Characterization of the farming and livestock production systems and the potential to enhance livestock productivity through improved feeding in Dayu Abergada, Goro District, Bale Highlands, Ethiopia

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Contents

Introduction ......................................................................................................................... 1
Methodology .......................................................................................................................... 2
  Study site ............................................................................................................................. 2
  Sampling method ............................................................................................................... 2
  Survey structure and format ......................................................................................... 2
  Data analysis .................................................................................................................. 2
Major findings ...................................................................................................................... 3
  Overview of the farming system .................................................................................... 3
  Livestock production system ......................................................................................... 6
  Feeds and feed resources .............................................................................................. 7
  Problems, issues and opportunities ............................................................................. 10
Summary ............................................................................................................................. 12
  Key issues ....................................................................................................................... 12
  Metrics .............................................................................................................................. 12
Introduction

The Bale Highlands of Ethiopia have large livestock populations. However, the potential of these large livestock populations has not yet been exploited due to different constraints such as inadequate feed both in quantity and quality, health problems, housing and breed constraints. The availability and quality of feed resources in Bale Highlands has been identified as a major problem. The availability of grazing land which was contributing a remarkable amount of feed sources for livestock is gradually declining. High human population density and the increasing demand for food is pushing smallholder farmers to cultivate grazing and marginal lands so as to satisfy their food demand. This is a primary cause for shrinkage/diminishing of grazing land in the area.

The Feed Assessment Tool (FEAST) was used to characterize the farming and livestock production systems of smallholder farmers in Goro district of Bale zone with a particular focus on the feed-related aspects. FEAST is a systematic and rapid method to assess local feed resource availability and use at site-level. It helps in the design of intervention strategies aiming to optimize feed supply and utilization through technical and organizational interventions.

The feed assessment study was conducted in December 2013 and was carried out by researchers from Sinana Agricultural Research Center (SARC) with backstopping from the International Center for Agricultural Research in the Dry Areas (ICARDA). The objective of the study were to provide an overview of the farming system and to identify the major livestock production problems, opportunities and potential interventions with particular emphasis on livestock feed aspects for improving the production and productivity of livestock.
Methodology

Study site
The study was conducted in Dayu Abergada kebele of Goro district which lies 490 km Southeast of Addis Ababa. Goro is located in the Bale Midlands of Ethiopia. The altitude of Dayu Abergada is 2150 meters above sea level (m.a.s.l.). Dayu Abergada is about 20 km from Goro town. Its GPS coordinates are 07°01’25.1”N and 040°20’43.2” E.

Sampling method
Prior to the site and farmer selection, the team from SARC and ICARDA held discussions with focal experts from zonal and district agricultural offices on the general objective of the study and the long-term benefits of the farming community from the survey. Based on basic information available at district level, the study kebele was selected with the participation of the District Livestock Officer. The potential of the kebele for livestock production and the accessibility to the main highway were considered in selecting the kebele. Subsequently, the selected kebele in the district was visited and discussions held with the Development Agents. The Development Agents were given guidance to select 18-20 farmers, both male and female, based on the size of land holding.

Survey structure and format
Accordingly, all selected farmers (14 men and 6 women) participated in group discussions using the participatory rural appraisal (PRA) approach to provide an overview of the farming system and to identify constraints and opportunities for improving livestock production in the kebele. Key informant farmers were selected from each category of land holding size from each of the discussion groups. Accordingly, 9 farmers, 3 from each category of landholding were purposively selected and individually interviewed from the study kebele.

Data analysis
The FEAST excel macro program (www.ilri.org/feast) was used for data analysis. Narrative responses collected from the group discussions were examined and reported.
Major findings

Overview of the farming system

The farming system is classified as a mixed Crop-livestock production system with a cereal dominant cropping system. The farm size of most of the households (45%) is medium sized with ranges from 1 hectare to 3 hectare while 35% of the households own the farm size below 1 hectare. Only 1% of the farmers in the kebele are landless and 29% of the farmers own large farm size of above 3 hectare (Figure 1). The average number of people living in each household is 6 people.

Figure 1: Average land size owned by various categories of farmers in Dayu Abergada

In Dayu Abergada, there are two distinct cropping seasons described by the farmers. The two seasons are locally named by the time of crop harvest. The season, which extends from April to August, is named genna while the season from September to early February is called bona.

Among the two cropping seasons, bona is the main cropping season and is very important for crop production. Because of weather condition genna is not productive. The agro-ecology differs within the kebele, one area cultivates a larger land share in genna season while the other part cultivates the larger land share in the bona season.
The dominant crops grown are cereals (wheat, barley and emmer wheat) and pulses (field pea and faba bean) as shown in Figure 2. Most of the farmers use some plots of their farm land for cultivating cereal and pulse crops alternatively in the two cropping seasons (i.e. they use the plots of their land for more than one crop per year). Fallowing is not commonly practiced. The crops grown are mainly used as a means of income generation whereas residues from cereal and pulse crops are the major source of livestock feed. Crop residues are also used for mulching to improve the soil and as raw material for wall construction of local houses. Irrigation is not practiced in the study area, crop production is totally rain-fed.

Labour is required during planting (especially for farmers using oxen to plough their farm land), weeding (herbicide application) and crop residue collection from the farm. Wheat is the major crop and since harvesting of wheat is mechanized, labour for wheat production is only required for land preparation and weeding. However, other crops require labour from land preparation to harvesting. Labour is not readily available throughout the year. The main labour source is family labour rather than hired labour. Children work in the fields after school and on weekends. Shortage of labour is a critical problem mainly during harvesting of crops other than wheat. Since daily labour is not available in the area, farmers work in group (dabo). Overlapping of farm work also exacerbates labour scarcity. While the farmers are harvesting during the genna season, the land of bona season needs to be prepared. Labour is most required for weeding and harvesting of both bona and genna season. Weeding is from October to November for bona season and from May to June for genna season while peak harvesting is in January for bona season and from July to August during the genna season.

The cost of daily labour is approximately Birr 50 (US $2.6) per day in addition to lunch for harvesting and weeding while it is Birr 40 (US $2.1) for ploughing including lunch and dinner. However, farmers usually do not hire labour on daily basis for harvesting rather they give a contract. They give land of 0.25 hectare for one cropping season in addition to Birr 300 (US $15.8) providing sleeping room and food. Many people leave the farm especially for education exacerbating labour shortage even for livestock keeping.

Crop production is the main source of income contributing to about 81% of the household income. Off-farm businesses such as trading and handicrafts are also an important livelihood activity contributing to about 14% of the total household income. Fattening cattle, draft animals and small ruminant production particularly sheep and goat fattening are also a means of income generation contributing only a very small percentage (Figure 3).
Figure 2: Major crops grown in Dayu Abergada

Figure 3: Contribution (%) of livelihood activities to household income in Dayu Abergada
Livestock production system
Draft cattle are the most important livestock species in Dayu Abergada. They are mainly kept for draft power (ploughing, threshing and crop residue collection), manure, cash income and meat. Local dairy cows are kept for milk production, manure, threshing, reproduction, cash income and meat while improved dairy cows are kept for the same purpose to that of local dairy cows, except they are not used for threshing. Small ruminants are also source of meat, manure and cash.

Village poultry are kept for egg production, home consumption and cash income.
Cattle are the most important livestock species in the area (Figure 4). Farmers reported that approximately 99% of the households own local dairy cows, whereas about 95% of the households own draft cattle. Only two individuals (about 0.25%) of the household keep improved dairy cows. Sheep production is not practiced. Few households keep goats. Donkeys are also owned by a large proportion (95%) of households. Since the price of fattened cattle is lower than that of draft cattle, farmers usually do not keep fattening cattle. The average milk yield from the local dairy cow is about 1.5 liters per cow per day. The production of milk mainly depends on feed availability. The local dairy cows produce more milk when green feed is available and lower when green feed is not available. Most farmers keep their draft cattle, cows and pack animals in open barns in the homestead due to shortage of cash for construction of house and lack of awareness of the effects of rainfall and cold stress on animals. However, goats, sheep and calves are kept in shelters constructed for them to protect them from predators such as hyenas.

Dayu Abergada has no animal health clinic at kebele level. Farmers go to a near town called Meliyou for animal health service and drugs. Animal diseases mainly occur depending on season. It is exacerbated during genna season. Bloating usually occurs in May and October when green feed is available. At the government clinic located at Meliyou, the service is very poor, just better than nothing. The workers are not available at work time and thus farmers are compelled to high costs of clinic service given at the private clinic. There is also no control on the expiry dates of drugs. Sometimes traders sell expired medicines to farmers, because the farmers are illiterate. The cost of treating an animal depends on the type of ailment. On average birr 20 ($ 1.1)/head of cattle is charged for treating a sick animal at the government clinic, while it is Birr 25 ($ 1.3)/head of cattle at the private clinic.

Artificial insemination (AI) service is not well established even if there is improvement nowadays. There is an AI technician at Meliyou but he is usually not available when the cows are on peak heat, ready for insemination. Generally AI service is very poor at Dayu Abergada. Most of the Farmers use their own local bull service. Improved bull service is not commonly used.
Feeds and feed resources

Crop residues, natural pasture, cultivated fodder crops and stubble grazing are the major feed resources for livestock. Since the majority of the cultivated land area is allocated to cereal and pulse crops production, the major share of livestock feed is obtained from crop residues which contribute approximately 65% of dry matter (DM) of the total diet (Figure 5).

Crop residues are also the major contributor to dietary metabolizable energy (ME) and crude protein (CP), contributing 57% and 51% respectively. Cereal straws of wheat, barley and emmer wheat are the dominant crop residues. The residues are collected from farms immediately after crop harvesting. Crop residues are available twice per year. Most farmers store the crop residues to be used during periods of critical feed shortage. The residues are chopped and mixed with purchased concentrated feeds such as wheat bran and linseed cake before feeding. Legume residues such as faba bean, field pea, lentils and chickpeas are also commonly used as animal feeds. According to farmers, residues from pulses (field pea and faba bean) have to chopped into very small pieces before feeding. There is wastage of crop residues since all of the residues are not well collected from the threshing ground. The collected residues are piled in stacks near homesteads and animals are given in the morning and evening. Draft oxen are fed on the residues before and after work.

Some farmers combine cereal and pulse residues and store them around the homestead. These residues are mainly fed when grazing land is very scarce. This is from beginning of March to the end of August. Immediately after crop harvesting stubble grazing is the major feed resource in the study area. Fodder oats and maize are the two major fodder crops cultivated solely for animal feed. They contribute about 8% of the total DM of the animal diet. Their contribution to ME and CP is 11% and 14% respectively. They are fed to all types of animals; however, priority is given to lactating cows and draft oxen. Scarcity of land, lack of forage seed and inadequate knowledge about improved fodder varieties are some of the reasons that limit the expansion and utilization of these improved forage species.
Grazing is practiced throughout the year but the dietary contribution from grazing is low when compared to that of crop residues (Figure 5). This is because grazing land is scarce and its nutritive value is also very low especially during the dry periods. Grazing is usually done around the homestead, on community land, by the roadside and on marginal land. Aftermath grazing, following the crop harvest also provides feed for all classes of livestock.

Naturally occurring and collected feeds such as weeds from cropland are also a good source of feed during and after the rainy seasons. They contribute about 10% of DM, 13% ME and 15% of CP to the total diet of the existing feed resource. Stall feeding of collected green feed from the crop land particularly wild oat (*Avena fatua*) is common in the area. These feed resources are mainly given to lactating and draft oxen by the roadside during the day and at home in the evenings.

Linseed cake, wheat bran and milling by products are the common concentrate feeds used by the farmers to increase crop residues intake, palatability as well as the feeding value. Most farmers in the area treat straws of crop residues by rethreshing and mixing with salt, concentrated agro-industrial by-products and by milling emmer wheat which is produced by them. Farmers who do not have natural pasture land but have the capacity to buy for their livestock purchases from another farmer who has excess pasture land. The availability and the cost of the concentrates vary from season to season. It is only available when most of the farmers use it in local markets. Farmers do not regularly use them due to their high price. The dietary contribution of purchased feeds is the lowest as indicated in Figure 5.

Generally, farmers indicate that feed shortage is critical from the beginning of March to beginning of September (Figure 6). During this period, the availability of grazing pasture and green forage resource is very scarce and livestock rely mainly on crop residues which are low in feeding value.
Crop residues 65%
Cultivated fodder 8%
Grazing 16%
Naturally occurring and collected 10%
Purchased 1%

Crop residues 51%
Cultivated fodder 14%
Grazing 17%
Naturally occurring and collected 15%
Purchased 3%

Crop residues 57%
Cultivated fodder 11%
Grazing 18%
Naturally occurring and collected 13%
Purchased 1%
Figure 5: The contribution (%) of various feedstuffs to DM (a), CP (b) and ME (C) to livestock diets in Dayu Abergada

Figure 6: The composition of the livestock diet throughout the year in relation to the rainfall pattern

Problems, issues and opportunities

Dayu Abergada has largely unproductive land for crop cultivation due to its stony terrain. Using farm inputs on such land is not profitable. Cash/credit is also not adequate constraining crop/livestock production. Farmers are limited to use basic technologies of both crop and livestock due to lack of cash and complexity and inadequate access to credit. Though crop inputs such as fertilizer, herbicides insecticides and fungicides are available, farmers face difficulty in affording these inputs due to their high price. Farmers reported that the ineffectiveness of these chemicals may be due to dilution (adulteration). Farmers believe that traders add foreign substances to the chemicals and also since some farmers cannot read traders sell expired chemicals to them. Supply of improved seeds of both food crops and forages is also another constraint to crop/livestock production in Dayu Abergada. The major livestock-related problems, their priority ranking according to farmers and the appropriate improvement options suggested by the farmers are summarized in Table 1 below.
Table 1: Livestock-related problems identified by farmers in Dayu Abergada and the corresponding suggested solutions

<table>
<thead>
<tr>
<th>Problems (in order of importance)</th>
<th>Problems identified</th>
<th>Proposed solution by the farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shortage of feed in quantity and quality</td>
<td>Proper utilization (improvement) of the existing feed resource such as crop residues and grazing lands Allocate some portion of their land for feed production (for cultivated forage and grazing) Minimize the number of animals to few improved and productive ones Better allocation and utilization of lands for different purposes including for use as grazing land</td>
</tr>
<tr>
<td>2</td>
<td>Lack of knowledge and skills</td>
<td>Improving extension service and applying expert advices Training and awareness creation</td>
</tr>
<tr>
<td>3</td>
<td>Disease</td>
<td>Establishment of well equipped animal health clinic with drugs, and other important facilities and trained(experienced) man power at kebele level Vaccination of animals</td>
</tr>
<tr>
<td>4</td>
<td>Shortage of improved breeds</td>
<td>Improving local breeds step by step through cross breeding with improved breeds. Establishment of research center working on breeding and distributing these improved breeds to farmers. Improving AI service</td>
</tr>
<tr>
<td>5</td>
<td>Cash /Credit shortage</td>
<td>strengthen credit and agricultural input providers such as cooperatives</td>
</tr>
</tbody>
</table>
Summary

Key issues

- Shortage of feed in quantity and quality
- Incidence of disease and parasites
- Lack of adequate awareness on intensification of livestock production.
- Lack of access to AI services and improved dairy cattle breeds

Metrics

- Milk yield: 360 liters per cow per year
- Meat off take: not applicable