Characterization of the farming and livestock production systems and the potential to enhance livestock productivity through improved feeding in Waltai Elabdu, Agarfa District, Bale Highlands, Ethiopia

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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government’s Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program’s monitoring, evaluation and impact assessment. [http://africa-rising.net/](http://africa-rising.net/)

This document was made possible with support from the American people delivered through the United States Agency for International Development (USAID) as part of the US Government’s Feed the Future Initiative. The contents are the responsibility of the producing organization and do not necessarily reflect the opinion of USAID or the U.S. Government.
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 ................................................................................................................ 5
  Feeds and feed resources ..................................................................................................................... 6
  Problems, solutions, opportunities and issues ...................................................................................... 10
Summary .................................................................................................................................................... 11
  Key issues ............................................................................................................................................. 11
  Metrics .................................................................................................................................................. 11
Discussion .................................................................................................................................................. 12
  Opportunities ....................................................................................................................................... 12
Potential interventions ............................................................................................................................. 12
Ways forward ............................................................................................................................................. 13
References ................................................................................................................................................ 14
Introduction

Livestock production is an integral part of the mixed crop-livestock farming system of Bale highlands. Livestock ensures the availability of nutrition and income for the farming community in Waltai Elabdu, a kebele in Agarfa district throughout the year. Besides, livestock provide draft power and manure for crop production. Hence, livestock and crop production are interdependent in Bale highlands where livestock holding was observed to have significant effect on crop cultivation (Solomon et al., 2009). However, despite their numeric and economic importance as well as the tremendous potential, the production and productivity of livestock is very low mainly due to poor nutrition, disease incidences and poor management.

The Feed Assessment Tool (FEAST) was used to characterize the livestock production system with a particular focus on the feed-related aspects smallholder farmers of Agarfa district of Bale highlands, Ethiopia. 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 on November 29th - December 2nd, 2013 by researchers from Sinana Agricultural Research Center (SARC) with backstopping from International Center for Agricultural Research in the Dry Areas (ICARDA). The objectives of the study were to provide an overview of the farming and livestock systems 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 Walta’i Elabdu kebele in Agarfa district which lies 446 km Southeast of Addis Ababa. Agarfa is located in the Bale highlands of Ethiopia. The altitude of Walta’i Elabdu is 2467m above sea level (m.a.s.l.). It lies 16 km from Agarfa town, the administrative center of Agarfa district. The GPS coordinates of Walta’i Elabdu are 07˚12’47”N and 039˚55’26.3”E.

Sampling method
The team from SARC and ICARDA held discussions with focal experts from zonal and district agricultural offices prior to the site and farmer selection. The general objective of the study and the long-term benefits of the farming community from the survey were discussed. 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
All selected farmers (15 men and 5 women) participated in a group discussion using the participatory rural appraisal (PRA) approach to provide an overview of the farming and livestock systems and to identify constraints and opportunities for improving livestock production in Walta’i Elabdu. Key informant farmers were selected from each category of landholding. Accordingly, 9 farmers, 3 from each category of land holding were selected and interviewed individually.

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 cereal-livestock production system with a cereal dominant cropping system. The average cultivated land per household is 4ha even though the farm size varies among the households. Majority of the households (60%) fall in the category of medium farmers with 2 to 5 ha of land and 10% of the farmers in the kebele are landless. Small and large farmers are 20% and 10% respectively (Figure 1). The average family size is 5 people per household.

![Figure 1: Household (%) in various categories of farm size in Walta‘i Elabdu](image)

Farmers described two distinct cropping seasons. The season, which extends from March to July, is named *genna (belg)* while the season from July to December is called *bona (meher)*. Among the two cropping seasons, *bona* is the main season and is very important for crop production because of the long and intense rainfall during this period.

The dominant crops grown are cereals (wheat, barley and emmer wheat), highland pulses (common peas and broad beans) and tef as shown in Figure 2. Most of the farmers use their farms to cultivate cereal and pulse crops alternatively in the two cropping seasons. Due to mechanization of wheat harvesting, most of arable land of the kebele is covered by wheat. In this kebele, 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 sources of
livestock feed. Crop residues are also used for mulching to improve the soil and as raw materials for wall construction of local houses.

Only few farmers (2.7%) use water pumps for irrigation in the study area, hence crop production is mostly 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. Harvesting of all other crops other than wheat is not mechanized, thus, labour is required starting from land preparation to harvesting. Labour is not readily available throughout the year. It is mainly family labour as opposed to hired labour. Shortage of labour is a critical during harvesting. In such cases, farmers organize themselves in groups called *dabo*. The cost of daily labour for land preparation and weeding is Birr 40 ($2.1) per day in addition to lunch. During harvesting, farmers do not hire labour on daily basis rather they give contracts for 0.167 hectare of land at a cost of Birr 150 ($7.9). Farmers also hire labour on yearly contract basis. They give land of 0.67 hectare in addition to Birr 600 Ethiopian ($31.6) and provide accommodation and food. Many people leave the farm especially for education, exacerbating labour shortage.

Crop production is the main source of income contributing about 81% to the household income. Other income sources such as draft animal, dairying, poultry production, fattening cattle, off-farm business and small ruminant production, particularly sheep fattening contribute only small amount of income generation for the farmers (Figure 3).
Livestock production system

The livestock production system in the study area is mainly extensive. Local breeds are predominant. Cattle are the most important livestock species (Figure 4). Draft cattle are kept for land preparation, threshing, crop residue collection, manure, and meat and cash income. Local dairy cows are kept for milk production, manure, threshing, reproduction, and meat and cash income. Improved dairy cows are not used for threshing. Small ruminants especially sheep are also a major source of meat, manure and cash. Village poultry are kept for egg production, home consumption and cash income from sales of eggs and live poultry.

Farmers reported that approximately 80% of the households own local dairy cows, whereas about 97% of the households own draft cattle. Only 5% of the household keep improved dairy cows. 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. Cattle are not housed. However, goats, sheep and calves are kept in the shelters constructed for them in order to protect them from predators (wild animals) such as hyenas.

There is no animal health clinic in Walta’i Elabdu. Farmers travel to the nearby town called Ali for animal health services and drugs. On average, the cost of treating a sick animal is Birr 40 ($ 2.1) to 60 ETB ($ 3.2). The cost is considered unaffordable by the farmers. Vaccinations are not available. Animal health experts do not work carefully. They use the same needle to give injections to several animals exacerbating the possibly of disease transmission from one animal to another.
Artificial insemination (AI) service is available though not effective. Cows rarely conceive. Farmers attribute this to insemination not performed timely, poor quality of semen and unskilled AI technicians. Farmers pay Birr 5 ($ 0.3) per head for up to 3 AI services. Improved bull services are available at a cost of Birr 20 ($ 1.1) for a single service. There is no charge for local bull service.

![Image](image.jpg)

**Figure 4: Average livestock species holdings per household in Tropical Livestock Units in Walta’i Elabdu**

**Feeds and feed resources**

Crop residues, natural pasture, cultivated fodder crops and stubble grazing are the major feed resources. 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 60% of dry matter (DM) of the total diet (Figure 5). Crop residues are the major contributor to dietary metabolizable energy (ME) and crude protein (CP), contributing 52% and 45% respectively.

Cereal straws such as wheat, barley and emmer wheat are the dominant crop residues. Legume residues such as faba bean and field pea are also commonly used as animal feeds. There is wastage of crop residues since the residues are not well collected from the threshing ground. The collected residues are re-threshed and piled in heaps near homesteads. Animals are fed the residues 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 the December to March (Figure 7). Farmers usually do not feed the residue of linseed to their animals because of abdominal disturbance.
Cultivated fodder crops particularly maize and fodder oats are produced by some farmers and contribute about 7% DM to the total diet. They are mainly fed to lactating cows, calves and draft oxen. Most farmers do not grow improved forage crops although they have great interest to. Lack of forage seed and poor extension services are some of the reasons that limit utilization of forage crops.

Grazing is practiced during and after rainy season. 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, 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 the rainy seasons. They contribute about 10% of DM, 13% ME and 14% 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 chopping and mixing with salt, concentrated agro-industrial by-products and by milled emmer wheat. Farmers involved in dairying, fattening of oxen and sheep use these locally made feed rations for their animals. The availability and the cost of the concentrates vary from season to season. Farmers do not regularly use them due to their high price. Wheat flour by-product, wheat bran and linseed cake are among purchased feeds for livestock (Figure 6) though their contribution as a dietary source of DM is very minimal (Figure 5).

Generally, farmers indicate that feed shortage is critical from the beginning of April to end of August (Figure 7). 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.
Figure 5: The contribution of various feedstuffs to DM (a), ME (b) and CP (c) to livestock diets in Walta’i Elabdu.
Figure 6: The composition of the livestock diet throughout the year in relation to the rainfall pattern in Walta’i Elabdu

Figure 7: The composition of the livestock diet (%) throughout the year in relation to the rainfall pattern in Walta’i Elabdu
Problems, solutions, opportunities and issues

The major livestock-related problems, their priority ranking according to farmers and the appropriate improvement options suggested by the farmers are summarized in Table 2 below.

Table 2: Livestock-related problems identified by farmers in Walta’i Elabdu 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>Disease</td>
<td>▪ Establishment of well-equipped animal health clinic with drugs, and other important facilities and trained(experienced) man power at kebele level</td>
</tr>
<tr>
<td>2</td>
<td>Cash/Credit shortage</td>
<td>▪ strengthen credit and agricultural input providers such as cooperatives</td>
</tr>
</tbody>
</table>
| 3                                 | Shortage of improved breeds | ▪ 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. |
| 4                                 | Shortage of feed in quantity and quality | ▪ 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 |
| 5                                 | Lack of knowledge and skills | ▪ Improving extension service and applying expert advices  
▪ Training and awareness creation |
Summary

Key issues

- Disease, traditional breeding and management practices limit livestock productivity and hence income, resulting in poor incentives for farmers to adopt improved technologies.
- Resource allocation: The root cause for the current feed shortage is the declining resources dedicated to livestock production. There is increasing “encroachment” of grazing resources, available lands being used for crop production. There is also limited opportunity for the development of cultivated forage due to farmer’s priority of allocating their land for crop production.
- Lack of improved breeds: there is no any research work on gradual improvement of local breeds.
- Attitude of farmers towards livestock production: Livestock, particularly sheep, pack animals and poultry are kept as Scavengers with practically no input, though they are the major source of livelihoods.

Metrics

Milk yield: 418 L per cow per year
Meat off take: not applicable
Discussion

Opportunities

- Expansion of arable lands produces large quantity of crop residues
- Bimodality of the rain fall allows double production per year of food as well forage crops

Potential interventions

Cereal production is dominant and crop residues are the main livestock feed resources. Farmers, however, incur a lot of wastage due to poor collection of the residues from the threshing grounds. Farmers in these kebele need to be educated on proper collection methods of crop residues as well as conservation of the residues. Alternate cropping of pulses and cereals offers an opportunity for improved crop residue quality. Therefore, more studies should be undertaken in these areas to determine the appropriate intercropping sequences and intercrop combinations and this information should be disseminated to the farmers so that they achieve maximum benefits of improved crop residue quality.

In the kebele, several farmers have already started cultivation of fodder crops such as oats. These feed resources are mainly fed to lactating cows, calves and draft oxen. To strength the fodder production activities, there is a need to further introduce, evaluate and popularize improved forage legumes and grass varieties with high herbage yield and quality. Improved perennial and annual fodder varieties such as elephant grass, vetch and alfalfa would increase the quantity and quality of available feed. Cooperatives in the area should be encouraged to source for and regularly supply certified forage seeds to farmers. Extension workers should be encouraged to carry out on-farm demonstrations of improved forage varieties.

The rapid increase in human population and increasing demand for food has resulted in the conversion of pasture land into cropping land. Thus, grazing is gradually being restricted to areas that have little farming potential such as swampy areas, roadsides and other marginal lands. At the kebele, there are privately owned grazing enclosures (locally named as ‘kalo’) located around the homesteads and farmlands. The establishment of enclosures should be encouraged.

The limited grazing lands are overgrazed and their productivity is very poor especially during the dry periods. This results in poor growth of grasses and domination by invasive unpalatable species. Improving the feeding potential of the limited grazing land resource through different management options such as over sowing with suitable forages species, awareness creation on proper grazing management and hay making from enclosures could be useful.

Weeds from the crop lands are important feed resources for livestock mainly during the wet season. Farmers in the kebele have been collecting weeds such as wild oats from the farm lands and feeding them to their animals. Excess feed material that is produced during these rainy periods could be collected and stored as hay for the periods of critical feed shortage. Moreover, there is a need for more awareness creation on the utilization of weeds from the farmlands as they could be risky for animal health due to extensive herbicide application.
Ways forward

Labour constraints are very limiting, therefore, any technologies and approaches introduced or disseminated to the farmers in the kebele should take labour issues into serious consideration. Technologies and approaches should integrate both crops and livestock. Animal husbandry and management issues should also be taken into consideration.
References
