Challenges, Opportunities and Available Good Practices related to Zero Grazing in Tigray and Hararghe, Ethiopia

By Gebregziabher Gebreyohannes and Gebrehiwot Hailemariam

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# TABLE OF CONTENTS

LIST OF TABLES ....................................................................................................................... IV
LIST OF PICTURES ..................................................................................................................... IV
ACKNOWLEDGEMENTS ............................................................................................................... V
ACRONYMS ................................................................................................................................ VI
ABSTRACT ............................................................................................................................... VII

1. INTRODUCTION .................................................................................................................... 1
   1.1 BACKGROUND .................................................................................................................. 1
   1.2 DEFINITION OF CONCEPTS ......................................................................................... 2
   1.3 OBJECTIVES .................................................................................................................. 2

2. METHODOLOGY ..................................................................................................................... 3
   2.1 SITE SELECTION ............................................................................................................ 3
   2.2 STUDY METHODOLOGY ................................................................................................. 3

3. RESULTS AND DISCUSSION ................................................................................................. 5
   3.1 HOUSEHOLD CHARACTERISTICS ............................................................................... 5
   3.2 LIVELIHOOD MEANS ..................................................................................................... 7
   3.3 CROP AND LIVESTOCK PRODUCTION SYSTEMS ......................................................... 7
   3.4 ANIMAL FEED AND FEEDING SYSTEM ....................................................................... 10
   3.5 GRAZING SYSTEM, LIVESTOCK PRODUCTION AND ANIMAL DISEASES .................. 13
   3.6 MARKETING LIVESTOCK AND LIVESTOCK PRODUCTS ............................................. 13
   3.7 INPUTS, SERVICES AND SERVICE PROVIDERS ......................................................... 16
   3.8 MARKET INFORMATION ................................................................................................. 18
   3.9 HOUSEHOLD MEMBERS DIVISION OF LABOUR .......................................................... 19
   3.10 OPPORTUNITIES OF ZERO GRAZING ......................................................................... 20
      3.10.1 Opportunities of zero grazing in Tigray ................................................................. 20
      3.10.2 Opportunities for zero grazing in western and eastern Hararghe zones of Oromia .. 22
   3.11 CHALLENGES OF ZERO GRAZING ............................................................................. 23
      3.11.1 Challenges of zero grazing in Tigray ................................................................. 23
      3.11.2 Challenges of zero grazing in western and eastern Hararghe zones of Oromia ....... 24
   3.12 AVAILABLE GOOD PRACTICES RELATED TO ZERO GRAZING ............................. 25

4. CONCLUSION ......................................................................................................................... 27

5. RECOMMENDATIONS ............................................................................................................ 32

REFERENCES ........................................................................................................................... 34
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE 1</td>
<td>Summary of household characteristics of the FGD participants in Tigray and Oromia region.</td>
<td>6</td>
</tr>
<tr>
<td>TABLE 2</td>
<td>List of NGOs operating in the study areas</td>
<td>18</td>
</tr>
</tbody>
</table>

**LIST OF PICTURES**

<table>
<thead>
<tr>
<th>Picture</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture 1</td>
<td>Focus Group Discussion participants in Chori district</td>
<td>4</td>
</tr>
<tr>
<td>Picture 2</td>
<td>Intercropping maize with beans</td>
<td>9</td>
</tr>
<tr>
<td>Picture 3</td>
<td>Rehabilitation of gullies as a source of feed in Arbeha-Atsbeba Tabia</td>
<td>11</td>
</tr>
<tr>
<td>Picture 4</td>
<td>Market places of Hararghe and Wukro from left to right.</td>
<td>14</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENTS

The research team would like to thank all organizations and individuals who have contributed to this study. We wish to thank Relief Society of Tigray (REST) for their support in the provision of information and facilitating the fieldwork through organizing the required logistics to undertake the study.

The financial support from the Drylands Coordination Group (DCG) made this work possible. We greatly appreciate the support of Ato Abiy Alemu, National Coordinator of DCG Ethiopia for backing and facilitating the field work in western and eastern Hararghe zones. The support of CARE-Ethiopia at Chiro district and Mensen für Menschen in Babile area are also highly appreciated. The contribution of Haramaya University and Vice president, Dr. Belayneh Legesse, was also duly acknowledged.

Many people were very generous with their time, and their insights have greatly improved our findings. The regional and District Office of Agriculture and Rural Development (OoARD) experts at various levels in all study areas were greatly appreciated for their constructive and invaluable reflections on the study, and for organizing the meetings with farmers. Moreover, many farmers have been involved in this study, shared with us their invaluable insights about zero grazing in particular and livestock production in general. It was a pleasure to spend time with them and we also learned a lot from them. Without their invaluable insights this work could not have been possible. Finally, the team would like to express our appreciation to the workshop participants for their valuable suggestion and comments.
### ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tr>
<td>AI</td>
<td>Artificial Insemination</td>
</tr>
<tr>
<td>BoARD</td>
<td>Bureau of Agriculture and Rural Development</td>
</tr>
<tr>
<td>OoARD</td>
<td>Office of Agriculture and Rural Development</td>
</tr>
<tr>
<td>DCG</td>
<td>Drylands Coordination Group</td>
</tr>
<tr>
<td>DECSI</td>
<td>Dedebit Credit and Saving Institute</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>FGD</td>
<td>Focus Group Discussion</td>
</tr>
<tr>
<td>FSP</td>
<td>Food Security Program</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GO</td>
<td>Government Organization</td>
</tr>
<tr>
<td>GTZ</td>
<td>Deutsche Gesellschaft für Technische Zusammenarbeit</td>
</tr>
<tr>
<td>HCS</td>
<td>Hararghe Catholic Service</td>
</tr>
<tr>
<td>ILCA</td>
<td>International Livestock Center for Africa</td>
</tr>
<tr>
<td>ILRI</td>
<td>International Livestock Research Institute</td>
</tr>
<tr>
<td>IPMS</td>
<td>Improving Productivity and Marketing Services</td>
</tr>
<tr>
<td>IRC</td>
<td>International Rescue Committee</td>
</tr>
<tr>
<td>MFM</td>
<td>Menschen für Menschen</td>
</tr>
<tr>
<td>NCA</td>
<td>Norwegian Church Aid</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>PSNP</td>
<td>Productive Safety Net Program</td>
</tr>
<tr>
<td>REST</td>
<td>Relief Society of Tigray</td>
</tr>
<tr>
<td>SSA</td>
<td>Sub-Saharan Africa</td>
</tr>
<tr>
<td>TLU</td>
<td>Tropical Livestock Unit</td>
</tr>
<tr>
<td>WFP</td>
<td>World Food Program</td>
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<td>WVE</td>
<td>World Vision Ethiopia</td>
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ABSTRACT

A comparative study was conducted on districts in eastern and western Hararghe zones and southern and eastern Tigray. The objective of the study was to assess the challenges, opportunities and available good practices in relation to zero grazing and develop recommendations that could help policy makers to design an appropriate strategy to implement zero grazing in Tigray.

The study covered four districts (Haramaya, Chiro, Babile and Fedis) of Hararghe and eight districts (Raya Azebo, Ofla, Atsbi-Womberta, Kilte-Awlalo, Degua-Temben, Hintalo-Wajirat, Tanqua-Abergele and Ganta-Afeshum) from Tigray. The districts were selected purposively to represent different agro-ecologies (high, low and mid-altitude) with similar mixed crop-livestock farming systems.

Primary and secondary data were collected through group discussions with farmers, community opinion leaders and key informants, from relevant institutions and through case studies.

In Tigray, the study identified the availability of internal by-laws for grazing land utilization in the community; the habits of closing part of the grazing lands during rainy season; the expansion of farmland to communal grazing lands which forces farmers to limit their animals’ movement; the availability of institutional supports/services on rehabilitation of degraded soils and hill bottoms. It also identified soil and water conservation structures, re-forestation, introduction of forage seed, planting materials and cross bred cows; expansion and provision of different services such as artificial insemination, medication, vaccination and credit; enrichment of degraded area closures; introduction and expansion of cactus for human and animal feed; crop intensification through the introduction and use of new technologies and inputs. Expansion of irrigation through the construction of dams, river diversion and other water harvesting techniques was also seen. Furthermore, the establishment of emerging towns/villages created an opportunity to increase demand of livestock (e.g. dairy cows) and livestock products (milk, meat and butter). The existence of commitment and support from the government and government institutions are also among the opportunities in Tigray.

In western and eastern Hararghe, the study identified the main reasons for the success of zero grazing in the area, such as the culture and better awareness of zero grazing; a favorable cropping system; a sorghum/maize based farming system during main rainy season, targeting animal feed; the existence of intercropping practices (perennial-annual, annual-annual); availability of perennial cash crops in crop lands, and the existence of intensive crop production; reliable and remunerative market and market outlet for fattened animals; small livestock number and fattening orientation; habit of using oxen for short time and then fattening for sale; minimum crop cultivation practices; availability of replacement oxen from market and the availability of good local breed for fattening (Ogaden and/or Borena breeds).

The constraints for the implementation of zero grazing in Tigray were shortage of feed in both quantity and quality; low level of awareness towards zero grazing; culture of keeping high number of livestock; consider livestock population as saving asset; undeveloped/non-remunerative and seasonality in market for livestock and livestock products; unavailability of
supplementary feeds; availability of communal grazing areas, and undeveloped and in some places biased by-laws on communal grazing land and closure areas utilization; giving feeding priority to oxen; shortage of watering points; lack of market orientation in livestock production; habit of maintaining oxen for a long time and producing oxen from own herd; limited introduction of improved dairy cows; introduction of zero grazing (top-down approach) with out prior arrangement and awareness creation; introduction of zero grazing at household level (not kushet/Tabia based); lack of closure areas enrichment program with forage crops; conflicting package of livestock technologies (destocking/restocking); improper utilization of grazing areas and poor grazing system; undeveloped markets and market information system.

In Hararghe, on the other hand, undeveloped rural market and road networks, long distance of market places, unavailability of animal products processing factories for value addition to maximize income of farmers, and limited forage production are reported to be the major challenges to practice zero grazing.

From the study it can be concluded that zero grazing has been exercised in Hararghe study areas for decades. Farmers adopted zero grazing due to shortage/lack of grazing land and labor; the culture of well developed fattening exercise and good market for fattened animals; the gain in animal productivity and reduction in disease incidence due to zero grazing; expansion of intensive agriculture including planting perennial crops such as chat and coffee; environmental degradations. Matching the number of livestock holding with the limited feed resources enabled increased livestock productivity. On the contrary, free grazing is exercised in Tigray, except in urban and pre-urban areas. Communal grazing lands, which are highly degraded, overgrazed and overstocked, are the main feed sources for animals. From this study it is recommended that awareness creation, grazing land utilization policy and right, availability and enrichment of closures, supply of inputs (better performing breed, forage seeds and planting materials), availability of milk and feed processing plants, developed market and market information and water availability, research support, change in the cultivation system, de-stocking unproductive animals, credit availability and integration of stakeholders are the preconditions for effective introduction and implementation of zero grazing in Tigray.
1. INTRODUCTION

1.1 BACKGROUND

Over the last few decades, the rapid population growth in Sub-Saharan Africa (SSA) combined with the rise in per capita income has caused a rapid increase in food consumption. The population in SSA is expected to increase by 2.75% per annum between 1990 and 2025, resulting in an additional 800 million people to feed. More than 500 million of these people will be living in cities and large towns (World Bank, 1989; Winrock International, 1992). According to the World Bank (1992) it is estimated that the demand for dairy products in SSA will increase by about 5.5 million tons at an annual growth rate of 4% by the year 2025. Over 1.3 billion people, nearly a third of the population of developing countries, live below the poverty line (defined as an income of less than US$1 a day). The situation is worse in Sub-Saharan Africa where more than half of the population fall into this category.

Agriculture is the dominant sector of Ethiopian economy contributing 45% of the GDP, 80% of the employment and 85% of the total export earning (FAO, 1993). Ethiopia accounts for 17% of cattle, 20% of sheep, 13% of goats and 55% of equines in Sub-Saharan Africa (FAO, 1993). Livestock contribute 16% of the GDP and 30% of the agricultural GDP (FAO, 1996). 70% of cattle, 75% of sheep, 27% of goats, and 80% of equines are found in the highland. The majority of Ethiopian cattle are zebu types resulting from extensive inbreeding, with some sanga types existing in the eastern and north eastern part of the country (Albero and Haile-Mariam 1982).

Livestock production systems should undergo more radical changes than crop production if expectations from this sector are to be fulfilled. Under the impact of the raising demand, output would need to increase considerably faster for animal production (4.7%) than crop production (3.6%) (Seyoum and Zinash, 1995). The increasing trend observed in livestock output are mainly achieved through the increasing number of livestock but not productivity per head. The increase in number of livestock coupled with increase in human population has resulted in shrinkage of grazing lands and animals are limited to graze on overgrazed communal lands (if any), road side and aftermath grazing and limited supplementation of straw. Besides, soil erosion and deforestation has worsened the situation. One of the contributing factors to poor soil fertility, land degradation and erosion is the free grazing of animals.

The livestock management in Ethiopia is mainly based on extensive grazing of communal grazing lands and arable lands. Animals grazing communal lands are believed to perform poorly (low milk yield, short lactation length, late age at first calving and long calving interval, poor growth rate, low fertility) which is a reflection of nutrition, health and breeding related problems.

Furthermore, soil and moisture conservation practices done so far through construction of terraces on arable lands and hill sides; and planting agro-forestry and forest trees has brought limited change due to the free grazing system of livestock. In order to increase outputs from livestock, conserve soil and moisture and reforest degraded and over grazed communal grazing lands, controlling animals from freely grazing is recommended as one alternative. This has been proved by the improvement observed by enclosing hill bottoms and grazing lands and protection from animal and human interference which favor bushes, trees and grass growth.
In Ethiopia, most farmers practice free grazing except in areas where grazing lands are limited in size and where the farming system favor growth of perennial cash crops. In Hararghe area for instance, tethering animals near crop land and house is a common practice experienced by most farmers since long time ago. But in Tigray, this practice is not common. Efforts made to introduce zero (controlled) grazing in Tigray started in 2006. The strategy was to adopt what Hararghe farmers have been practicing for years. However, this has been faced by resistance by farmers which has resulted in a low adoption rate. This necessitated doing a comparative study of the opportunities, challenges and available good practices to implement zero grazing in Tigray.

1.2 DEFINITION OF CONCEPTS

**Controlled grazing:** a system of livestock grazing where animals graze in a specified place for a certain period of time, where animals are tethered and graze or fed where they are or where animals are kept indoors and fed in a cut and carry system.

**Zero grazing:** one type of controlled grazing system where animals don’t graze totally. Nevertheless, in this study zero grazing is used to refer to controlled grazing.

1.3 OBJECTIVES

- To assess the existing challenges, opportunities and available good practices in relation to the zero grazing system.
- To give recommendations that may help policy makers to design an appropriate strategy for ensuring an effective implementation of zero grazing in Tigray.
2. METHODOLOGY

2.1 SITE SELECTION

The study was conducted in western and eastern Hararghe and Tigray region. Four districts, namely Haromaya, Chiro, Babile and Fedis from western and eastern Hararghe zones of Oromia region and eight districts from Tigray (Raya-Azebo, Ofla, Atsbi-Womberta, Kilte-Awlaelo, Degua-Temben, Hintalo-Wajirat, Tanqua-Abergele and Ganta-Afeshum) were selected for the study. The sites were selected in consultation with the district Office of Agriculture and Rural Development and other relevant non-governmental organizations operating in the selected zones (Relief Society of Tigray, CARE Ethiopia, Menschen für Menschen). In this study major agro-ecologies such as highland, lowland and midland areas were covered in both regions. The criteria employed to select the study sites were agro ecology, cattle population, level of crop-livestock interaction, stover vs. straw based feeding system, breed diversification, irrigation/water potential, market access, population density, communal grazing land utilization and land size.

2.2 STUDY METHODOLOGY

**Document review:** All sources of information that are relevant to the topic were reviewed and documented.

**Qualitative assessment:** Participatory tools were employed. Focus group discussion with district and region experts and farmers and opinion leaders of the community, key informant interview (at region, district and community level), case studies and observations by the team were used to generate the required information.

**Focus Group Discussion (FGD):** In each village the research team conducted focus group discussions with farmers. The participants in the focus group discussions comprised of 8-12 male and female mixed farmers. Focus group discussion participants from Tigray included both those who are currently exercising zero grazing and those who are not. The focus group discussions were handled using a checklist prepared by the research team. The checklist focused on community characteristics of each village (such as socio-cultural, economic, market and policy aspects, livestock population), village resources such as major crops grown in the area, purpose of keeping livestock, feed type, source and seasonality, constraints of the production system, status of zero grazing, available good practices related to zero grazing implementation strategies, and preconditions to exercise zero grazing etc.
Household case studies: In each village the research team conducted case study interviews, which provided deeper understanding of the challenges and opportunities of zero grazing. It enabled the research team to understand certain hidden issues that people may not be willing to discuss in focus groups.

Key informant interview: The research team conducted key informant interviews in each region at different levels with individuals who are knowledgeable about zero grazing and existing practices.
3. RESULTS AND DISCUSSION

3.1 HOUSEHOLD CHARACTERISTICS

Household economic characteristics of the study areas of both regions are summarized in Table 1. There was no difference in family size in both regions and across agro-ecologies. The average family size of the sample respondents who participated in the farmers group discussion (FGD) was 6.2 persons. The dominant religion of the western and eastern zone of Hararghe is Muslim and all farmers who participated in the FGD were Muslims, whereas farmers who participated in the study in Tigray were Christians.

The land size of the study area varies across regions and agro-ecologies. In western and eastern Hararghe, the average land size of the study Tabia varies from 1.42 ha in the lowlands to 0.43 ha in the highlands. The household land holding in the lowlands is relatively higher, but the productivity of the land in these agro-ecologies is relatively lower compared to the high and midlands. It was also observed that there was high prevalence/infestation of pervasive weeds such as partinimum and striga. Similarly in Tigray, landholding varies from 0.44 ha in Habes Tabia (highland) of Atsbi-Womberta district to 0.87 ha in the lowlands of Tsige’a Tabia of Raya-Azebo district and Sheka-Tekli Tabia of Tanqua-Abergele district.

During the focus group discussion in Hararghe zone, it was indicated that land size has been continuously declining due to population growth and hence there was no or reduced grazing lands. This condition forced Hararghe farmers to keep smaller livestock herds and intensify their cropping and grazing systems. Hence the continuous decline of land holding, land fragmentation and grazing land degradation in Tigray become an opportunity to reduce livestock population and follow intensive grazing system such as semi zero grazing or zero grazing systems in some places.

The livestock population of the study areas is higher in the lowland compared to the midland and highland. The major livestock types are cattle, shoats (sheep and/or goats), equines, bees and poultry. The livestock composition in the study areas varies from place to place due to variations in agro-ecology, land holding and farming system.

Livestock holding per household is higher in Tigray compared to western and eastern Hararghe zones of Oromia region, while the body condition of the animals and productivity is higher in Hararghe zone. For instance, during Ethiopian New Year a fattened ox was reported to be sold up to 9000 Birr in Hararghe but up to 3000 in Tigray. The average Tropical Livestock Unit (TLU) in the highlands of Hararghe study Tabias was 1.46 units compared to 2.9 to 4.51 units in the highlands of Tigray (Table 1). The availability of communal grazing areas and enclosures are better in Tigray compared to Hararghe area. It was hard to find cattle grazing on communal grazing areas in Hararghe study areas except in Haramaya district near the Haramaya Lake, which is communally owned by the community.
<table>
<thead>
<tr>
<th>Region</th>
<th>District</th>
<th>Agro-ecology</th>
<th>Tabia</th>
<th>No. of respondents</th>
<th>family size</th>
<th>land size</th>
<th>livestock holding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>M</td>
<td>F</td>
<td>Total</td>
<td>ox</td>
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<tr>
<td>Western Hararghe</td>
<td>Chiro</td>
<td>Highland</td>
<td>Wachuhormat</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>6.8</td>
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<td></td>
<td></td>
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<td>Arberekete</td>
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<tr>
<td>Eastern Hararghe</td>
<td>Haromaya</td>
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<td>Finkile</td>
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<tr>
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<td>Licale</td>
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<td></td>
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<td>Observation</td>
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<td>3</td>
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<td>3</td>
<td>8</td>
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<td>Sheka-Tekli</td>
<td>5</td>
<td>3</td>
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<td>Abreha Atsbeha</td>
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<td>Hashenge</td>
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<td>3</td>
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<td>6</td>
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</table>

*TLU = Tropical Livestock Unit
3.2 LIVELIHOOD MEANS

Livelihood means in the study areas vary from place to place and agro-ecology to agro-ecology. Crop and livestock production, safety net and other off farm activities such as trading (petty trade, shopping, salt, livestock, crop, and provision of services like camel renting, ox renting, breeding donkey, etc), labor selling, remittance, handicrafts, etc. were identified as livelihood means in the studied areas.

Crop production is the major source of livelihood in all study areas followed by livestock production and safety net. In eastern and western Hararghe, the major source of cash is from crop production (beans, chat, coffee in some districts, vegetables, groundnuts and green cobs), fattened ox, cow milk, camel milk (mainly in Babile district), fattened ram/buck and bull calf. In Tigray, however, the main source of cash is from sales of pulses (faba bean, field pea, lentil, and chick pea), teff, sorghum, vegetables, green cobs and old ox. Small ruminants (ewe, ram, doe, buck, lamb, ewe with lamb) are sold at the time of cash need and during religious festivals and holidays. Productive Safety Net Program has been exercised in both study regions. Honey and bee colony sales are also reported to generate cash income in some districts in Tigray. The role of honey bee in Hararghe is not prominent. But areas on the way to Fedis, which are at present dominated by bushes and shrubs, could be planted with bee forages and can contribute to honey production in the area. Besides, in some of the study areas in Tigray, the study team observed females selling local drinks like tela and tej to support their livelihood.

3.3 CROP AND LIVESTOCK PRODUCTION SYSTEMS

The production system in the studied areas is a mixed crop livestock production system where farmers grow crops and keep livestock. However, the degree of interdependence of crops and livestock and the priority given by farmers varies in the two areas.

In Tigray, crop cultivation is a priority activity and entirely dependent on livestock. Farmers keep cattle mainly to satisfy drought power requirement. Ox has vital importance for assuring livelihood security in the Ethiopian highlands. There is also a lot of social prestige associated with ownership (Aune et al., 2001). The dominant crops that are grown vary with agro-ecology and altitude. In the highlands, crops like wheat, barley, hanfetse\(^1\) and beans are given priority. In the lowlands sorghum, maize and teff are the priority crops. In the mid altitude teff, wheat, barely, sorghum and maize are cultivated.

The tradition of growing hanfetse in the highlands of Tigray is common. FGD participants in Mahbere-selase Tabia of Deb’u’a-Temben district explained that the reason why farmers plant mixed wheat and barley is to benefit from the competitive growth of the two crops and differences in tolerance to moisture stress. Such mixture grows faster than sole planted wheat or barley. Moreover, FGD participants added that, due to the difference in the degree of tolerance to moisture stress, when they are planted in mixture, during time of moisture stress there will not be complete crop failure, even if it happens, they will get high dry matter of crop residue for their

\(^1\) Mixture of barley and wheat grown together
animals. Besides, it is common to see weed in crop fields. Particularly palatable weeds such as oat is not weeded. This is mainly to get high biomass of crop residue.

The type of livestock kept by farmers in the different agro ecologies is presented in Table 1. The role livestock play in the high and mid altitude areas of Tigray is similar, that is, mainly to meet the draft power requirement of the household. Moreover, livestock are kept for the purpose of herd reproduction, milk production for home consumption and sale, manure for crop production, store of wealth, dung for fuel wood and dowry. Sheep dominate in all study woredas compared to goats. This could be due to agro-ecology and type of feed available in the highlands favoring sheep over goat. Donkeys are kept by farmers for transportation purpose. Livestock production is not market oriented. Farmers do sell their animals whenever they need cash for food, seed and other purposes.

In eastern and western Hararghe, the crop production system in all agro-ecologies gives priority to livestock. All farmers, irrespective of the agro-ecology, grow sorghum and maize mainly targeting animal feed. Crop production is secondary. Sorghum and maize are selected for their high biomass as animal feed. Even in the high lands of Qulubi, the land allocated to small cereal crops is very small. During the short rainy season, farmers grow wheat, barley and beans and use the straw for animals. Chat, sweet potato and vegetables are also grown. Chat is the main cash crop followed by vegetables and sweet potato. Intercropping is a common practice in Hararghe study areas. Farmers grow maize and/or sorghum as a sole crop or intercropped with chat, sweet potato, ground nut or beans depending on the agro-ecology. In the highlands, the intercropping is maize or sorghum with haricot bean, while in the low lands maize or sorghum are intercropped with ground nut.

In general, the basic difference between Tigray and Hararghe emanates from the difference in farming systems. In both places, the farming system is mixed crop livestock production system. However, according to a study report (Alemu, 1987), within the mixed crop livestock production system there are two subsystems, namely crop livestock and livestock crop mixed farming system. These two vary in the priority they give to either crop farming or livestock. In Hararghe the system is livestock crop mixed farming where farmers give priority to livestock, and crop farming is geared towards maintaining animal feed. In Tigray on the other hand, the farming system is crop livestock mixed farming where farmers give priority to crop production. Livestock are subsidiary to crop and is meant to fulfill the draught power requirement for crop cultivation. These differences have brought variation in crop choice, cropping pattern and crop productivity.

The livestock production system in East and West Hararghe is market oriented. Fattening is commonly practiced by all farmers in all places. Farmers keep a small number of oxen which are mainly purchased from market, fattened and sold for beef after a few years of work. Dairy production is based on a reduced number of local cows kept by farmers. Milk selling is not a taboo but due to the low milk yield of the local cows kept by farmers almost all milk is consumed as *Hoja*. However, in some places, women households experience a traditional system of marketing milk called *Afosha* where three or more women form a milk group for marketing milk. In this system, milk from the member households is collected daily and taken to market for

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2 *Hoja* is the traditional drink in Hararghe prepared from milk
3 *Afosha* is a system through which women in rural areas of Hararghe form a group for milk marketing.
sale by one of the group members, and the money is utilized by the household who took the milk to the market. This is done by the group members turn by turn. Small ruminants are mainly kept for fattening and sale. In Babile, farmers milk camels and cows. They sell cow milk in nearby villages, Harar and Dire Dawa town. Camel milk, however, is transported as far as Djibouti. They are making the advantage of relatively longer shelf life of camel milk compared to cow milk. The respondents in Babile district reported that they sometimes mix cow and camel milk to increase the shelf life of the milk. FGD participants indicated high demand for camel milk in their area.

The rainfall conditions in the two studied areas are different. In most parts of Hararghe, the rainy season is longer and starts in April/May. Farmers grow crops like maize and sorghum which are contributing to the feed resource of the area. In Tigray however, the rain is not reliable and is of short duration. Farmers grow crops with short growing period.

![Picture 2. Intercropping maize with beans](image)

Hararghe farmers grow crops targeting animal feed. During the main rainy season, even in the highlands farmers grow maize and sorghum as a sole crop or intercropped with haricot bean, ground nut (in the low lands), or other perennial cash crops. This system of cropping is targeting animal feed since the fattening package of Hararghe farmers is based on sorghum and maize leaves, seedlings, tassels and defoliated leaves.

In Tigray, however, crop production is given priority. In the highlands, farmers grow highland crops and use the straw as animal feed. In the low lands of Raya Azebo and Alamata, farmers practice feeding thinned sorghum or maize plants to their animals as a supplementary to grazing. Nevertheless, this practice has its own drawback. The first is, unlike Hararghe farmers, the feeding is not market oriented and is not targeting certain objectives. It is neither for fattening nor milk production. Second, since farmers own large numbers of livestock and feed them indiscriminately the response of the animals to such feeding practice will be low. The biomass yield might not be enough to feed all animals and bring change in live weight and body condition of the animal. Third, animals fed in such a way are kept for the whole year or for years, and weight gained in one season will be lost in subsequent months. Thus, such a feeding system has
to target certain objectives in order to make the system profitable. This needs demonstration and training of farmers, and evaluation of the system for its economic feasibility.

### 3.4 ANIMAL FEED AND FEEDING SYSTEM

Feed shortage is a critical problem in the studied areas, mainly during the dry season (March to June) when farmers finish stored feed. In Tigray livestock feeding is based on grazing communal grazing lands, road sides, degraded areas, area closures and crop residue (straw, maize and sorghum stover). In areas where farmers grow cactus, it is being used as animal feed mainly during the dry season. In some areas such as Habes farmers own a piece of communal grazing land and harvest grass for hay. In other places, part of their grazing area is kept closed during the rainy season and the grass is used either in a cut and carry system, or are let to be grazed by oxen.

In Tigray there is a culture of closing part of grazing lands during the rainy season, but the system of utilization of grasses grown in closures differ from place to place. In some areas farmers have by-laws to administer and use closures at the end of the rainy season. For instance, in Habes Tabia (Atsbi womberta district) the bylaw offers equal rights to all farmers in the area to get similar sized paddocks irrespective of cattle ownership and type of cattle. They have the right to use the grass grown in their paddock. Animals are not allowed to graze throughout the year. Farmers harvest grass two to three times a year. This is favored by the high moisture in the area. Farmers have the right to harvest the grass and feed their animals or, in case they have no animal, to sell and benefit from the land. Similarly farmers in Sasun-Bethawariat of Ganta-Afeshum district reported that they follow the same practice/by-laws. But the guarding in this Tabia is done through user contributions or the guard is allowed to graze one ox all the time for the guarding service.

In Hayelom Tabia (Atsbi womberta district), on the other hand, farmers close part of the communal grazing land during the rainy season. These closures are utilized by all farmers equally. Each farmer is allowed to bring two oxen to graze in the closure. Those who have no oxen have the right to sell their share to farmers who have more than two cattle. The price ranges from 100 to 200 birr per annum. The sale is not necessarily for oxen, cows can also graze in the closure.

In Abreha-Atsbiha (Kilte-Awlaelo) farmers close part of the communal grazing area during the rainy season, and the grazing areas are grazed by oxen only. Farmers have no equal right to use the grasses in the closure. Farmers who have no oxen do not have the right to use, while those having higher number of oxen are favored by the system. Similar experiences have been observed in Tsigea Tabia of Raya Azebo district.
In Ofla (Hashenge Tabia) farmers do not practice closing communal grazing lands, as for instance the grazing areas near Hashenge Lake. There, all species, ages and sexes of livestock graze year round.

In Hararghe, farmers practice certain feeding systems. Most farmers give priority to their animals. The major feed resources are sorghum and maize stover, straw, maize and sorghum leaves, thinned maize and sorghum seedlings and sterile plants, maize tassels, sweet potato leaves, haricot bean leaves and weeds grown in crop fields. Cattle, sheep and goats are observed tied with rope near crop fields or chat fields. All feeds are taken to the animals. As reported by FGD participants and experts, the feeding system of the area can be explained as follows:

- Farmers use high seed rate to enhance maize and sorghum biomass growth and then thin excess seedlings and feed to animals. The thinning is done day to day, not at once.
- Farmers defoliate sorghum and maize leaves after maturity.
- Farmers detassel maize plants after maturity and feed to animals.
- Maize and sorghum stovers are finally harvested and stored in the house for later use.
- Sweet potato leaves are also fed to fattening animals.
- Farmers prefer and use young animals for fattening.
- Farmer grows perennial crops like chat which prevents animals from grazing stubble and crop aftermath. This favors the growth of grasses and leaves which are later weeded and fed to animals.
- Priority in feeding animals is given to fattening oxen followed by milking cows.
- Farmers fatten their oxen during the rainy season and sell it at the end of the rainy season.

“Farmers do give due consideration to livestock production. Even they feed their cattle on green maize with cobs. This is because farmers know that they can get the amount of income that one can earn from a hectare of land by selling one fattened ox......”

Experts’ view from Haramaya
Farmers train and use un-castrated bull for traction for one or two years and then fatten and sell. They believe that unless an ox worked for one or two years, it will not be responsive to fattening. The length of time they keep on feeding depends on the availability of feed and the condition and age of the animal. When there is feed shortage farmers do not keep fattened animals long to prevent the animal from losing weight.

Farmers purchase animals for traction and fattening. This was also confirmed during observation of the team to Kersa market whereby both fattened and young bulls were present. Bulls used for traction are not necessarily grown up in the farm.

Farmers feed their animals’ defoliated leaves and thinned seedlings. These are potential feeds for animals. However, farmers are not aware or negligent of the effect of defoliation on crop yield mainly related to the high priority they give to their animals. An experiment conducted at Haramaya (the then Alemaya) to study the effects of leaf removal and planting density on yield and yield components of maize indicated that grain yield was significantly reduced when leaves were removed at any stage of plant development when compared with the control. Defoliation at 50% flowering had a significant negative effect on all variables. Significant interaction was observed between planting density and degree of defoliation with regard to grain yield. When leaves below the upper ear were removed, a 10.7% grain yield increase was recorded over the control at the population of 133,333 plants per hectare. Results showed that at high population densities, the leaves above the upper most ears are more important than the lower ones. Grain yield also increased with increasing population density and delayed time of defoliation. Partial defoliation below the upper ear, at high planting densities modifies the photosynthetic efficiency of leaves and defoliation should be delayed until 30 days after 50% flowering (Senait and Dejene, 1992).

Communal grazing areas which are used for cut and carry system need to be improved with more productive forages. Existing grass types on the communal grazing lands indicate over grazing. Thus, these areas could be good for forage development intervention demonstration. Grasses like Napier grass can provide high biomass of grass and can be harvested two to three times a year if properly managed. Thus, planting Napier grass could be an alternative for high forage biomass harvest.

In some places such as Dibla-Sihet Tabia of Ganta-Afeshum District, crossbred breeding bull is assigned for breeding purpose and allowed to graze communal grazing lands year round for the service it gives.

The use of cactus (Opuntia ficus spp) fruits as food for humans and the cladodes as feed and as a source of water for animals are also stressed by farmers. Two types of cactus exist in Tigray, the spiny and spineless. Farmers feed spiny cactus cladodes after removing the spines with knife or burning the spines. They prefer the spiny cactus for fencing back yard and crop fields. The spineless is planted in the backyard to protect from being browsed by animals. In Tigray about 30520 ha (1.88% of the total area of Tigray) is covered with cactus, with 48.6% growing in the wild and 51.3% cultivated (Frew, 2001).
Grazing areas include communal grazing lands, road side grazing, gullies and hill bottoms. These grazing areas are characterized by overgrazing, degraded soil condition and dominance of unpalatable grass species. The management and mode of utilization of grazing lands varies from place to place. In some places the communities have internal by-laws on how to use, who is eligible and when to use grasses grown on such lands. Others do not have by-law, and misuse grazing lands freely. The problem associated with communal grazing lands is that, with the exception of a few places, farmers do not try to improve the grazing lands, or there is no systematic way of utilization. This is mainly due to the high population of livestock grazing in the area and lack of alternative grazing area. The government has no or little intervention on those grazing areas. In some places, however, there is some experience of enclosing part of the communal grazing lands at least during the rainy season and then either practice cut and carry or graze their animals at the end of the rainy season. Such experiences could be entry points for any forage development practices such as over sowing, replanting, fertilization, etc. to rehabilitate degraded grazing lands. Observations in Habes indicated that through the joint effort made by farmers and IPMS-ILRI it was possible to rehabilitate degraded grazing lands by over sowing different grass species.

3.5 GRAZING SYSTEM, LIVESTOCK PRODUCTION AND ANIMAL DISEASES

Grazing system has an impact on the health of the animal. Free grazing exposes animals to contagious diseases, internal and external parasites, tick born diseases, reproductive diseases such as brucellosis, infectious reproductive diseases, etc. Communal grazing areas are the main sources of parasites. Internal parasite such as Faciolasis, has a big impact on animal and human health. In grazing areas near Hashenge Lake, this parasite is a serious problem. Farmers and the district office of agriculture have reported the incidence of the parasite and its impact. It causes high mortality, emaciation and death. Farmers in Hashenge Tabia of Ofla district reported that they started zero grazing or tethering their animals with the start up of milk cow package. They reported that a few years ago farmers bought milking cows on credit and let them graze on the Hashenge grazing area. They lost their animals due to disease and are paying their debt. Thus to reduce the risk of death of animals purchased on credit they started to tether near their house. Similarly, farmers in Dibla (Ganta Afeshum District) reported the advantage of zero grazing. They said, before they started tethering, their animals were grazing on the communal grazing lands and were suffering from disease and bloat. Now, such incidences do not take place and the farmers are happy with the zero grazing. The problem of parasites could be alleviated through different ways. Use of Anti-Helments and acaricides are the option to control internal and external parasites respectively. However, continuous use of medicines and acaricides could result in resistance of the species. Thus this problem could be minimized by implementing zero grazing. The impact of parasites on livestock productivity and market is clear. Sheep infested with internal parasites are rejected in foreign markets. There is a high rate of rejection of sheep liver due to internal parasites, and rejection of skin and hide due to damage inflicted by external parasites.

3.6 MARKETING LIVESTOCK AND LIVESTOCK PRODUCTS

Success in market is becoming increasingly important for livelihood development of the rural community. In the global world there is an increasing competition, which means farmers do not
only compete with their neighbors but also with the global market. Thus, one has to understand marketing, how market functions, and how to engage in the market place. This requires the ability to identify, quantify, and meet the needs, wants and desires of a consumer. To be successful in the market place, rural communities need to adopt new technologies, access new types of information and gain new enterprise skills.

Market for live animals in both study areas are nearby towns. Buyers come from different directions. The marketing system involves farmers, middle men, traders and government. Visits to some of the market places both in Hararghe and Tigray showed that livestock markets are fenced areas where government bodies collect tax from buyers. Pricing is based on mutual negotiation between the buyer and seller with or without the involvement of middle men. This type of transaction appears to benefit merchants and middle men. Farmers fix price on guess rather than through calculation of costs of inputs and their labor. Farmers do not have a habit of recording. In some places like Babile (western Hararghe), farmers reported that middle men stand by the side of the farmer in time of price negotiation. This has come due to the fact that if the middle men sides the traders farmers will not take their animal to him next time.

Market observation made in some of the study areas indicated the differences in composition and condition of animals coming to market. In Hararghe a number of young bulls, fattened oxen, sheep and goat are available and are in most cases in good body condition. In Wukro (eastern zone) and Shikomayo (southern zone) of Tigray on the other hand, animals coming to market were dominantly in poor body condition, emaciated, old oxen, weak lambs, and ewes with their lamb. This is mainly a reflection of the feed and feeding system experienced by farmers before marketing live animals.

Picture 4 Market places of Hararghe (left) and Wukro (right).

Availability of young bulls in Hararghe market could be associated with the habit of farmers to buy drought oxen every year. In Tigray on the other hand, farmers in most cases rear their own bull from their herd. This requires long time feeding and management which might not be economical.
Beef production is highly influenced by the availability of market. Market has to be remunerative and has to provide necessary facilities for efficient transaction, with minimum weight loss and stress to the animal. However, the system of livestock marketing in Ethiopia is not developed. It is characterized by markets that lack basic infrastructure, facilities like cattle pen, weighing scale, water troughs, feed and market information (Zewdu and Sintayehu, 1987). During the FGD with farmers it was reported that livestock and livestock product marketing is characterized by strong seasonality and subject to price fluctuation due to religious festivals and fasting.

Livestock markets are fenced in all towns but lack other infrastructure. In order to formalize the marketing system, modern techniques of livestock marketing need to be introduced. The existing system has to be revised and standard methods should be adopted. In Tigray, the study team have observed animals being trekked from Mehoni to Mekelle. This system of transportation has an impact on the weight and body condition of the animals. For instance, oxen are bought from Mehoni market and trekked to Mekelle for about 2-3 days. In the mean time the animals might not have access to feed and water as required. They graze road sides while walking. The effects of trekking and trucking have been documented by Keno (1987). He reported an average body weight loss of 26.5 kg or 8.3% of the departure weight. Animals trekked lost significantly more weight than those which were trucked. These losses amount to 9.3% and 7.3% of departure weight of trekked and trucked animals, respectively. Younger animals lost more weight than older ones, lighter animals had significantly less shrinkage than heavier ones (Keno, 1987). Thus, care has to be taken during animal transportation. Animals have to be trucked to prevent weight loss and have to be provided with feed and water during transportation.

The purchase price of animals is dependent on body weight, condition and season. Heavier and good conditioned animals fetch higher price. Selling price of animals is also higher during holidays and religious festivals. Farmers in both study regions prefer to sell their animals during these periods. Nevertheless, even during the other time of the year, the price of Hararghe Sanga will not drop due to the high demand in the area, Adama (the then Nazreth) and Addis Ababa. Further more, the existence of different abattoirs and live animal exporters around Addis Ababa, Adama, Mojo and Bishoftu (the then Debre Zeit) created a favorable environment for live animal market. The culture of eating raw meat (Quirt) is widely spread in almost all big and small towns of Ethiopia, except in Tigray where Quirt is limited to a few restaurants in Mekelle. Eating raw meat requires highly fattened and conditioned animals. In Tigray, however, the meat in most cases is not suited for raw meat consumption due to the poor quality of beef originating from over worked oxen.

During the focus group discussion in western and eastern Hararghe, farmers pointed out that the main market for fattened animals is during September to January. There is a concentration of most of the holidays and religious festivals during that time, and a lot of fattening activities end with the time of the main rainy season. Farmers in Hararghe reported that fattening activities during the rest of the season depend on the availability of feed reserve. Farmers that kept enough feed reserve are the ones fattening during the dry season.

Marketing milk is not a common practice in most of the rural communities, except those located near towns. In Tigray study areas farmers sell butter and use the butter milk for home consumption whereas in Hararghe areas farmers drink milk as Hoja. Some of the reasons for not selling milk were culture, lack of infrastructure and low milk yield of local breeds. But those
communities located nearby towns are increasing their milk production for sale to meet the increasing milk demand. For instance the study team observed that there was a high demand for cow and camel milk. Milk marketing is characterized by the high demand during non-fasting season and low demand during fasting seasons. In some of the studied areas like Sasun Bet-bethawariat and Hagereselam, farmers are organized in milk marketing cooperatives by Land O’ Lakes and the Relief Society of Tigray (REST) respectively to bulk and sell their milk to collection sites and sell from there to customers. Similar marketing infrastructures are being requested by farmers in study areas located in Ofla, Raya-Azebo, Kilte- Awlaelo and Atsbi-Womberta districts.

3.7 Inputs, Services and Service Providers

Provision of inputs and services related to livestock production is important in improving the productivity of the livestock sub-sector. The major inputs related to livestock are forage seeds, forage planting materials, concentrate, medicines, vaccine and improved dairy breeds. The major services provided to farmers are medication, vaccination, artificial insemination, provision of market information and credit.

In almost all areas surveyed, focus group discussion participants reported that medication and vaccination services are available at an affordable price. In Tigray study areas, medication and vaccination services are provided solely by government organizations, whereas in Hararghe study areas it is supported by non-governmental organizations. The incidence of disease such as parasitic (internal and external) and contagious diseases are highly prevalent in Tigray compared to Hararghe region. This was reported to be mainly due to the free grazing system, which favors the transmission of diseases. In all study areas, provision of health service is hampered due to shortage and frequent mobility of manpower. In Hararghe study zones, Menschen für Menschen (MFM) and CARE Ethiopia provided training of Para vets to farmers to improve the service provision.

Experts at all study sites in Tabias of Tigray reported that they provide artificial insemination service to farmers. However from the conversation with FGD participants it was understood that artificial insemination (AI) is not widely distributed. Discussions conducted at various levels showed that artificial insemination service provision is not well equipped with the required facilities and trained manpower to meet the ever increasing demand for AI service. Moreover, lack of communication among the service providers and beneficiaries was reported to be an additional factor that hinders the smooth provision of the service.

Furthermore, the demand for crossbred cows/heifer is very high in Tigray and Babile district of Hararghe due to the high demand for milk and an interest to replace the local animals with better producing breeds. Provision of Begait cows (local cattle breed found in western Tigray) and/or heifers is being practiced in Tigray. Similarly crossbred cows are distributed in Babile district, mainly in villages nearby Babile town. However, the demand for cross bred cows is limited due to the high cost and high feed requirements of crossbred cows. The expansion of artificial insemination service and crossbred cows will increase production and encourage intensification of livestock production.
Moreover, agricultural development agents provide extension services such as daily supervision and training. Most of the trainings offered to farmers are orientation on livestock packages, health and feed aspects. However, FGD participants reported that they need specific training and skills in the management of crossbred cows such as breeding, health, feeding and housing aspects.

The number of extension workers per Tabia ranges from three to four in Tigray and one to three in Hararghe study areas. A farmers training center were also well established in Tigray compared to Hararghe areas. This might be a good opportunity for training farmers about zero grazing through theoretical and practical trainings.

Provision of credit to small scale farmers in the rural community is one of the most important services for the improvement of livestock production and adoption of intensive livestock management practices. FGD participants and experts in all study districts pointed out that credit is provided to farmers, but the form and amount of credit varies over time and among study districts. In Tigray, credit is provided by Dedebit Credit and Saving Institute (DCSI) at the annual interest rate of 9%. Credit is given using a group lending system and the amount of money could go up to 5000 Eth birr and the repayment period can go up to four years depending on the type of investment. FGD participants indicated that high interest rates and time of credit provision is badly timed In most cases credit is provided during May to June. But the beneficiaries prefer to receive credit during September to October when the price of livestock is low and there is enough feed for the livestock.

On the other hand, provision of credit in Hararghe study areas was limited. It is provided by Food Security Programs and some NGOs operating in the areas (for instance Care-Ethiopia in Chiro district and MFM in Babile district. The credit provision system adopted by MFM was backed by intensive training and seems to be feasible and flexible.

The major service providers, if not the only in some places, are government institutions. The Bureau of Agriculture and Rural Development (BoARD) provides planting materials, vaccine, medicines, credit, artificial insemination services, crossbred cows and bulls, and better performing indigenous breeds (such as Begait cows, in Tigray). The participation and assistance of NGOs were also underlined. The role CARE Ethiopia is playing in Chiro district and Menschen für Menschen in Babile district, REST, IPMS-ILRI, Land O’ Lakes, World vision, Catholic mission, finance institutions such as Dedebit Credit and Saving Institution and others are of paramount importance. The team observed that in all study districts the role of the private sector was minimal, despite its potential in service provision.

Menschen für Menschen provides credit for women using group lending system. First beneficiaries are requested to prepare and submit business plan. The preparation of business plan is assisted by our social worker staff stationed in each Tabia. Basic training is offered before providing credit. The training targets the business plan. For instance, fattening, dairy, poultry, trade etc... The credit is flexible in that beneficiaries are allowed even to shift in between. Defaulting is not a common practice in Hararghe. It is considered as a taboo.

MFM key informant
### Table 2 List of NGOs operating in the study areas

<table>
<thead>
<tr>
<th>Study districts</th>
<th>NGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haraghe</td>
<td>CARE, IRC, GOAL, CHIPS, MERCY COPS, HCS</td>
</tr>
<tr>
<td>Chiro</td>
<td>SELF HELP</td>
</tr>
<tr>
<td>Haromaya</td>
<td>MFM</td>
</tr>
<tr>
<td>Babile</td>
<td></td>
</tr>
<tr>
<td>Tigray</td>
<td></td>
</tr>
<tr>
<td>Atsbi-Wemberta</td>
<td>IPMS, WVE</td>
</tr>
<tr>
<td>Raya-Azebo</td>
<td>REST</td>
</tr>
<tr>
<td>Ofla</td>
<td>ACTION AID</td>
</tr>
<tr>
<td>Abreha-Atsbeha</td>
<td>GTZ, REST, WFP</td>
</tr>
<tr>
<td>Degu’a-Temben</td>
<td>REST, CATHOLIC</td>
</tr>
<tr>
<td>Ganta-Afeshum</td>
<td>Catholic mission, Land O’ lakes</td>
</tr>
</tbody>
</table>

#### 3.8 MARKET INFORMATION

Market information is essential for decision making in production and marketing, reducing transaction costs and business risks, enabling efficient storage, facilitating the flow of goods from producers to consumers, meet consumer demands, and reduce cheating and unfair pricing practices. The type of market information needed are input sources and prices, product prices in different markets, the best time of the day/week/month/year to sale, price trends and seasonality, number and type of buyers operating in different local markets, volume and quality requirements and selling arrangements.

Market information can be obtained from Radio, TV, news papers (mass media), key informants, neighbors who have better information, friends, local organization (like Equb, Mahiber and Idir), BoARD and other actors operating in the area.

Market information is the basis for setting the price of crop and livestock. In Tigray, market information is transmitted through Dimtsi Weyane Tigray Radio Station in local language every Thursday. Farmers who have radio can get the information. The radio station presents prices of agricultural commodities in major towns of the region. This is reported to contribute to the awareness of farmers as to the price of commodities. Farmers in Tigray reported that they get information informally from colloquies and neighbors who visited the market some time before them, asking traders coming from towns, discussions during social gatherings in the community/village to which farmers have better trust. Such information has been assisting them to set the price. Prices for animals is remunerative during religious festivals such as New Year, Easter, Christmas, Ramadan, Mowlid, etc. However, farmers do not seem to target these markets in terms of producing better animals for selling. In 2000 (Ethiopian calendar) Ethiopian New Year, the price of sheep with moderate body condition reached about 600 Birr in Shikomayo.

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4 The list of NGOs is not exhaustive, only as listed by experts and FGD participant farmers.
market which is higher than the usual price. The price was probably exaggerated due to the poor supply of sheep to the market. Livestock producers in Tigray lack market orientation in product development. Despite the fact that the New Year market day is remunerative, animals observed in the market for sale were highly emaciated and the composition of the animals didn’t seem to fulfill the consumers demand in terms of quality and quantity. In Hararghe, on the other hand, farmers know in principle when they should buy oxen for fattening and when to sell, but they lack support with market information from the government and non-governmental organizations. Traders come to the site from as far as Addis Ababa, Adama and Bishoftu to buy and truck animals. The role the Isuzu trucks are playing in providing fast transportation service for animals is substantial.

In all study districts, the Office of Agriculture and Rural Development (OoARD) has a unit that collects market information and all the information is sent to zones/regions, but it was reported by the experts that there was no feedback to the community or district for use.

3.9 HOUSEHOLD MEMBERS DIVISION OF LABOUR

The farming community exercises herding, purchasing, selling, feeding, watering, milking, churning and selling of dairy products. The division of labor varies between Hararghe and Tigray. In Hararghe, where cattle are tethered near house or farm land, feeding and herding is the responsibility of the household head. In Tigray, where cattle graze freely on communal lands, herding is the responsibility of kids or hired labor.

Cattle purchase and sale, in both study areas, is the responsibility of the household head. In Tigray, Ofila district Tabia Hashenge, a female headed household reported that they require assistance of male neighbors when they purchase and sell animals. They go to the market together with men to choose and settle the bill.

In Hararghe, the sale of small ruminants, poultry, milk and butter is the duty of females. Milking is done by both males and females. The issue raised in all studied areas of Tigray related to milking was that males tend to favor the calf by leaving some milk in the udder, in the sense that the calf will grow fast. Females, on the other hand, completely milk their cows since the income from sale of milk is utilized by the women household to cover minor expenses in the house. Camel milking is done by males. Farmers confirmed the advantage of the children going to school on shift bases. This enabled the children to work (herd, water) on shift bases. Thus, a half day education system has been reported by farmers as an alternative in order for the children to go to school. Otherwise drop outs will increase, especially during time of peak farm activities.
Plowing is the responsibility of the household head. Women households also plow in some areas. Farmers with no oxen have alternatives. They will borrow ox in exchange for straw or for labor during weeding or harvesting or rent. Those with one ox combine with other farmers who have one ox and work turn by turn. In areas like Habes (Atsbi-womberta district), farmers who have no ox either sell their share of grass or give it to farmers who have oxen in exchange for oxen. In Arberekete (Chiro district), it has been reported that well-to-do farmers buy oxen and distribute to farmers who have no oxen. Those who have received an ox will use the ox for plowing. Then, they fatten and finally handover to the owner for sale. The owner will replace a young bull for the same purpose.

Draught oxen are a sign of wealth status in some of the societies. Farmers said that “Instead of losing an ox, better to lose four others” reflecting that if the farmer does not have an ox he is poor and not respected by the community.

Watering is a joint responsibility. The husband, women and kids are involved depending on the distance to watering points. In Hararghe, this is not a problem. In Tigray, however, since herd size is higher and animals graze freely, provision of water to all animals is a problem particularly if the watering points are located at a distant place. Thus, kids or husbands have the responsibility to take the animals to the watering point. In areas like, Yechila (Tanqua Abergale) farmers have to trek their animals a long distance to Tekeze River to drink water. The importance of cactus as a source of water is highly stressed by farmers, particularly during the dry season and drought periods in almost all cactus growing areas. Studies made on cactus supported the advantage cactus has in fulfilling water needs of animals during dry season (Frew, 2001).

3.10 OPPORTUNITIES OF ZERO GRAZING

The opportunities to implement zero grazing in Tigray and Hararghe could be discussed as matters of socio-cultural, technical, economic and policy/environmental/natural issues.

3.10.1 Opportunities of zero grazing in Tigray

Socio-cultural opportunities
Farmers have social laws through which they administer grazing lands. These by-laws could act as a basis for establishing rules and regulations on how to use communal grazing lands and closure areas. As noted above, the by-laws are different from place to place but indicate the need for having certain rules, and they have to be fine tuned and supported by the government. For example, the by-laws of Habes Tabia of Atsbi-Womberta district and Sasun-Bethawariate Tabia of Ganta-Afeshum district on how to use grazing lands could be cited as a good example. They created good opportunities to practice zero grazing. However, the presence of communal grazing lands in some areas is negatively affecting zero grazing. Farmers do not accept zero grazing on the assumption that they have large grazing lands and can benefit more by having a big number of livestock herd. Unless these areas are managed properly, they can not give the service which they ought to give. If farmers are convinced to implement zero grazing, such grazing lands could be a good source of grass. Hence there is a need to fine tune the by-laws to allow zero grazing and maximize livestock productivity from the existing good practices.
Challenges, Opportunities and Available Good Practices Related to Zero Grazing

The culture of tethering animals and the habit of closing part of the grazing lands during the rainy season is also another opportunity for the implementation of zero grazing.

Expansion of farmland to communal grazing lands were reported to be an opportunity for the implementation of zero grazing by reducing the size of grazing land there by forcing farmers to reduce their livestock herd. Some farmers, for instance in Habes Tabia of Atsbi-womberta district has already started tethering their animals due to shortage or lack of grazing lands. Similarly Hararghe farmer started zero grazing due to shortage of grazing land.

In Tigray the culture of closing part of the grazing land during the rainy season for oxen could be taken as one opportunity for zero grazing. These areas could be enriched with grasses and properly utilized through cut and carry system. The existing trend is that although these areas are closed during the rainy season, their grass growth and cover is poor. The practice of Raya-Azebo farmers of feeding defoliated sorghum leaves, seedlings and weeds could be channeled to market oriented production of fattened animals instead of feeding both productive and unproductive herd.

**Technical opportunities**

At present, government and non-governmental institutions are working with farmers on rehabilitation of degraded soils and hill bottoms, construction of soil and water conservation structures, re-forestation, introduction of forage crops (seed, planting materials) and improved cross breed cows, provision of different services such as artificial insemination, medication, vaccination and credit, enrichment of closures and introduction and expansion of cactus. All these technical interventions, inputs and services are reported to be some of the technical opportunities for implementing zero grazing in Tigray.

Moreover, FGD participants and experts in Tigray study areas pointed out that crop intensification through the introduction and use of new technologies and inputs, the expansion of irrigation through the construction of dams, river diversion and other water harvesting techniques are an opportunity for the adoption of zero grazing. Crop intensification enables the shift from the current free grazing system to intensive grazing system by improving feed availability and preventing animals from grazing crop aftermath and stubbles. Intensification will also lead farmers to produce products that are required by the market.

Availability of large communal grazing lands in some areas like Hashenge, Tahtay Wargeba and Yechila kebele is negatively affecting the implementation of zero grazing. But, they could serve as forage banks with the introduction of appropriate interventions.

The level of management that farmers practice to their animals depends on their quality and production level. High grade productive animals are better managed than non productive local animals. In Hararghe, the level of management farmers practice to their fattening animal is extraordinary. This is in anticipation to the high income that the farmer will get from sales of his animal. Similarly in Tigray, crossbred cows are managed better than the locals. Thus, improving the quality of the herd will also assist for implementation of zero grazing.

**Economical opportunities**

The establishment of emerging towns/villages that created an opportunity to increase demand to livestock (e.g. dairy cows) and livestock products (milk, meat, butter) and the expansion of
infrastructures were reported to be an opportunity for the implementation of zero grazing. The income of farmers is raising, the level of consciousness of the community is improving and more farmers and their children are learning. This could help in future efforts to implement zero grazing.

Environmental opportunities
The availability of soil and water conservation practices to rehabilitate hill bottoms, degraded grazing lands and gullies, presence of enclosures and habit of closing part of communal grazing lands during rainy season are good opportunities for some places to use available feed resources through cut and carry system.

The relatively better rainfall in terms of length of rainy season and amount of rain, enable farmers in Hararghe to grow crops like maize and sorghum, which requires a longer growing season and to feed their animals through thinning, defoliation and chopping stovers. The short rainy season and low and erratic rainfall in areas like eastern and southern Tigray such as Enderta, Hintalowajirat, Tanqua-Abergele and Seharti-Samre is considered one opportunity to base the livelihood of the farmers on intensive dairy or beef production. The existing trend in these areas is that farmers grow crops such as wheat, barely, teff and beans. Due to the unreliable rainfall and repeated droughts, farmers are not sure of harvesting grain from their field till they reach the end of the cropping season. These repeated droughts have resulted in crop failure and forced farmers to harvest the straw for their animals. In such areas, the rainfall could be enough to grow forage plants and base their livelihood on sales of fattened animals and animal products. Particularly in places which are in close proximity to Mekelle and other towns of the region such specialization could be one alternative to making the farming community food secure and the environment protected.

3.10.2 Opportunities for zero grazing in western and eastern Hararghe zones of Oromia
- The presence of inherited culture and better awareness of zero grazing
- Favorable cropping system that is suitable for fattening
- The system of growing sorghum/maize during main rainy season targeting animal feed
- Availability of perennial cash crops in crop lands intercropped with annual crops developed confidence and prevented animals from freely grazing and also reduced dependence of farmers on livestock as means of livelihood.
- Intensification of crop production left no land for grazing
- Reliable and remunerative market and market outlet for fattened animals
- Presence of soil and water conservation practices
- Small livestock number enabled farmers to manage well
- Good fattening experience and orientation
- Habit of using oxen for short time and then fattening for sale
- Minimum cultivation practices
- Source of oxen for plowing/fattening not necessarily from own herd
- Availability of good local breed for fattening (Ogaden and/or Borena breeds)
3.11 CHALLENGES OF ZERO GRAZING

3.11.1 Challenges of zero grazing in Tigray

A. Lack of awareness
   - Low level of awareness towards zero grazing, its advantage and impact on labor, livestock productivity, disease and parasite incidence and child education.
   - Farmers relate zero grazing with grazing land confiscation

B. Shortage of feed and poor feed utilization system
   - Shortage of feed in both quantity and quality
   - Unavailability of supplementary feeds and feed processing factories
   - Availability of communal grazing areas encourages farmers to follow free grazing
   - Unavailability of policies to strengthen existing farmers by-laws for using grazing areas
   - Giving feeding priority to oxen which is idle for most part of the year
   - Limited availability of watering points requires labor to transport water for all animals
   - Due to the distance of watering points and the water having to be transported it became a problem to fetch water to all animals.
   - Poor utilization of grazing areas (letting oxen to graze closure areas, example Abreha Atsbeha, Haiki-Meshal and Tsige’a).
   - Poor grazing system: mixed grazing of cattle, sheep and equines e.g. Hashenge
   - Limited introduction of cactus in the lowlands example Tanqua-Abergele

C. Market and infrastructure
   - Undeveloped/non-remunerative market for livestock and livestock products
   - Lack of market oriented livestock production
   - Insufficient road networks
   - Market for milk and milk products not well developed
   - Insufficient market information
   - Lack of standards for live animal market. Animals are marketed based on visual judgment and this differs from animal to animal and from one person to the other.

D. Culture
   - Culture of keeping high number of livestock
   - Habit of maintaining oxen for a long time and producing from herd
   - The culture of considering oxen as indicator of wealth status
   - Consider livestock population as saving

E. Inputs and services
   - Inefficient artificial insemination service
   - Limited introduction of improved dairy cows
   - Limited adoption of forage technologies
   - Lack of awareness on how to use and when to use introduced forages
   - Lack of awareness of farmers on saving
F. **Strategy of implementation**
- Introduction of zero grazing at household level (not kushet/Tabia based). This developed a sense of losing the right to benefit from the communal grazing area.
- Introduction of zero grazing (top-down approach) without prior arrangement and awareness creation.
- Lack of continuity of interventions.

G. **Technical interventions**
- Conflicting package of livestock technologies (destocking/restocking). For example, the purchase of local livestock as part of the livestock package, promoted restocking livestock herd whereas zero grazing encouraged destocking.
- Lack of closure area enrichment program with forage crops.
- Limited closure areas and soil and water conservation activities, example: Tanqua-Abergele.

H. **Policies**
- Lack of grazing land use policy.

### 3.11.2 Challenges of zero grazing in western and eastern Hararghe zones of Oromia
- High potential for milk production, but the market is not well developed.
- Poor road networks.
- Long distance to market places.
- No processing or value addition of animal products to maximize income of farmers.
- Forage production is not enough, particularly the supply of planting materials.
- Expansion of pervasive weed known as *Partinium*.

Guarding communal grazing lands seems to be a problem in most study areas of Tigray. Farmers who own higher number of cattle do not accept zero grazing. They are rather governed by the decision of the majority of the citizens of the kebele. Thus, the existing trend of zero grazing might be reversed unless strong awareness creation is made targeting those farmers who do not have interest to practice zero grazing. The other reason which warrants its sustainability is the costs associated with guarding. During the start of zero grazing, communal grazing lands were guarded by guards employed by either government or non-governmental organizations. For instance, in Dibla-Sihet Tabia the catholic mission was supporting the community to rehabilitate their grazing land and had been paying wage for the guards. Later, when the catholic mission withdraw their support to pay wage to the guard, the situation was reversed and farmers let their animals graze freely. Then, the community discussed and divided the land into paddocks and handed them over to each household. Now each household is taking care of his paddock. Such paddocks are closed and farmers have the right to use grass grown on their paddock. Two to three harvests are being collected in a year.

Guarding communal grazing lands is made possible by the contribution of money by each household, from safety net programs and by crossbred breeding bull owners being allowed to graze the breeding bull in the communal grazing area in return for their service to the community and guarding of the particular communal grazing land.
Resistant farmers try to reverse the situation from zero grazing to free grazing
- By resisting monthly contribution of guard fee
- By complaining about the costs of grasses they buy from farmers who have no cattle. Previously, the grass growth was poor and farmers who had no cattle sold grasses grown in their paddock once every year and those who bought used it the whole year. Now, because the grass growth is improved due to the interventions made, those farmers who have no cattle have started to sell the grass at a higher price because it is possible to harvest two or three times in a year. This created complaints by farmers who have a higher number of animals.
- Resistance is prevalent among farmers who have no labor to manage their paddock and herd their animals
- Paddock size is different. During the time of dividing into paddock, the condition of the grazing lands was not uniform. There were areas which were highly degraded and others with good grass cover and condition. Thus, the size of the paddock was made to vary to compensate the condition of the grazing lands. Now, because of the rehabilitation works done, those paddocks which were in poor condition are growing higher grass biomass and are benefiting more than farmers who have smaller paddocks.
- Despite its importance, in areas where there is no fair utilization of communal grazing lands, farmers tend to reject zero grazing. Such complaints have to be resolved in order to make the system sustainable.

### 3.12 AVAILABLE GOOD PRACTICES RELATED TO ZERO GRAZING

Farmers are endowed with huge innovative knowledge in different fields which are, or could be the basis for modern scientific knowledge and innovations. These innovations are not properly documented, or limited efforts have been done to make use of the farmer’s traditional knowledge to the welfare of human beings. In the study area there are good practices being practiced by farmers, including:
- Closing parts or all of the grazing lands during the rainy season or year round for pasture production
- Farmers have by-laws by which they administer communal grazing lands and closures called *Hizaeti*. For instance
  - In Habes village of Atsbi-Womberta district, communal grazing lands are divided into paddocks and distributed to farmers in the village. All farmers will have an equal right to get a paddock of the grazing land irrespective of sex of the household, animal ownership and type and number of animals. They harvest the grass and use it either for their animals, they sell it to other farmers in case they don’t have cattle, or they exchange it for oxen.
  - In Hik-Meshal village of Atsbi-Womberta district, farmers close their communal grazing lands during the main rainy season and use the grass preferably for oxen. Each farmer will have equal right to graze two oxen or any two animals only. These which don’t have ox sell their share to farmers who have more that two oxen.
- The practice of restricting hill sides and degraded areas and gullies to rehabilitate and soil and water conservation activities could be potential source of feed.
- “Hararghe fattening package” is either unique to Hararghe farmers or are commonly practiced in the area since a long time ago. The fattening package includes:
• Using high seed rate for maize and sorghum and then thin weak and sterile plants and feed to fattening oxen. Thinning will be done in a way that supports the oxen for a longer period of time.
• Defoliation of sorghum and maize plants: the lower old leaves are defoliated and fed to oxen.
• Detasling maize after grain setting, and feeding it to oxen
• Tethering oxen near crop field
• Habit of keeping manageable number of animals
• Oxen are in most cases bought during the cropping season and used for plowing, then fattened and sold for beef.

• Traditional milk marketing system of Hararghe women called Afosha. This is a culture of forming a women’s group of three whereby each day a member of the group will collect milk from all members and sell it, and use the money for its own. Other members will wait their turn. Each day each woman contribute an equal amount of milk to the group.
• Practice of feeding Fenugreek to highly emaciated oxen who fail to respond to fattening, is suggested by Babile farmers.
• Better understanding of Hararghe farmers about fattening oxen.
• Animal centered cropping system: planting sorghum/maize as a sole crop, or intercropped with haricot bean (in the highlands), or ground nut (in the low lands) or chat during the main rainy season in all agro ecologies is targeting animal feed production. In the high lands, highland crops such as barley, wheat and teff are planted in small quantity, or planted during the short rainy season.
• The feeding habit of Hararghe farmers is based on sorghum and maize and will not contradict to the fattening practices.
• There is introduction of urea treatment techniques in some areas
• Trainings are being offered to farmers in training centers.
• The use of sorghum and maize leaves, seedlings and stovers by farmers in the Raya-Azebo district could create a possibility to adopt Hararghe farmers to fattening packages with some market oriented approach. Farmers using such feed resources has to target animals to be marketed following the end of the main rainy season.
4. CONCLUSION

During the focus group discussion with farmers and experts, it was pointed out that free grazing was one of the factors known to contribute to land degradation, soil erosion and reduced water percolation. Besides, such a system of grazing created a conducive environment for disease transmission, exposure to internal and external parasites, uncontrolled breeding which could result in high degree of inbreeding, poor grass growth due to over grazing and trampling by animals, dominance of increasers in the grazing lands, misuse and over exploitation of grass lands and ultimately loss of resources. Furthermore, it was indicated that free grazing become a bottle neck for any improvement interventions such as reforestation and construction of soil and water conservation structures, planting of forage legumes on soil bands and borders of arable lands. The effect of free grazing on arable lands is formation of crust on the soil. Since livestock graze on crop aftermath they remove all aftermath left after crop harvest which otherwise would have been used to fertilize the soil. Crusts prevent water percolation and enhances run off and soil erosion. Free grazing, however, is believed to have a positive effect on the soil through distribution of manure over the field. FGD participants at different levels underlined the possible problems associated with free grazing.

The implementation of zero grazing in Tigray was started in 2005 cognizant to the above fact, after a Hararghe experience sharing visit by high level officials and experts (personal communication). Then a regional workshop was organized to share the experiences. The participants of the workshop were district level administrators and experts from each district. During the workshop it was decided to arrange successive workshops at district and tabia level to create awareness at all levels and introduce zero grazing. Accordingly, orientation workshops on the importance of zero grazing were organized in each district for district level experts and Tabia cabinets.

This study was conducted after three years of experience on zero grazing and hence experts and farmers during focus group discussion have different opinions about the implementation of zero grazing.

Experts at different levels have underlined the importance of zero grazing. For instance, experts from Ofala district explained that: “Whether we believe or not we have to adopt zero grazing, because environmental degradation is increasing due to overgrazing, high soil erosion and poor water retention etc ... But it needs time. It should not be an activity or program implemented overnight. It should be a process and requires political, institutional and technical support”

On the other hand, majority of focus group discussion participants suggested that though zero grazing has so many advantages, at this moment they are not ready to implement zero grazing. The existing constraints and opportunities are indicated in the following sub-section. For example farmers from Mahbere-selase of Dogua-Temben quoted that: “In principle zero grazing is good for it improves the productivity of livestock, reduces the risk of disease prevalence, reduces uncontrolled breeding and allow children to attend school etc. With free grazing there is no feed for our cattle except loosing their energy by going here and there. Our cattle are tied even without being tied. However, we have not adopted zero grazing because our belief is in livestock number rather than quality, and because of the low level of awareness on zero grazing.”

Some people ask why we tie our animals. It is only the guilty person who is supposed to be tied. This is against the rule of the Bible. People do not listen to what experts say but to what they observe.”

In some study Tabias, farmers have showed interest to implement zero grazing. For instance, FGD participants of Habes Tabia of Atsbi-Womberta district said: “Those who keep a high number of livestock and those who used to take the share of the poor are the ones resisting zero grazing”. Similarly, experts in lowland areas and in small ruminant dominated livestock populations with open browsing species were resisting the implementation of zero grazing as: “It is not possible for Districts like Tanqua-Aberegele to exercise zero grazing. This is mainly because there is high livestock population dominated by shoats, shortage of feeds and watering points for livestock. However, it is possible to practice/start practicing zero grazing in selected potential tabias of the district which has access to irrigation, availability of grazing lands, area closures, and nearby watering points in Tabias like Agbe, Sheka-Tekli, Adi-weyane and Emba- Rafael.” (Experts at Tanqua-Aberegele district.)

Lack of grazing lands and small landholding have forced Hararghe farmers to keep smaller livestock herds and intensify their cropping and grazing systems. Hence, land size and absence of grazing land seems to have implications for the implementation of zero grazing in Hararghe and for not practicing zero grazing in Tigray.

The contribution of livestock to cash income is higher in Hararghe than in Tigray. The farming system in all study areas is mixed crop-livestock production system. However, the degree of interdependence of crops and livestock and the priority given by farmers varies in both areas. In Tigray, crop cultivation is a priority activity and entirely dependent on livestock. Livestock are kept to maintain draught oxen for crop production. However, in Hararghe, the production system, irrespective of agro-ecology, gives priority to livestock by growing sorghum and maize, mainly targeting animal feed. The primary purpose of keeping livestock is for fattening. Moreover, the livestock production system in east and west Hararghe is market oriented. Minimum ox cultivation is exercised and most of the farmlands with perennial crops are cultivated using hand hoeing. Hence, zero grazing has implications with minimum cultivation, livestock productivity and market orientation.

Feed shortage is the main constraint in all study areas. The main coping mechanism during feed shortage (during the dry season) in Hararghe study areas is selling or reducing the herd size. But in Tigray, migration of livestock and use of cactus are some of the options suggested in some of the study areas.

There exist different by-laws to manage communal grazing lands in Tigray. Some of the by-laws ensure the benefit of all community members while others benefit those who have livestock only. These by-laws have to play a role for sustainability and productivity of communal grazing lands and the implementation of zero grazing.

Diverse indigenous cattle, sheep and goat breeds/types do exist in the study areas. Boran and Ogaden cattle breeds which are the most common cattle breed in eastern and western Hararghe are known for their potential as beef animal. The availability of these breeds seems to favor
livestock production in the zones. Diverse livestock breed/types do also exist in Tigray, but their potential for fattening or milk is not known.

The availability of livestock with good body condition in Hararghe market and dominantly with poor body condition in Tigray market is mainly a reflection of the feed and feeding system experienced by farmers before marketing animals. Availability of young bulls in Hararghe market could be associated with the need of farmers to buy draught oxen every year. In Tigray, on the other hand, farmers in most cases rear their own oxen from their herd for draught, which requires long time feeding and keeping high number of herds to maintain the draught oxen.

Livestock marketing is not well developed in the study areas. However, the price of Hararghe Sanga is relatively high due to the high demand in the area and the existence of different abattoirs and live animal exporters around Addis Ababa, Adama (Nazreth), Mojo and Bishoftu (Debre-Zeit).

Marketing milk and milk products could be improved through the introduction of improved dairy cows, adoption of intensive production systems and establishment and strengthening of milk processing and selling cooperatives. Provision of inputs and services related to livestock production are also important in improving the productivity of the livestock sub-sector. The major inputs related to livestock are forage seeds, planting materials, concentrate, medicines, vaccine and improved dairy breeds. The major services are medication, vaccination, artificial insemination, provision of market information and credit.

Though artificial insemination service is provided to all farmers, the provision of the service is not well equipped with the required facilities. Trained manpower and communication facilities, uninterrupted liquid nitrogen and semen supply, better awareness of farmers to heat detection and time of insemination are the prerequisites for successful artificial insemination service. The demand for crossbred cows is associated with the high demand for milk, and the interest of farmers to keep few better yielding cows rather than many unproductive animals.

Building the capacity of agricultural development agents and farmers through exchange visits and trainings based on training need assessment will have important implication for the successful implementation of zero grazing. The availability of farmers training centers in Tigray might be a starting point and a good opportunity for training of farmers and demonstration of proven technologies to farmers.

Provision of credit to small scale farmers in the rural community is one of the most important services for the improvement of livestock production and adoption of intensive livestock management practices. However, the purpose of credit provided by Dedebit Credit and Saving Institute seems to concentrate on the purchase of livestock rather than on supply and enrichment of feeds. Moreover, the current credit utilization does not seem flexible and backed by intensive training and follow-up. Credit availability has to match with the time the farmers need. Delay in credit acquisition might influence the purpose of taking credit by the farmer. Interest rate is reported to be high and farmers complain about the interest rate they are forced to pay for the time elapsed between the BoARD processing the credit and the implementation.
Little or no market information is provided to farmers. As a result farmers do trust and make use of information informally received from colloquis and neighbors, asking traders coming from towns and from discussions during social gatherings in the community/village.

Prices of animals is remunerative during religious festivals such as New Year, Easter, Christmas, Ramadan, Mowlid, etc. However, Tigray farmers do not appear to be targeting these markets in terms of producing better animals than the market demand.

There seems to be a variation in household division of labor in livestock production and marketing between Hararghe and Tigray study areas. In Hararghe, since cattle are tethered near house or farm land, the feeding and herding activities are undertaken by the household head. While in Tigray, since cattle graze freely on communal lands, herding is the responsibility of kids or hired labor.

Some of the opportunities to implement zero grazing in Tigray are availability of by-laws; the habit of closing part of the grazing lands during the rainy season; availability of institutional supports/services; the existing exercise of introducing forage crops (seed, planting materials) and improved cross breed cows: expansion and provision of different services; enrichment of degraded areas through enclosing; crop intensification through the introduction and use of new technologies and inputs; the expansion of irrigation through the construction of dams, river diversion and other water harvesting techniques; establishment of emerging towns/villages that created an opportunity to increase demand to livestock (eg., dairy cows) and livestock products (milk, meat, butter) and the expansion of infrastructures; availability of soil and water conservation practices to rehabilitate hill bottoms, degraded grazing lands and gullies; presence of enclosures.

In western and eastern Hararghe, some of the opportunities for the success of zero grazing are the existence of a certain culture and better awareness of the advantage of zero grazing; favorable cropping system that fits to the animal feeding system; sorghum/maize based farming system during main rainy season targeting animal feed; intercropping of perennial and annual crops, annual-annual (cane cereals with legumes); availability of perennial cash crops in crop lands intercropped with annual crops and intensification of crop production; reliable and remunerative market and market outlet for fattened animals (Harar Sanga); presence of soil and water conservation practices; small livestock number and fattening orientation; habit of using oxen for a short time and then fattened for sale; minimum crop cultivation practices; availability of better performing local breed for fattening (Ogaden and/or Borena breeds).

The constraints for the implementation of zero grazing in Tigray are shortage of feed in both quantity and quality; low level of awareness towards zero grazing; culture of keeping high number of livestock; consider livestock population as saving; undeveloped/non-remunerative market for livestock and livestock products; availability of communal grazing areas (encourage farmers to freely graze their animals) and unavailability of appropriate by-laws for using communal grazing areas; giving feeding priority to oxen; watering points; lack of market oriented livestock production; habit of maintaining oxen for a long time and producing oxen from own herd; limited supply of improved dairy cows; problem of system approach (top-down approach) without prior arrangement and awareness creation, assessment of the ground; introduction of zero grazing at household level (not kushet/Tabia based); lack of closure areas enrichment program.
with forage crops; conflicting package of livestock technologies (de-stocking/restocking); poor utilization of grazing areas and poor grazing system; limited introduction of cactus in the lowlands; limited closure areas and soil and water conservation activities; insufficient road networks; markets and market information system not well developed.

The major challenges in zero grazing of Hararghe areas were reported to be undeveloped rural market and road networks, long distance of market places; no processing of animal products to maximize income of farmers (value adding); not sufficient forage production; the expansion of pervasive weeds such as partinium and striga.
5. **RECOMMENDATIONS**

The recommendations are drawn based on the analysis of existing opportunities, challenges and review of available good practices and experiences on zero grazing within and outside the study areas. In order to successfully exercise zero grazing the introduction process has to be based on available good practices. Therefore, the study team has suggested the following recommendations.

**Forage development**: Introduction of zero grazing must be preceded by the introduction of forage development activities, rehabilitation of grazing lands through over sowing, reseeding and weeding, and closing and enriching hill sides and degraded gullies with forages that are adaptable to the specific conditions and provide high biomass production.

**Awareness creation**: Awareness creation to farmers and experts at different levels through provision of intensive training, experience sharing and visits to successful zero grazing practices, strengthening farmers training centers and development of pilot learning sites as demonstration plots in potential areas is a key for the successful implementation of zero grazing. Demonstration of “Hararghe fattening packages” to areas with similar agro-ecology and farming system in Tigray like Raya-Azebo could be one alternative for promoting zero grazing.

**Participatory planning and implementation strategy**: Involving the local administration and opinion leaders during planning and implementation of programs and participation of the community and other relevant stakeholders during planning and implementation of zero grazing.

**Policies and by-laws**: Facilitating and strengthening applicable by-laws on how to use communal grazing lands and rights to use grasses grown on these communal areas that favor zero grazing and protect the application of by-laws. Moreover, the grazing use right of poor farmers of the community who have no oxen to benefit from the communal grazing areas should be included. High number of livestock population is one of the constraints for the implementation of zero grazing in Tigray. Therefore, avoiding conflicting programs that are not consistent with zero grazing practices, for example the livestock package on credit that increases the local livestock breeds in areas that are exercising zero grazing.

**Provision of institutional support**: Continued support from both government and non-governmental organizations in research and development aspects is needed for the introduction and implementation of zero grazing. Intensification of artificial insemination and health services through training of farmers or promotion of private enterprise to provide service and provision of inputs (such as planting materials, seeds, better performing breeds on credit based upon the demand of the farmers) should be intensified. Already practicing farmers should be strengthened through providing preferential treatment, protecting local bylaws, providing inputs, training, crop intensification through promotion of technologies and expansion of irrigation, forage development and enrichment, market development, livestock development, health and AI services.

**Markets and marketing infrastructures**: Creating market opportunity for fattened animals and products and creating value adding activities such as encouraging the establishment of processing
plants to the sector is of paramount importance. Moreover, up-to-date market information on input sources and prices, product prices in different markets, the best time of the day/week/month/year to sell, price trends and seasonality, number and type of buyers operating in different local markets, volume and quality requirements and selling arrangements should be provided. Development of the required infrastructures such as roads, telephone, electricity, markets.

**Intensification:** Crop production should be intensified through the expansion of irrigation, use of inputs and technologies and selection of high value crops. Moreover, developing a habit of fencing crop lands could contribute to the implementation of zero grazing.

**Credit:** credit is required to buy inputs related to animals, small milk processing equipments, crossbred cows, etc. This will help farmers to intensify their production system and exercise zero grazing.

**Reducing herd size (de-stocking):** the livestock holding has to match with available feed. Keeping more animals than the stocking rate dictates or without having sufficient feed reserve will result in animals with poor condition, slow growth rate and ultimately death as a result of emaciation and starvation. The present coping mechanism to feed shortage that farmers practice is through de-stocking or reducing herd size and focusing on oxen and one or two cows. However, it should be based on farmer’s interest. The government can assist farmers in keeping better performing animals. Reducing herd size by selling unproductive local animals and replacing them with better performing crossbred or local (if any) cows will offset the decline in income of the farmer due to de-stocking.

**Change in the cultivation system:** the major problem in the mixed crop livestock production system of Tigray is use of draft oxen for crop cultivation. This entails to keep more herd to maintain a pair of oxen. Thus, use of equines for draft as well as for plowing can improve efficiency of the farming activity by letting equines work longer hours in a year than oxen. Thus one will not need to keep large size of cattle herd to maintain oxen. Furthermore, affordable machineries that can plow land need to be looked into. Since the land holding of farmers is so small, they can buy such machineries to plow their land individually or in a group. Use of single ox or cows for traction has tested for plowing in some parts of Ethiopia. Such technologies could be tested and demonstrated to farmers in Tigray as an option.

**Research:** Ethiopia is not the only country planting forage crop. There are different experiences from Africa and elsewhere in Asia which could be imported and tested for their suitability to our local condition. Such effort has been limited so far and need attention by the government. Besides, different forages have been distributed to farmers as animal feed packages. But the existing trend is that farmers are not aware of the way they should use to feed their animals. Forage legumes planted near homestead appear to grow longer like any other tree nearby. The research and extension system has to fill such gaps. Forage crops differ in adaptability. Thus, selection and testing of varieties appropriate for over sowing and rehabilitation of degraded grazing lands and closures need to be recommended from research.
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