeds from crop lands and maize leaves were fed through cut and carry system. Muleta et al., reported that farmers use strategies to overcome feed shortage through supplementing livestock with any available crop residues and fodder tree and shrub leaves. Farmers reported that there is time where feeds are surplus, adequate and deficit [13]. As reported by Addisu et al., the livestock feed availability, access, quality and quantity varies in different seasons of the year. In some seasons of the year, there was excess feed availability and there were also some seasons in which livestock face dearth feed shortage [28]. As reported by Bedasa feed availability depends on sources of feed, feeding strategies, managements and feed use factors [26].

## Livestock feeding system

The feeding systems in the study area were dominantly by partly grazing (39%) followed by only stalled feeding (34%) and free grazing (27%). Grazing or cut and carry system with limited movement was found in the study area. The importance of it was higher in this study probably due to insufficient biomass produced by the natural pasture, hence farmers opted to use cut and carry system to feed their livestock by purchasing fodder from school and church compounds and other sources in the wet season and crop residues, supplements and browse trees/shrubs during dry season This result was in agreement with the report of Belay [29]. observed that partly grazing was common in some places in the mixed farming system whereby crop residues, forages, and weeds were given to the animals [30]. The study was similar to the previous work by Molla et al., that show the management of livestock feeding was both partial grazing and home feeding [21]. This home/

homestead feeding is an interesting feature of livestock feeding which in turn has enormous advantage to promote fodder development and using cut and carry system which has importance to reduce free grazing. Muleta et al., reported that most of the farmers keep their animals at backyard and tether their animals during wet season and some farmers tether their animals throughout the year [13].

In feeding crop residues, cattle owners give priority for cattle first. In crop residues feeding oxen, cow, bull, heifer and small ruminant were given priority with descending order Table 7. Similar result was reported in Mecha District, where farmers had their own preference of feeding crop residues to their animal giving priority for ploughing oxen and lactating cows [30]. Priority in feeding hay and supplementary feed was given to cow, however, oxen were fed first in the traction/cropping season since they are used for traction power. Depending on the season priorities in feeding different feed resources differ. Accordingly, oxen are feed first during cropping season, and other time cows. As reported by Mekuanint and Girma in Bale Zone feeding strategy depends on the nature of the farming system, objective of herding animals and the availability of feed resources in that area which is to be affordable by the farmers [3].

## Conclusion

Generally in the study area livestock were the main component of the farming system, however livestock production is constrained by shortage of feed and the available feed resources are low in nutritional quality. Crop residues are most important in contributing to livestock feed but they tend to be of low quality. Hence, brainstorming farmers how to treat crop residues with different methods is important. Scaling up of improved forages establishment and utilization system should be practiced.

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### References

1. Asfaw N, Shahidur R, Berhanu G (2011) Livestock production and marketing in Ethiopia. Ethiopian Support Strategy Program II, Working Paper 26 Washington, DC IFPRI, Studies on the economic contributions of livestock in North and East Africa.
2. Ekalawi Y, Balaselțan S (2017) Agricultural Sample Survey 2016/17 (2009 E.C.), Report on livestock and livestock characteristics (private peasant holdings). Vol II Central Statistical Agency, Addis Ababa, Ethiopia.
3. Mekuanint G, Girma D (2017) Livestock feed resources, nutritional value and their implication on animal productivity in mixed farming system in Gasera and Ginnir Districts, Bale Zone, Ethiopia. Int J Livest Prod. 8: 12-23.
4. Dawit A, Ajebu N, Sandip B (2013) Assessment of feed resource availability and livestock production constraints in selected Kebeles of Adami Tullu Jiddo Kombolcha District, Ethiopia. Afr JAgri Res 8: 4067-73.
5. Ahmed H, Abule E, Mohammed K, Treydte AC (2010) Livestock feed resources utilization and management as influenced by altitude in the Central Highlands of Ethiopia. Live Res for Rural Dev 22.
6. Abera M, Adugna T, Getnet A (2014) Feed resource assessment and utilization in Baresa Watershed, Ethiopia. Int J Sci Res 3: 66-72.
7. Yisehak K, Janssens G (2014) The impacts of imbalances of feed supply and requirement on productivity of free-ranging tropical livestock units : Links of multiple factors laboratory of animal nutrition, faculty of veterinary medicine. Afr J Basic Appl Sci 6: 187-197.
8. Alkhtib A, Wamatu J, Kassie G, Rischkowsky (2016) Analysis of crop residue use in small holder mixed farms in Ethiopia. Renew Agr Food Syst 32: 454-462.
9. Annual report (2009) DOA District Office of Agriculture, Bahir Dar Ethiopia.
10. CSA Central Statistical Agency (2007) Ethiopian Central Statistic Authority. Addis Abeba, Ethiopia.
11. Gryseels G (1988) Role of livestock on a mixed smallholder farms in Debre Berhan, PhD Dissertation, Agricultural University of Wageningen, Netherlands.
12. Musa LMA, Peters KJ, Ahmed MKA (2006) On farm characterization of Butana and Kenana cattle breed production systems in Sudan. Livestock Research for Rural Development 18: 177.
13. Muleta D, Getachew A, Mitiku E (2017) Assessment of feed resources availability and utilization in Daro Labu district, Western Hararghe Zone. J Nat Sci Res 7: 50-57.
14. Selamawit D, Yeshambel M, Bimrew A (2017) Assessment of livestock production system and feed balance in watersheds of North Achefer District, Ethiopia. J Agri Enviro Intern Devel 111: 159-174.
15. Mushir A, Mulugeta N (2012) Livestock husbandry and economic-sustainability of small farmers in peri-urban areas: A case study from West Gojjam Region, Ethiopia. Ethiopian J Environ Stud Manag 5: 207-217.
16. Woody species diversity and their preferences on farmers' land holding (2014) J Natu Sci Res 4: 96- 108.
17. Freyer B, Vaarst M (2014) Smallholder farmers' adaptation to climate change in Zenzelima, Ethiopia. A case study of female and male farmers' perception of and ability to adapt to climate change in Zenzelima, Ethiopia.
18. Zewdie W, Aberra A, Alan JD (2015) Assessment of livestock production and feed resources at Robit Bata, Bahir Dar, International Livestock Research Institute Ethiopia.
19. Evaluation of nutritional composition of selected indigenous fodder tree/ shrub leaves as feed resources in Daro Labu District, Eastern Ethiopia (2015) MscThesis, Haramaya University, Haramaya, Ethiopia.
20. Bimrew A (2018) Smallholder farmers' livestock production and marketing in Bahir Dar Zuria District, Northwestern Ethiopia. J Dev Agric Eco 10: 159-164.
21. Molla T, Asresie H, Biruhalem K, Baye B, Mekonen T, et al. (2014) Participatory rural appraisal report: South Achefer Woreda, Amhara Region. CASCAPE working paper 2.2.5.
22. Freweini A, Getachew A, Yoseph M, Mengistu U (2014) Assessment of the feeding potential and utilization of Erythrina burana and Casimiroa edulis in Eastern Harerghe zone of Ethiopia. Lives Res for Rural Devel 26:82
23. Getachew M, Firew T, Yeshambel M (2017) Sheep fattening practices in Fogera District, Amhara National Regional State, Ethiopia. J of Bio Agri Healthcare 7: 24-50.
24. Gelaynew B, Ajebu N, Getnet A, Getahun A (2016) Assessment of livestock feed resources in the farming systems of mixed and shifting cultivation, Gambella Regional State, Southwestern Ethiopia. Glob J of Sci Fro Res 16:5.
25. Solomon G, Megersa A, Melku M, Hoekstra D, Berhanu G, et al. (2016) Smallholder Dairy Farming Systems in the Highlands of Ethiopia: System-Specific Constraints and Intervention Options.
26. Bedasa E (2012) Study of smallholder farms livestock feed sourcing and feeding strategies and their implication on livestock water productivity in mixed crop-livestock systems in the Highlands of the Blue Nile Basin, Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.
27. Asaminew T, Eyassu S (2009) Smallholder Dairy Production System and Emergence of Dairy Cooperatives in Bahir Dar Zuria, and Mecha Woredas, World J Dairy Food Sci 4: 185-192.
28. Addisu J, Fitsum T, Deribe G, Zekarias B (2016) Assessment of available feed resources, feed management and utilization systems in SNNPRS of Ethiopia, J Fisheries Livest Prod 4: 1-9.
29. Belay D, Azage T, Hegde BP (2012) Smallholder livestock production system in Dandi district, Oromia regional state, central Ethiopia. Global Veterinaria 8: 472- 479.
30. Malede B, Yeshambel M, Aschalew A, Shewangzaw A, Addis G (2016) Crop residue quality loss and forage conservation strategy in Mecha Districts of Amhara Region, Ethiopia. J Anim Feed Res 6: 107-112.