Assessment of livestock production system and feed resources availability in three villages of Diga district Ethiopia

Dereje Duressa[1], Debela Kenea[2], Wakgari Keba[3], Zelalem Desta[4], Gutema Berki[5], Gerba Leta[6], Adugna Tolera[7]

[1]Wollega University; [2]Ethiopan Evangelical Church; [3]Oromia Agricultural Research Institute; [4]Diga District Livestock Agency; [5]Diga District Agriculture Office; [6]International Livestock Research Institute; [7]Hawassa University

September 2014

ilri.org
better lives through livestock
ILRI is a member of the CGIAR Consortium

Box 30709, Nairobi 00100, Kenya
Phone: +254 20 422 3000
Fax: +254 20 422 3001
Email: ILRI-Kenya@cgiar.org

Box 5689, Addis Ababa, Ethiopia
Phone: +251 11 617 2000
Fax: +251 11 617 2001
Email: ILRI-Ethiopia@cgiar.org

Introduction

The CGIAR Humidtropics research program takes a systems approach to sustainable intensification. In Ethiopia the Humidtropics Action Site encompasses Western Oromia. Eight field sites have been identified for field research. These include Jeldu, Diga and Lemo woredas. Jeldu and Diga are woredas that were selected by a precursor to Humidtropics, the Nile Basin Development Challenge (NBDC) Project of the Challenge Program on Water and Food (CPWF). Diga district is located in East Wollega Zone of Oromia Regional State. Jeldu district is in West Shewa Zone of Oromia Region. Lemo woreda is in Southern Nations Nationalities and Peoples Regional State in Hadiya Zone. The formation of the local innovation platforms at each project site or district was initiated in 2011 by the Integrated Rain Water Management Strategies Technologies Polices and Institutions Project of the NBDC. In the ex-NBDC sites, Innovation Platforms were established to bring together local stakeholders and to develop practical action to deal with local natural resource management issues.

The Diga Innovation Platform, since its inception, has conducted a series of meetings and interactions to identify and prioritize the land and water management issues in the woreda (district). Moreover, community engagement exercises were carried out to gain a clear picture of the existing situation and understand the opinion of the farmers as to what needs to be done in order to mitigate land and water management problems in the area. The major challenges identified during the NBDC baseline exercise and community consultation meetings were soil erosion and land degradation, termite infestation and animal pests (Ludi et al., 2013). The impacts of these challenges included reduction of biomass and grain yield and shortage of livestock feed supply. As a result, inhabitants have been compelled to migrate and resettle in fragile and previously non-arable areas.

The challenges required interventions and so mitigation measures such as backyard forage production were suggested to arrest and reverse the prevailing problems. According to Mengistu (2002) backyard fodder development provides an opportunity for reaching a large number of farmers in a short period of time. The IP members eventually realized the necessity of supporting such interventions with evidence including use of tools such as the Feed Assessment Tool (FEAST). FEAST is a systematic method for assessing local feed resource availability and is used with a view to designing intervention strategies aimed at optimizing feed utilization (Duncan et al., 2012). Therefore, this study was carried out with the aim of rapidly assessing the prevailing farming and livestock production system, feed resources availability and livestock production constraints of the area in order to identify potential intervention strategies for the development of livestock feed resources and natural resource management.

Methodology

Main features of the study area

Diga is one of the 17 woredas of East Wollega zone of Oromiya Regional State located at a distance of 343 km west of Addis Ababa and 12 km west of Nekemte, capital of East Wollega Zone. The altitude of the district ranges from 1100 to 2300 masl, the mean annual rainfall varies from 1200 to 2000 mm and the temperature ranges from 18°C to 32°C. The district consists of 21 rural kebeles and 2 special town kebeles making a total of 23 total kebeles and 12 farmers' services cooperatives. The area of land in the district is estimated to be 59,545.5ha, of which 48.6% and 51.4% are located in mid-altitude and lowland agro-ecological zones respectively. Of the total available land in the district, cultivated land accounts for 40.5% whereas cultivable land, forest land, grassland and others make up 23.3%, 11.6%, 8.4% and 13.3%, respectively (Diga District Office of Agriculture and Livestock Agency).

Three villages (Humbo, Dapo and Dembi) were selected from Arjo Konan Bula kebele for this study. The villages are near Arjo Gudatu town along the main road to Gimbi and Assossain within the lowland agro-ecology at altitudes of 1350-1450 masl. The PRAs and individual interviews were conducted at 09°02'18.7"N latitude and 036°17'12.7"E longitude in Humbo, 09°03'03" N latitude and 036 °17'17" E longitude in Dapo, and 09°02'25.6"N latitude and 036°15'46.7"E longitude in Dembi villages.

Sampling and data collection methods

Prior to the survey, members of the technical team participated in a three day Feed Assessment Tool (FEAST) application training which was organized by the International Livestock Research Institute (ILRI) in Addis Ababa. A team of five members comprising ILRI/IWMI staff conducted the assessment using the FEAST tool in June 2013. The study was sponsored by International Livestock Research Institute (ILRI) and the International Water Management Institute (IWMI).

The selection of villages was conducted by representatives of the technical group and agricultural and livestock experts from the district. The three selected villages were part of the NBDC intervention site, where soil erosion, land degradation and termite infestation were identified as major problems. Development agents and village representatives, of the selected villages, selected the farmers based on wealth category (based on the size of land holding - below average, average, above average), gender, age and educational status. A total of 45 participants were selected from the three villages for the study. Accordingly, 15 farmers (9 men and 6 women) were selected from each village for the Participatory Rural Appraisal (PRA) survey. After the PRA discussion, 9 farmers (6 men and 3 women) representing the 3 wealth categories were selected from each village for individual interview on quantitative information.

Data analysis

The FEAST excel macro program (www.ilri.org/feast) was used for data summary and analysis. Narrative responses collected during the group discussions were examined and reported in qualitative manner.

The Feed Assessment Tool (FEAST) is a systematic method to assess local feed resource availability and use. It helps in the design of intervention strategies aiming to optimize feed utilization and animal production. More information and the manual can be obtained at www.ilri.org/feast

FEAST is a tool in constant development and improvement. Feedback is welcome and should be directed feast@cgiar.org. The International Livestock Research Institute (ILRI) is not responsible for the quality and validity of results obtained using the FEAST methodology.

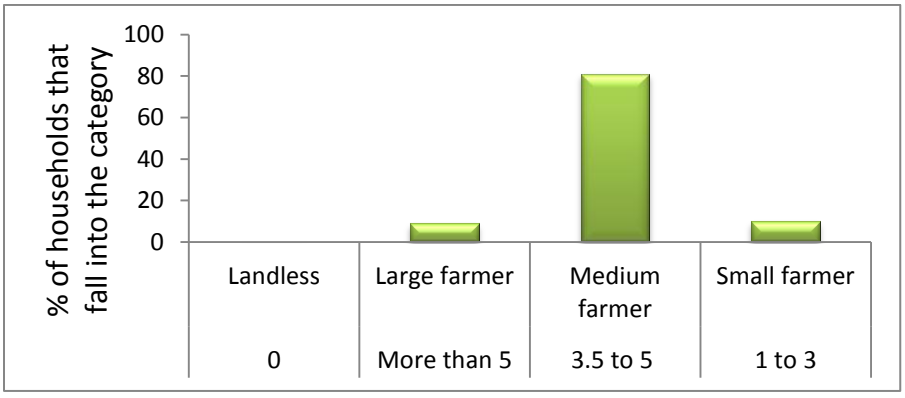
Results and discussion

General observation of the study villages

Mixed crop-livestock production is the dominant production system in all the three villages. The number of households living in Humbo was reported to be 32 whereas the numbers of households in Dapo and Dembi villages were 27 and 42, respectively. The average family size per household was reported to be 8 persons for Humbo, 7 persons for Dapo and 5 persons for Dembi villages.

Land holding

The average land holding per household for various wealth groups is indicated in Figure 1. According to the definition of land holding size category developed by the respondents from each village, most households in all the three villages have medium size of land holding of about 2.5-3.5 or 4.5 ha (about 80% of the respondents in Humbo and about 60% both in Dapo and Dembi villages).This is followed by below average and above average farmers. About 14% of the respondents from Dembi village can be categorized as having large land holding of above 4.5 ha. However, it is to be noted that the definition of small, medium and large land holding sizes are different in the three villages. The average land holding of a household was reported to be 4.25 and 2.75 ha in Humbo and Dembi villages, respectively.



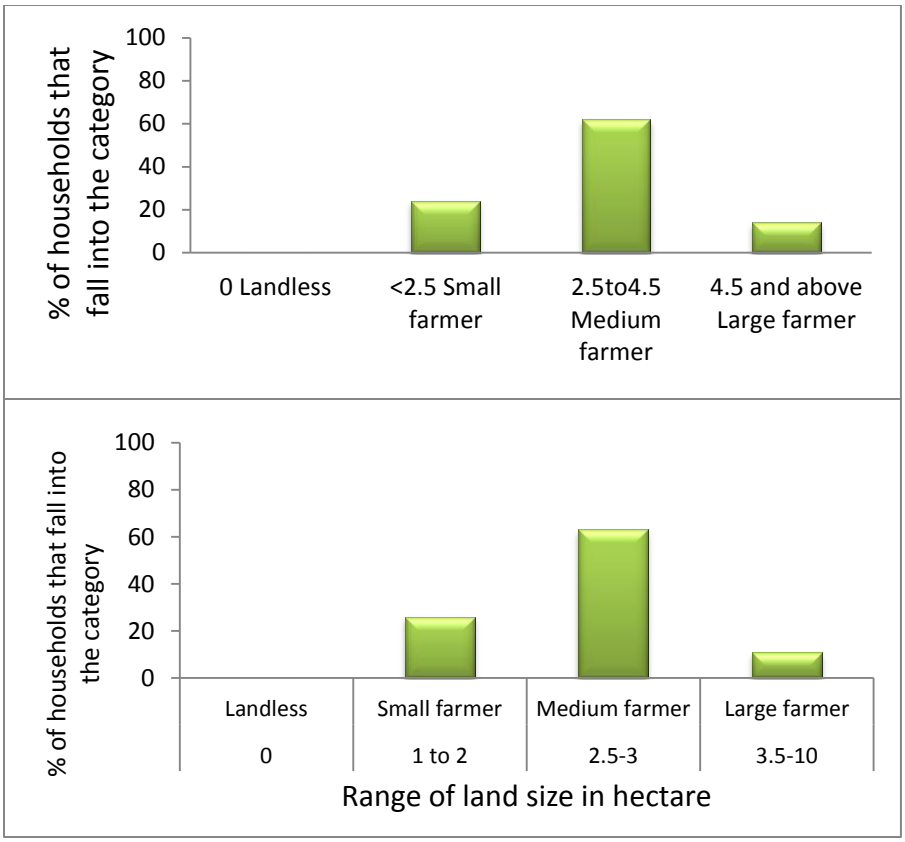


Figure 1. Group information based on land holding (ha) of the farmers in Humbo (top), Dapo (middle) and Dembi (bottom) villages

Most of the farmers in the villages are recent resettlers from mid-land or upland areas and the settlements are more sparsely dispersed than in the upland areas. Thus farmers in these villages possess comparatively larger land holdings than farmers in the some other parts of the country (Duguma et al., 2012; Andnet et al., 2014; Ashenafi et al., 2014). There was no report of landless farmers in any of the three villages.

Overview of the farming system

Mixed crop-livestock production is the dominant production system in all the three villages. In addition to food crops, some farmers also grow cash crops such as coffee (*Coffea arabica*) and mango (*Mangifera indica*) fruits. Compared to the other two villages, Humbo village is known for having larger tree coverage. Termite infestation, soil erosion and land degradation are typical features of all the villages leading to a decline in crop production and productivity. Groundnut was reported to be a hardy crop next and along with millet seems better adapted to such degraded and termite infested soils than other crops. Some farmers also tend to focus more on livestock production because of the poor soil fertility and termite problems that affect crop production.

Figure 2. Degraded land due to termite infestation (left) and resilience of groundnut on a similar plot (right)

Crop production

Crop production is an important livelihood activity for farmers in the study villages and is mainly based on rain-fed agriculture. The area receives a mono-modal rainfall pattern with one rainy and cropping season that occurs between April and October. Maximum rainfall is received from June to August. The crop growing season can range from May to December depending on the longevity of the crop. Farmers in Humbo and Dembi villages do not have access to irrigation water or irrigation facilities to support off season crop production whereas about 23% of the farmers in Dapo village have access to irrigation. On the other hand, wetland residual moisture farming, locally known as "*bonee*", is widely practiced in Humbo village for growing maize and potato during the dry season.

Maize is the main crop grown in all the three villages followed by sorghum, finger millet and tef in Humbo and by finger millet and sorghum both in Dapo and Dembi (Figure 3). In addition, groundnut, sesame and haricot bean are also grown in the area. The average area of land allocated for dominant arable crops production was reported to be about 2.5 ha per household for Dapo village. It was reported that some farmers are dropping production of sesame due to soil erosion and declining productivity of the land. Intercropping is not a common practice although the agro-ecology is suitable for intercropping of maize and haricot bean. The traditional practice of fallowing land for soil fertility restoration has also declined because of population growth and declining productivity of the available land for sufficient production. In Humbo village, it was reported that improper drainage practices in the farmlands are aggravating soil erosion and loss of the fertile soil. Invasive weeds, locally known as "*Caraba*" and "*Kise*" were reported to cause impediments to the productivity of both crop and grazing lands. In general, crop production is basically declining because of land degradation and widespread termite infestation.

The crops grown by the farmers are used both for household consumption and as sources of cash income. Sesame, coffee, mango fruit and some spices such as ginger and cardamom are mostly grown for sale to generate cash income for the family whereas the other crops are grown largely to satisfy the food consumption needs of the families. Ginger and cardamom are often found under shade trees, which indicate that the agro-ecology is suitable to diversify crop production and minimize the risk of

crop failure regardless of the emerging threats such as crop pests, soil degradation and increasing soil acidity. However, it was indicated coffee is suffering from attack by the insect known as leaf miner (*Leucoptera coffeella*).

Crop residues are used as major sources of livestock feed during the dry season. However, small amounts of crop residues are sold as an income source and are also used for house construction, particularly for plastering of walls and thatching of roofs. Some farmers also use crop residues for mulching purposes to enhance fertility of the soil. Despite the importance of fodder crops as livestock feed, farmers in the area hardly grow improved forage crops. Moreover, the extension service to support forage development in the area appears to be weak and non-functional

Figure 3. Spices grown under shade of fruit trees

Figure 4. Coffee trees infested by leaf miner (*Leucoptera coffeella*)

Crop production is the major livelihood option for Humbo residents. The agriculture is mainly rain-fed. Mono-modal rainfall is the common feature for the zone in general with the rainfall distribution ranges from April to October. However, maximum rainfall is received from June to August. Therefore, crop growing season for the area ranges from May to December depending on the longevity of the crop type.

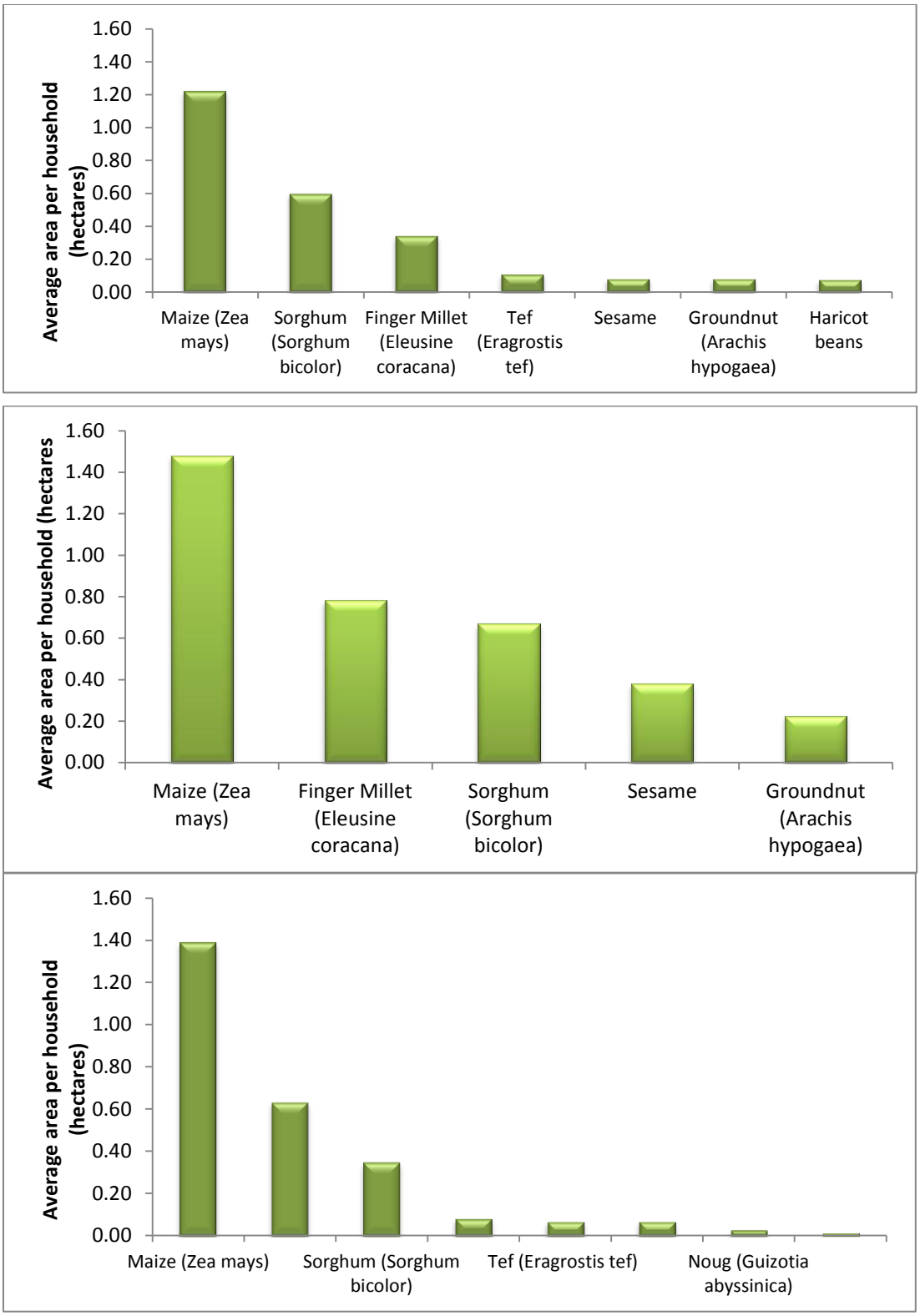


Figure 5. Dominant crops grown by the households in Humbo (top), Dapo (middle) and Dembi (bottom) villages

Livestock Production

Livestock production is an important source of income and means of livelihood in the study villages. Livestock are kept for various purposes including production of replacement stock, source of food for the family (mainly milk and milk byproducts), draught power, transport, income generation (sale of products and live animals), soil compaction for planting small cereal crops and manure production for soil fertility management. They are the drivers of crop production mainly as sources of draught power and provision of manure for soil fertility restoration.

In all the three villages, local dairy cows (lactating) are the dominant types of animals kept in the village followed by draught and fattening cattle, which is followed by donkeys in Humbo and Dapo and by goats in Dembi villages (Figure 6). In Dapo village, 63% of households own local dairy cows. Draught cattle are also owned by the same percentage of households. Only 3.7% of the households exercise cattle fattening and use as a source of income. Thirty percent (30%) of the households rear goats with an average holding of 4 goats/head. The main uses of goats in the village include generation of cash income, meat, breeding stock and manure production. Village poultry are kept by 66.7% of the households with an average holding per household of about 5 birds. The importance of keeping the chickens is for consumption of meat and eggs and as sources of income. Among the equines, only donkeys are present and these are kept by 33.3% of the households with an average holding of 1 donkey per household.

Poor animal husbandry skills and techniques, inadequate capacity for termite management, animal feed shortage and disease were indicated to be major limitations to livestock production. Trypanosomiasis was reported to be one of the limitations to cattle rearing in the village. Though the respondents are eager to improve the productivity of their local animals through crossbreeding using artificial insemination (AI) so far they do not have access to the service. As a result no farmer from the villages owns improved animal breeds of any kind. Veterinary services are provided by both government and private sectors and are available at district level. Respondents criticized the high price of veterinary drugs particularly from private vendors. Moreover, shortage of acaricides on the local market was reported by respondents.

In Dembi village, livestock contribute 33% to the livelihood assets of the household. Local dairy cows serve the farming community as a source for milk, butter, manure, and replacement of breeding stock. Draught cattle, on the other hand are used for ploughing, threshing, manure production, and breeding purposes. Although, all livestock species serve for generation of cash income, they all shared similar features in various aspects (source of food, manure etc.). Livestock holding per household is related to farm size as the bigger animals such as cattle and equines are largely owned by farmers with above average land holdings whereas poultry is owned by virtually all farmers.

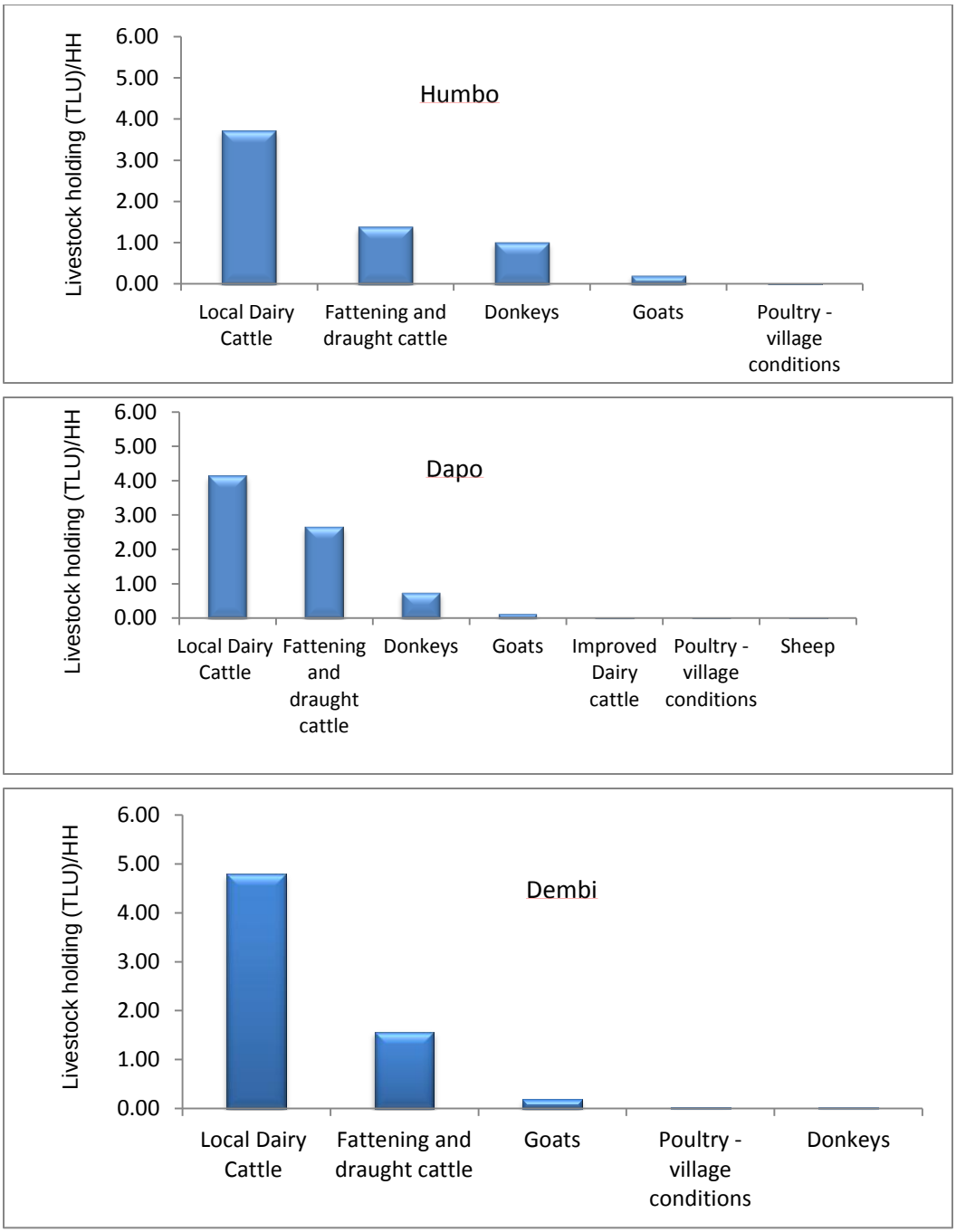


Figure 3 Average livestock holding per household **(**in TLU) in Humbo (top), Dapo (middle) and Dembi (bottom) villages

As farmers are currently moving towards abandoning their land due to soil degradation and pervasive termite infestation and the area of crop land per household is diminishing. Hence, the benefit earned from livestock production tends to increase overtime. Large areas of idle farmland would be an opportunity for intensification of livestock provided the land is rehabilitated with tolerant grass species that have high biomass production potential and resilience capacity to adverse biotic and abiotic factors often prevailing in the village. Chomo grass (*Brachiaria humidicola*) is one such grass species expected to

reclaim the degraded land because of its creeping nature that anchors its lower nodes to the ground and its resistance to intermittent attack by termites.

Livestock management and feed resources

Livestock management practices in all the villages are based on the traditional knowledge of the farmers and it was noted that the farmers lack adequate knowledge and skills in improved livestock management practices. Free grazing is the commonly practiced system of grazing in all the three villages. Feed shortage is also commonly experienced among most farmers particularly from December onwards. High temperatures in the area during the dry season lead to feed shortage as grasses dry out and the residues are consumed by termites. Fodder conservation for the dry season is not a common practice. Thus the excess forage available during the rainy season is often wasted by being trampled upon by animals and burning during the dry season.

Livestock Housing

Mature cattle are kept in open enclosures or kraals (Figure 7) during the night to prevent them from wandering around and damaging crops or other properties and to protect them from predators. The farmers periodically shift the location of the kraal to adjacent sites. This is important to achieve two objectives simultaneously viz. to maintain cleanliness of the kraal by moving it to an adjacent new site when the kraal becomes dirty and secondly to distribute the manure on the farm land as the kraal is moved to different areas of farmland. This is a very useful indigenous traditional practice that has helped to maintain the resilience and sustainability of the smallholder agricultural system. Small ruminants, young calves and chickens are housed in one corner of the family dwelling and their excreta (manure and urine) are cleaned from the house daily.

Figure 7. Night corralling for confinement and protection of cattle from wild animals

Fodder crop production

Access to animal feed is dwindling over time. Almost all HHs in the study village use an open grazing system whereas only few farmers practice tethering. Feed processing activities such as chopping of green materials and urea treatment of crop residues are not practiced in any of the study villages. The rapidly increasing human population and the concomitant expansion of croplands, fragility of the soil, termite infestation and overstocking of livestock exacerbate the problem of land degradation and ultimate feed shortage.

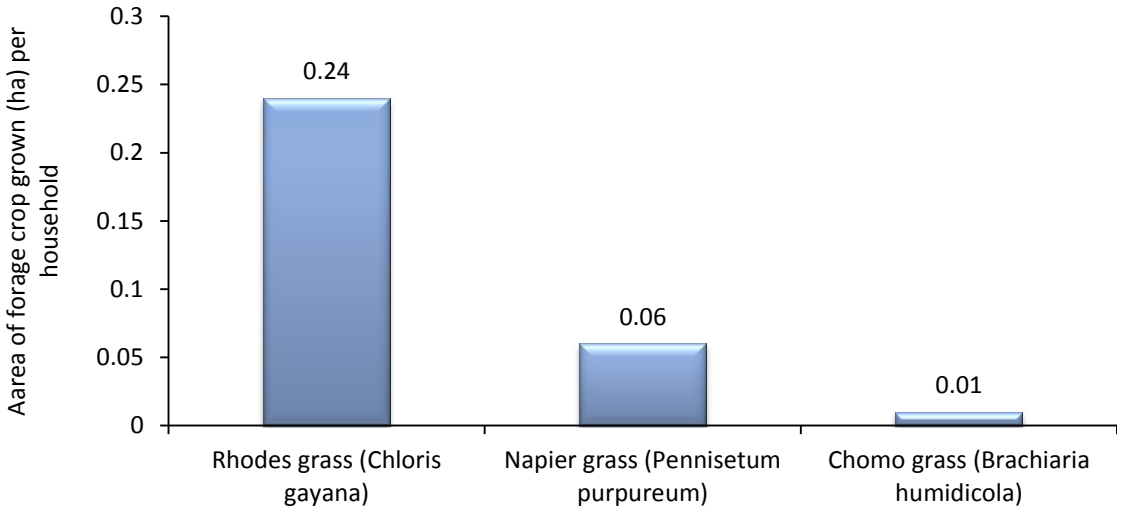


Figure 8. Fodder crops grown in Dembi village

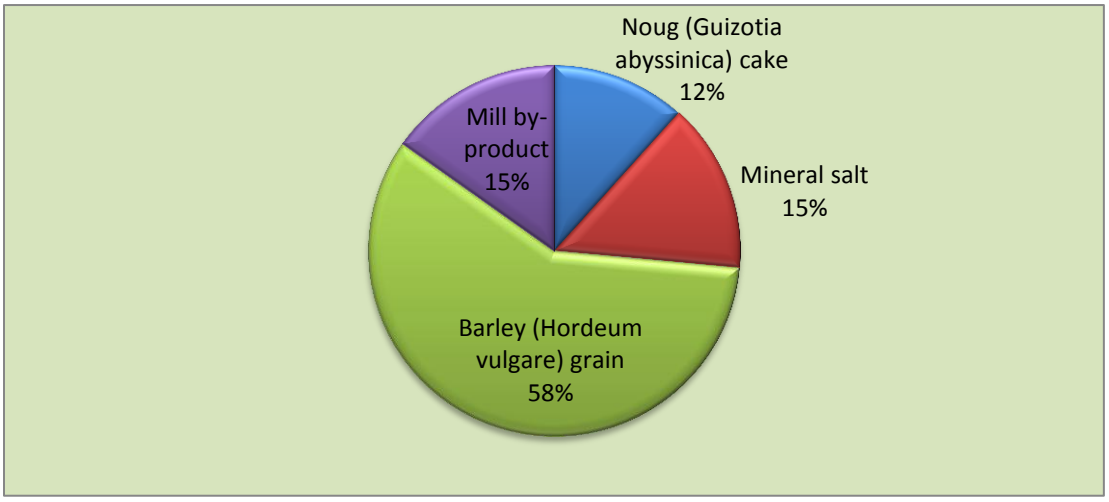
In the past the area was endowed with abundant feed resources including naturally occurring pasture, and shrubs in the nearby forest. Thus cultivation of improved forage crops was not common in the past. However, in recent years, fodder interventions started with the help of the NBDC project, and the number of fodder crops grown in the village and number of volunteer farmers engaged in the production is increasing particularly in Dapo and Dembi villages. Fodder crops such as Rhodes grass (*Chloris gayana*), Napier grass (*Pennisetum purpureum*), and Chomo grass (*Brachiaria humidicola*) are increasingly growing on farmers fields (Figure 9) although it should be noted that the areas devoted to forage production are high due to project intervention and are not typical of the area.

In addition to their major significance as animal feed, these perennial grasses serve to rehabilitate the degraded soil which has developed as a result of improper land management and termite infestation. The resilience of Rhodes grass to termite infestation is one attractive attribute of the grass and has led it to become the number one farmers' choice (Figure 8). Small amounts of Chomo grass planting material were supplied to the farmers during the last growing season. The grass is thought to compete well with the other two species in terms of tolerance to termites and for simplicity of its multiplication through its tillering habit. Some innovative farmers who first adopted growing of Rhodes grass on their farmland (Figure 9) were encouraged to collect and sell the seed to the IP for Birr 100/kg. Effecting collection of seeds from innovative farmers tends to incentivize farmers so that the income becomes the driver to foster the scaling up / out of fodder technologies. In such away, farmers could be encouraged to give special emphasis for the production and management of fodder species.

Figure 9. Rhodes and Napier grass on a farmer's plot

Concentrate and feed supplement

Only a few farmers feed their animals with concentrate and feed supplement. According to the survey, barley grain takes the largest share of feed purchased and fed to animals in Humbo village whereas noug cake followed by flour mill by-products were reported to be the major feeds purchased in Dapo and Dembi villages (Figure 10). Flour mill by-products, mineral salt and noug cake are some other feeds usually purchased and fed as supplementary feed in Humbo village. Salt is a common supplementary feed purchased by respondents from all three villages. Millet flour, prepared at home, accounts for 16% of the supplementary feed in Dembi village. The price of both noug cake and salt was reported to be Birr 4/kg whereas that of flour mill by-product (wheat bran) was Birr 3/kg during the year preceding the survey. It was indicated that the frequency of use of supplementary feed was generally low.



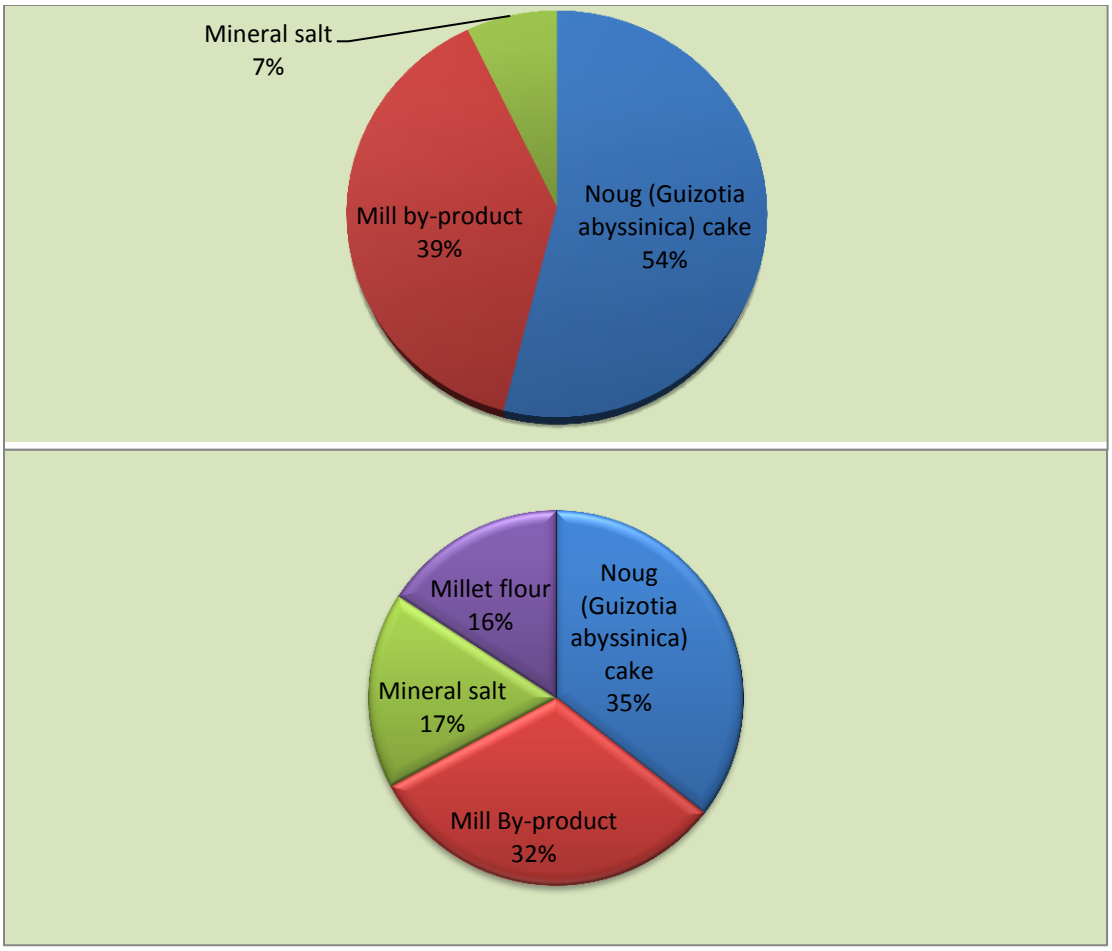


Figure 4. Breakdown of concentrate feed or ingredient purchased over a 12 months period in Humbo (top), Dapo (middle) and Dembi (bottom) villages

Dietary composition of various available feeds

The study indicated that grazing is the major contributor to the livestock feed supply, ranging from 75% of the total DM in Dembi village (Figure 13) to 82% of the total DM in Dapo village (Figure 12). The study further revealed that naturally occurring and collected fodder is the second most important contributor to livestock feed supply in the study area (Figures 11, 12 and 13). The contribution of crop residues to the total DM supply varied from 5% in Dembi village (Figure 13) to 11% in Humbo village (Figure 11). Overall the current findings are in conformity with the previous reports of Oromia Regional State (2001), which showed that grazing accounts for 81% of the livestock feed supply in Diga-Leka district followed by crop residues (13%) and crop aftermath (6%).The contribution of cultivated fodder to the total DM and nutrient supply is comparatively higher in Dembi followed by Dapo villages due to the recent interventions by the NBDC project in both villages. On the other hand, the contribution of improved forages to the diet of livestock is nil in Humbo villageas since there was no prior forage intervention in the village. Humbo village is a very recent addition to the intervention sites of the NBDC project under the Diga Innovation Platform.

In terms of the potential of biomass availability, crop residues appear to be comparable to natural pastures. However, substantial amounts of crop residues are wasted due to improper use or burned.

Thus it is important to raise awareness of the farmers for proper management of crop residues to enhance their utilization as animal feeds in the face of declining availability of natural pastures and lack of other alternatives sources of feed supply. In addition, harvesting and preserving the natural grass that flourishes during rainy season or during times of plenty by avoiding free grazing will improve livestock access to feed during the times of scarcity although strategies to protect against termite damage would need to be devised.

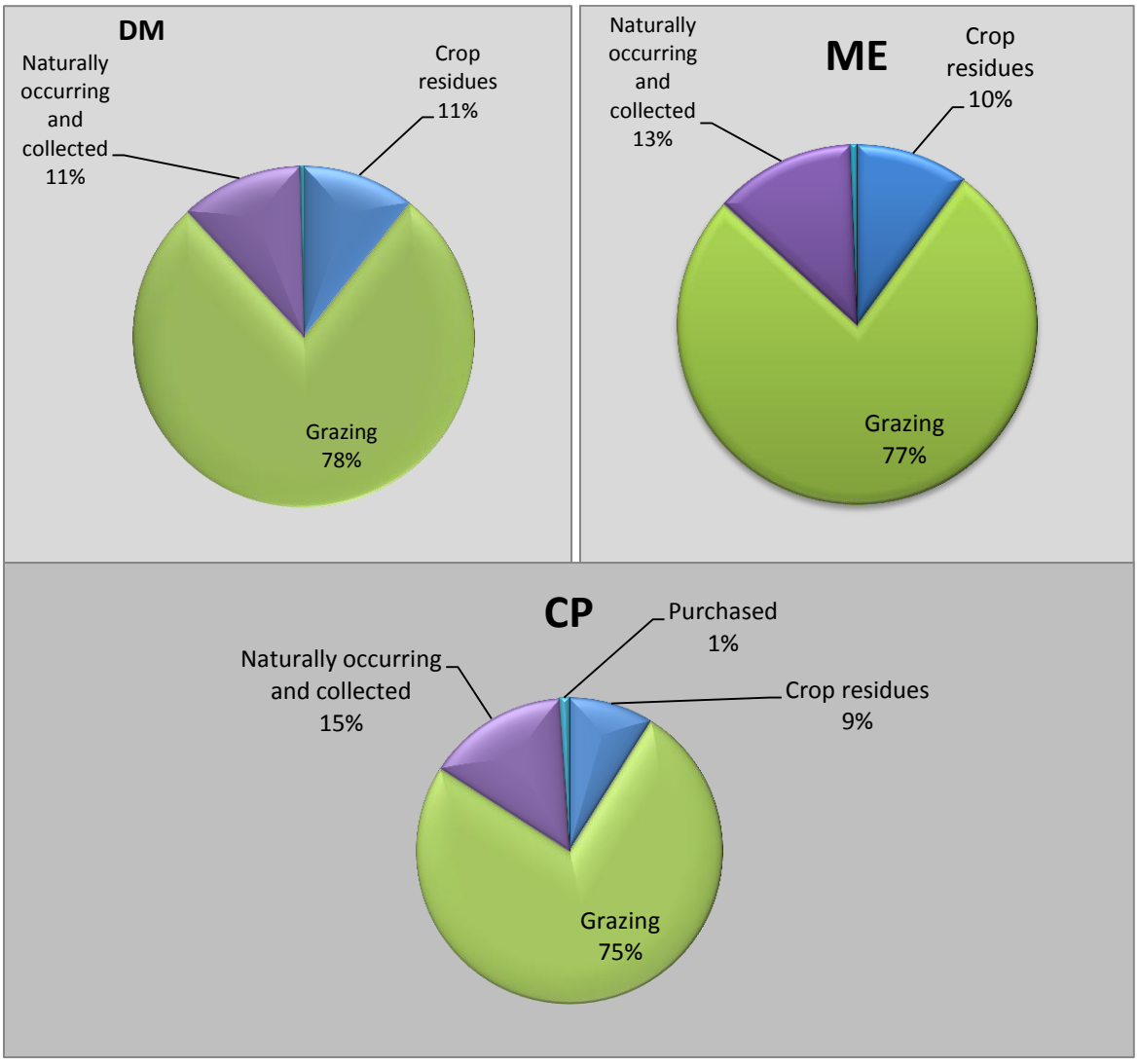


Figure 11. Dietary composition of different feeds (DM, ME and CP) in Humbo village

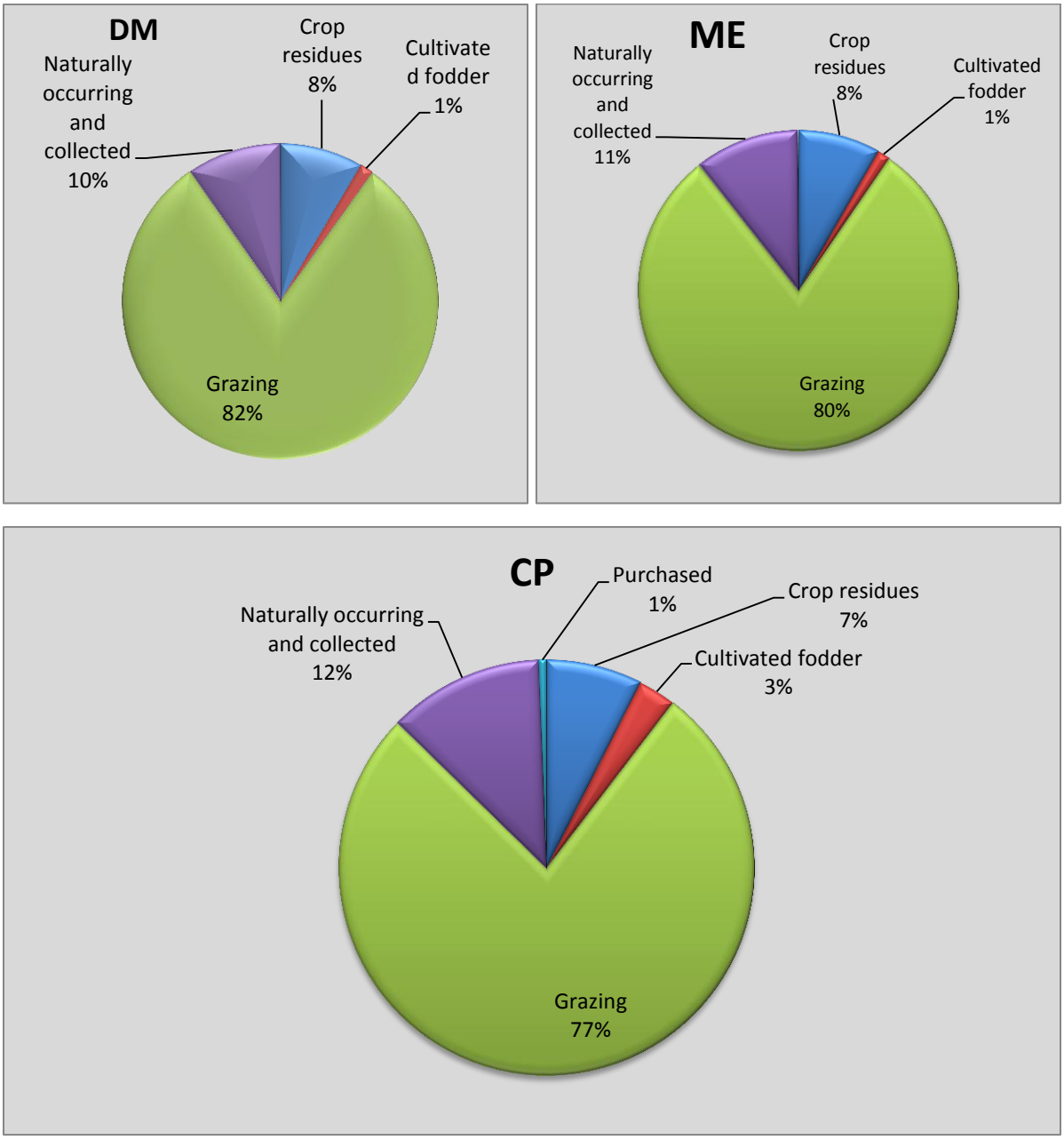


Figure 5 Dietary composition of different feeds (DM, ME and CP) in Dapo village

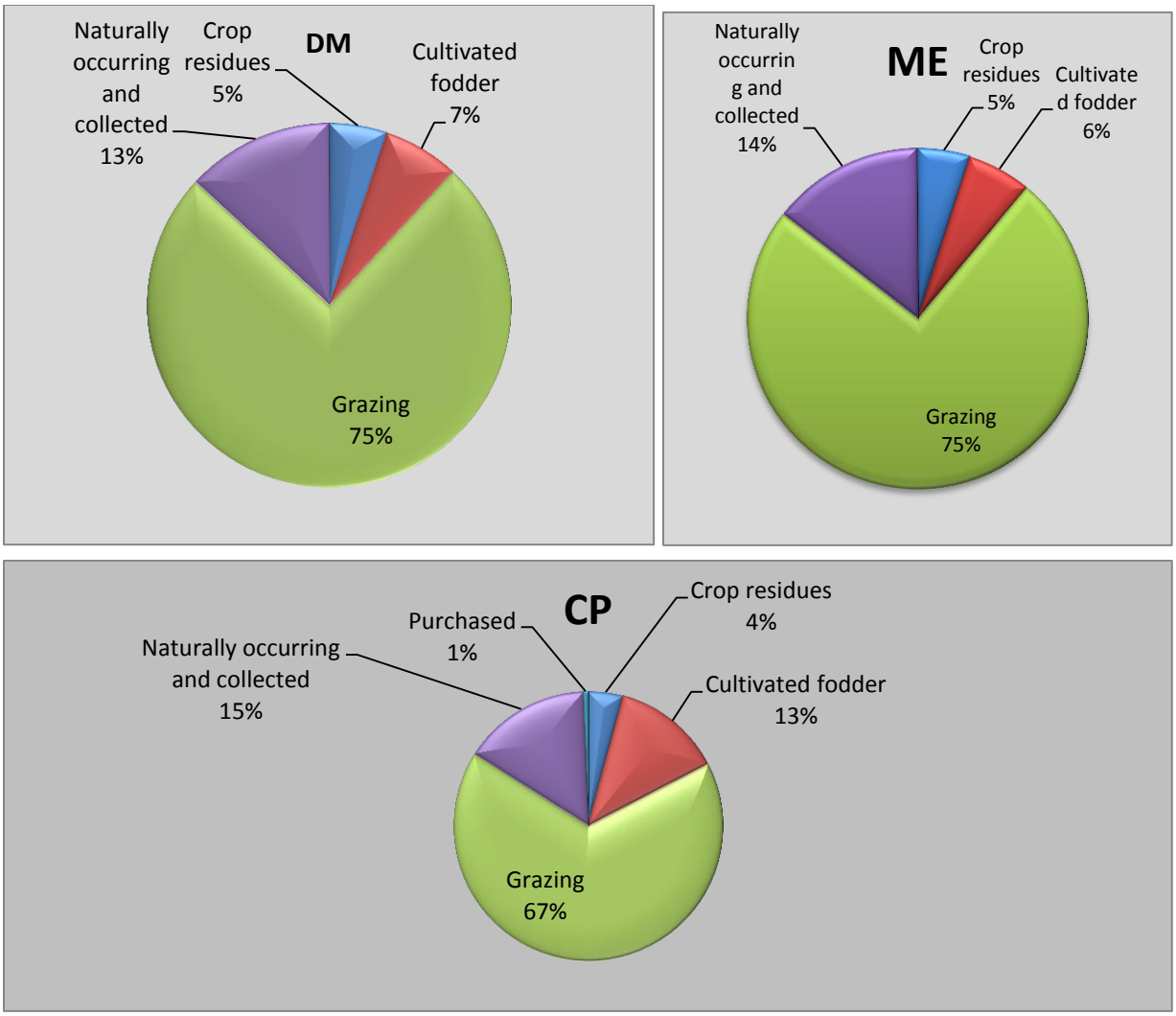


Figure 6. Dietary composition of different feeds (DM, ME and CP) in Dembi village

Seasonal feed availability

Grazing of natural pasture constitutes the main source of animal feed throughout the year with maximum availability during crop growing season (June to December) in all the three villages. Although there is plenty of natural pasture during the wet season, farmers in the study area do not have a tradition of conserving and keeping the excess forage for the dry season, when there is a relative shortage of feed. Nevertheless, plenty of crop residues are available during the dry season from October to March. In March additional crop residues are obtained mainly from wetland residual moisture based crop production locally known as*"bonee"*. Crop residues are abundantly available at the beginning of the dry season following the harvest and threshing of cereal and pulse crops. However, the abundant crop residues right after harvest and threshing is used wastefully by animals on the farm due to lack of proper conservation, storage and feeding systems. Naturally occurring and collected green forage stands in the third position, after grazing of natural pasture and crop residues, in terms of its contribution to the livestock feed supply in the area (Figure 14). The contribution of concentrate feed is insignificant.

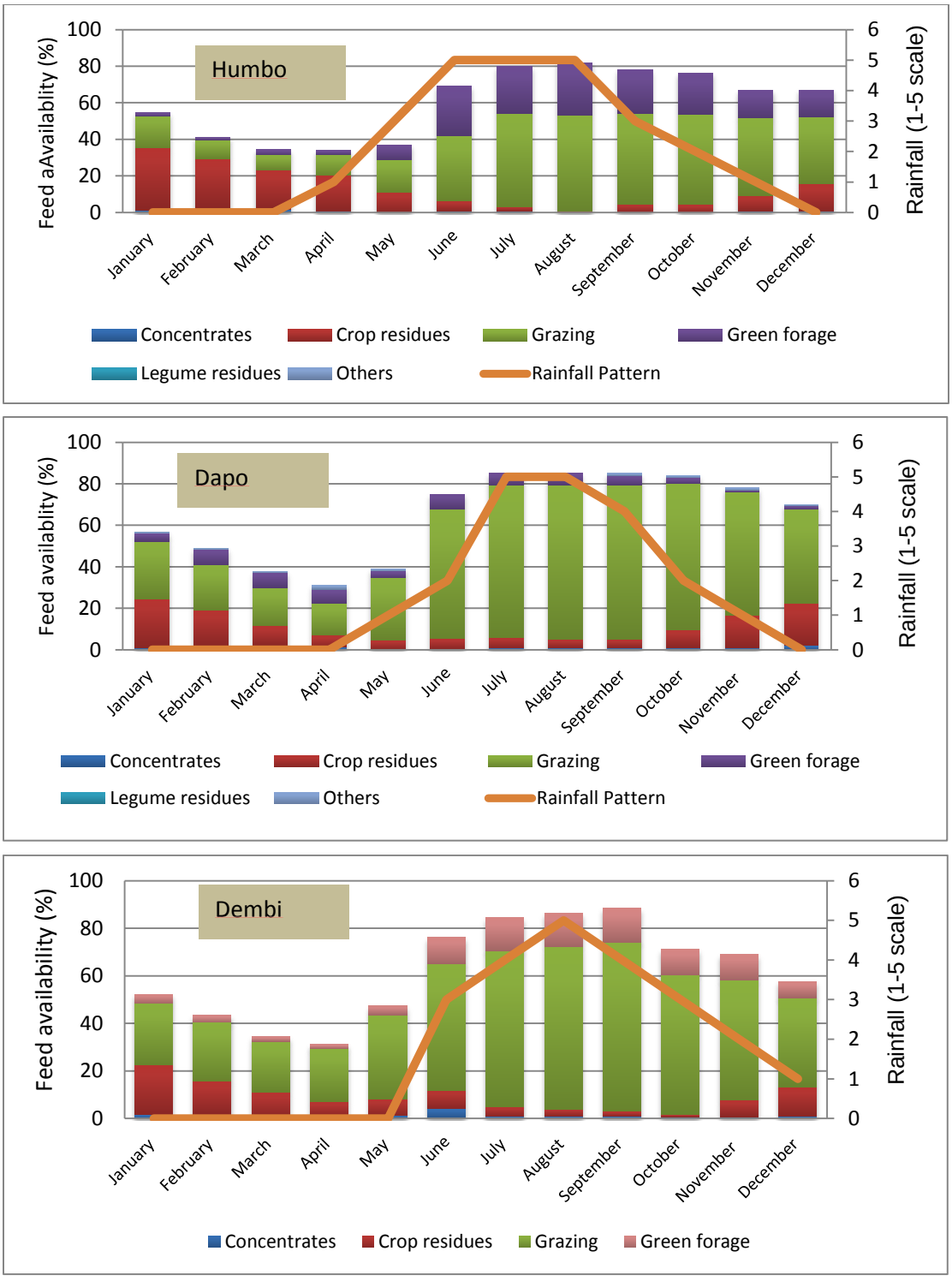


Figure 14. Seasonal feed availability in Humbo (top), Dapo (middle) and Dembi (bottom) villages

Labour Availability

Labour is an important resource that determines the production and productivity of agricultural practices of a given household. Labour shortage was reported to be a common problem for all the three villages particularly during the peak harvest, planting and weeding seasons. The average daily cost of labour was reported to be Birr 30 without food and Birr 50 when the food and drink provided to the workers by the farm families are taken into account. It was indicated that family labour is declining as many children are leaving the villages for education. Some of the young people are migrating out in search of employment opportunities in other places and the elders indicated that such out migration of the young and able bodied members of their community is contributing to the declining agricultural productivity in the villages.

Agricultural inputs

To increase production and productivity of crop and livestock, input utilization is important. It was indicated that agricultural inputs such as improved pesticides, herbicides, concentrate feeds and improved animal breeds are not readily available. Fertilizer is readily available in the local market but most farmers are unable to purchase the required quantity because of the high price.

Credit services

Credit sources for purchase of livestock and crop production are not satisfactory. Although credit facilities are available from microfinance institutions such as Oromia Saving and Credit Share Company, most farmers do not use the services because of fear of risks associated with crop and livestock performance failures that could lead to failure of repayment of the loan. Moreover, the credit services provided by the micro-finance institutions are group based which makes individual farmers accountable for the group members who are unable to pay their loan.

Household income sources

Agriculture is the mainstay of farmer livelihoods in the study villages. Accordingly, crop and livestock production are the main contributors to livelihoods of the communities in all the three villages. Crop production contributes about 58% to the household income in Humbo village and its contribution in Dapo and Dembi villages was reported to be 64% and 59%, respectively. Among the crops grown, maize, sorghum and finger millet are commonly used both for consumption and income generation whereas crops such as sesame, groundnuts and mango fruit contribute to the income of the community. Crop residues and leftovers from the various crops grown in the villages are used as animal feed, fire wood, mulch etc. In Dapo village, livestock contribute about 36% of the household income. Over 90% of the residues from maize and finger millet produced in this village are directly used as animal feeding especially during the scarcity period. Crop production and livestock production contribute about 59% and 33% to the livelihood of the households in Dembi village (Figure 15). Both crop and livestock production also create job opportunities for the majority of the inhabitants and the two enterprises are interdependent. Basically, crop production is practiced using oxen draught power. In addition, the night corralling and restoration of soil fertility is another significant benefit the farmers are tapping from livestock production. Therefore, manuring the farmland with cow dung is a means of restoring soil fertility thereby improving biomass production and building resilience to termite infestation. Livestock contribute household income from sale of animals and animal products. Bee keeping is another potential source of income for the villagers that should be further strengthened through introduction of transitional or modern bee hives. Crop production is also creating the opportunity to access feed for livestock during the dry season. Hence, the tradeoff between livestock and crop production needs to be viewed from multiple angles.

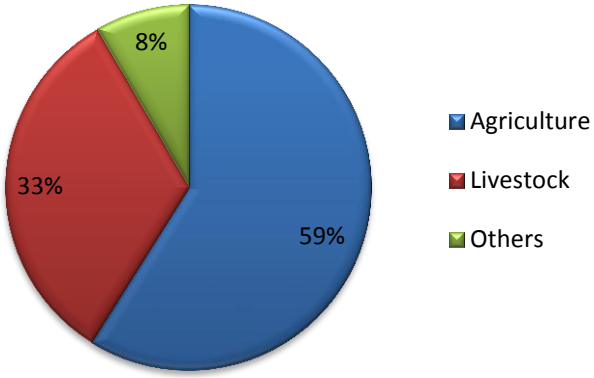


Figure15. Contribution of crops and livestock to household income in Dembi village

Major problems and opportunities

Diga woreda in general, and Humbo and other villages in particular, have several common problems that limit both crop and livestock production. Crop and livestock husbandry knowledge gaps, termite infestation, feed shortage, and disease are mentioned among others. The site also has high potential for crop and livestock production. Adequate rainfall and large size of farmland can be mentioned among others.

The participants of the PRA discussion in each of the three villages identified several limitations to crop and livestock production and listed them in ranked order through a pair-wise ranking exercise (Tables 1, 2 and 3). In Humbo, lack of modern scientific knowledge of livestock and crop production was identified as the first limiting factor followed by livestock diseases, feed shortage, water shortage and lack of improved livestock breeds in decreasing order of priority (Table 1). In the case of Dapo village, animal disease was identified to be the main problem followed by feed shortage, lack of improved breeds, soil degradation and water shortage in a decreasing order of importance (Table 2). Pair-wise ranking of the problems in Dembi village indicated that feed shortage is the main problem followed by animal disease, lack of knowledge, shortage of AI service and water shortage in decreasing order of importance (Table 3)

Table 1. Major issues and respective solutions suggested by respondents from Humbo village

Major issues	Suggested solution
Lack of knowledge	Intensive capacity building in line with different needs
Livestock disease	Isolation of the diseased animals, utilization of traditional and veterinary medicine
Feed shortage	Proper preservation and utilization of crop residue (CR) and intensive production of improved forage species and termite management
Water shortage	Building micro dams and spring development for home and livestock consumption
Lack of improved breed	Strengthen the use of AI services

Table 2. Major issues and respective solutions suggested by PRA participants from Dapo village

Major Issues	Suggested solutions
Animal disease	Expansion of veterinary service and use of proper animal husbandry
Feed shortage	Use of improved forage; improving the communal grazing land and proper storage and use of crop residues
Lack of improved breed	Use of Artificial Insemination and supply of improved breeds
Soil degradation	Termite management; adapting soil conservation measures, and practicing multiple cropping practices like intercropping of pulses with cereals, crop rotation…
Water Shortage	Utilization of water harvesting techniques; spring development and afforestation of upstream areas

Table 3. Major problems identified in Dembi village and solutions suggested by farmers

Major issues	Suggested solutions
Feed shortage	Cultivation of improved forages, proper management and use of crop residues, termite control through different mechanism including by growing termite tolerant forage species…
Animal disease	Improve access to vaccination and veterinary services
Lack of knowledge	Provision of holistic capacity building on livestock husbandry (Training).
Shortage of AI service	Provision of AI equipment and kits along with the technician at site level.
Water shortage	Promote pond construction and water harvesting structures

Actual and potential opportunities for improving livestock production in the study villages

The villages are sparsely populated with relatively large land holdings per household compared to many other parts of Ethiopia (Gemeda et al., 2012; Ashenafi et al., 2014; Andnet et al., 2014) although most of the land is degraded due to soil erosion and termite infestation. The high priority currently given by the federal and regional governments of Ethiopia for soil and land management is an opportunity for integrating improved forage development activities with this initiative of the government to improve soil fertility, land productivity and fodder availability for livestock. Availability of abundant pastures during the rainy season and large quantities of crop residues after crop harvest are potential feed resources that could be used for enhancing the productivity of the livestock if the excess is properly conserved and managed for use during times of scarcity. The high rainfall regime and warm climate are favorable for

growth of food and fodder crops. Moreover, the proximity of the study villages to Arjo Gudatu town and the Addis Ababa – Gimbi main highway offer another advantage for accessing agricultural inputs and for marketing agricultural products. The availability of locally adapted livestock breeds such the Horro cattle and sheep breeds that have good potential for high growth rate is also another opportunity for enhancing livestock production and productivity by applying appropriate feeding and management practices. Free AI service is given by the district's Livestock Production and Health Agency for genetic improvement of the livestock resources although the efficiency and effectiveness needs substantial improvement.

Conclusions

Crop and livestock production are the major means of livelihood for the farmers in the study villages. Thus, due attention has to be given to the improvement of the agricultural productivity in the area. The following are some of the main points that need consideration.

1. Make use of potential opportunities of large available land area and unproductive farmland due to termite infestation and worsening soil degradation by introduction of tolerant and resilient fodder species. In this connection, experience sharing and collective action on termite management among farmers would be important.
2. Capacity building and knowledge management on livestock and crop husbandry. Strengthen the prevailing enthusiasm of the target community who are striving very hard to see tangible changes on their farmland,
3. Improve collective action on joint learning and action so that sense of ownership gradually develops among stakeholders,
4. Empower the champion farmers and other development practitioner to ensure sustainability of the collective action
5. Enable farmers to innovate and become self-reliant by learning and doing, and
6. Expansion of fodder development and intensification of livestock production through inspiring proper crop residue management and use, controlled grazing and introduction of cut and carry system, etc. By doing so, future productivity and sustainability of the crop and livestock system can be ensured.

In general, it is advisable to promote farmers' perceptions on improved techniques of feed harvesting, processing and preservation so that adequate feed could be accessed during season of meager supply. Above all, introducing and increasing the production and productivity of niche compatible and resilient forage species to adverse climate and the prevailing termite infestation is strongly recommended.

References

Andnet, D., Temesgen, A., Zewdie Wondatir, Tibebu S. and Jonse, N., 2014. Assessment of livestock production system and feed resources availability at Melka watershed of Jeldu district, West Shewa Zone of Oromia Regional State, western Ethiopia. Unpublished draft report

Ashenafi, M., Fikadu, T., Melese, M., Shimelis, M., Shewangizaw, W. and Tesfaye, A., 2014. Characterization of the farming and livestock production systems and the potential to enhance livestock productivity through improved feeding in Lemo district, southern Ethiopia. Unpublished draft report.

Duguma, G., Jembere, T., Degefa, K., Temesgen, W., Kumsa, A., Wamatu, J. and Duncan, A. 2012. Characterization of the farming and livestock production systems and the potential to enhance livestock productivity through improved feeding in Horro district, Ethiopia. International Livestock Research Institute, Addis Ababa, Ethiopia. 13p.

Duncan, A., York,L., Lukuyu, B., Samaddar, A. and Stűr, W. 2012. Feed Assessment Tool (FEAST). www.ilri.org/feast.

Ludi, E., Belay, A., Duncan, A., Snyder, K., Tucker, J., Cullen B., Belissa, M., Oljira, T., Teferi, A., Nigussie, Z., Deresse, A., Debela, M., Chanie, Y., Lule, D., Lema, Z., Berhanu, A., Merrey, D.J. 2013. Rhetoric versus ralities: a diagnosis of rainwater management development process in the Blue Nile Basin of Ethiopia. Colombo, Sri Lanka: CGIAR Challenge Program on Water and Food (CPWF). 58p. (CPWF Research for Development (R4D) Series 5)

Mengistu, A. 2002. Forage production in Ethiopia: A case study with implications for livestock production. Ethiopia Society of Animal Production. Addis Ababa, Ethiopia.

Oromia Regional State. 2001. Report on natural grazing lands and livestock feed resources: Woody biomass inventory and strategic planning project. Addis Ababa.p94.