Characterization of Malt Barley based farming system in Bale highlands and West Arsi zone of Oromia, South Eastern Ethiopia

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This study was examined characterization of malt barley based farming system in Bale and West Arsi zones of Oromia regional state. Primary and secondary data were used for the study. Primary data were obtained through interview schedule by well-structured questionnaire. Secondary data were gained from zonal and district offices of agriculture of the selected sites for the study. A multistage sampling technique was employed for selecting 120 household respondents from three districts: Adaba, Dinsho and Gasera. Descriptive statistics were used to analyze data using SPSS software. According to the survey finding the average landholding of farmers in the study area is 3.00ha. Barley production in the study area was decreasing due to its low price as compared to wheat, less availability of improved technologies and weak market linkage to malt factory. It is concluded that malt barley production is viable and profitable in the area if all recommendation is followed and applied accordingly.

Key words: barley production trends, socioeconomic benefits, mechanization and technology, Market linkage

INTRODUCTION

Barley (Hordeum vulgare L.) is one of the main cereal crops produced in the Ethiopian highlands. It grows in the range of 1500–3500 masl, but is predominantly grown between altitudes of 2000 and 3000 masl (HailuGebre and van Leur, 1996). Barley ranks fourth in worldwide production of all cereals (FAO, 2004). Ethiopia is the second largest barley producer in Africa, next to Morocco, accounting for about 25 percent of the total barley production in the continent (FAO, 2014). It is one of the staple food crops in Ethiopia, accounting for 6 percent of the per capita calorie consumption (Shahidur et al, 2015). It is also important in terms of the lives and livelihood of small farmers. In the 2013/14 meher season, about 4.5 million smallholder farmers allocated more than 1 million hectares of land (12 percent of total cereal area) to barley cultivation. Corresponding barley production was about 2 million tons, equivalent to 10 percent of the total cereal production in the country (CSA, 2014).

Barley is an important crop in Ethiopian cereal production and in food security. It is a cool-season crop that is adapted to high altitudes. It grows in a wide range of agroclimatic regions under several production systems. At altitudes of about 3000 masl or above, it may be the only crop grown that provides food, beverages and other necessities to many millions of people. Barley grows best on well-drained soils and can tolerate higher levels of soil salinity than most other crops. Food barley is commonly cultivated in stressed areas where soil erosion, occasional drought or frost limits the ability to grow other crops (Berhanu Bekele et al., 2005). Malting barley, however, requires a favourable environment to produce a plump and mealy grain. The diversity of barley ecologies is high, with a large number of folk varieties and traditional practices existing in Ethiopia, which enables the crop to be more adaptable in the highlands (Fekadu A. et al, 2002).

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Although barley is not among the top cereal crops in Ethiopia, its importance is rapidly growing in terms of production, potential for poverty reduction, as well as for the country’s coffers and the current balance of payment situation. Between 2003/04 and 2013/14, the number of smallholders growing barley increased from 3.5 million to 4.5 million; yields increased from 1.17 metric tons per hectare to 1.87 metric tons per hectare; and total production grew from 1.0 million tons in 2005 to about 1.9 million tons in 2014 (CSA, 2005; CSA, 2014). However, Ethiopia produces mostly food barley, with its share estimated to be 90 percent (Alemu et al., 2014), and remains significantly deficient in malt barley. As a result, while the country has generated a surplus of food barley and has consistently exported a small amount, the net import bill for malt barley jumped from US$240 thousand in 1997 to US$40 million in 2014.

As reported by Mohammed and Getachew (2003) and presented by Ethiopian-Barley-Business (2012) malt barley is among crops demanded in good quantity that lacks supply in which its impact is directly connected with national economy, as Beer Factory import it from abroad with high hard currency. The report of Malt factory indicates that as the share of inland production of malt covers only 35 to 40% and the left 60 to 65% is imported on the behalf of beer factories which exhausting the country’s foreign currency reserves. Similarly in 2011, breweries in Ethiopia imported 60% of the malt primarily from international producers (Ethiopia-Barley-Business-Case presentation, 2012). As indicated by (Shahidur et al. 2015), while the country has generated a surplus of food barley and has consistently exported a small amount, the net import bill for malt barley jumped from US$240 thousand in 1997 to US$40 million in 2014. If this trend continues, Ethiopia’s barley import bill could be as high as US$420 million by 2025.

The area devoted to barley production in Ethiopia over the past 25 years has fluctuated. It was around 0.8 million hectares in the late 1970s, and rose to more than 1 million hectare in the late 1980s. It then declined and remained between 0.8 and 0.9 million hectare until the beginning of the third millennium. The production of barley, by-and-large, has been below 1 million tonne per year for most of the past 25 years, except during the years when the area under barley increased above 1 million hectare. Productivity, however, has never increased above 1.3 t/ha, which is about half the world average.

Malting barley is malted for the preparation of lager, pilsner and other beers. Currently, the major Ethiopian users of malt are the domestic breweries. Their annual demand has not so far been met by the local malt supply, and
consequently, the breweries have long been dependent on heavy importation. While there is immense potential for producing malt barley in Ethiopia, its production is restricted to a few areas, most importantly the Arsi–Bale zones of region areas. Farming system surveys are essential to identify, quantify and prioritize farmers’ production constraints and development opportunities to much research out puts with farmers’ strategies and preferences. Based on this concept this survey was conducted at highlands of Bale (Dinsho and Gasara districts) and West Arsi (Adaba district) in areas which are potential and suitable for malt barley production. According to Bekele et al, 2004, in Ethiopia Bale zone is the second both in barley area and production volume next to Arsi. In Bale more than 30% of the total area allocated for cereal was covered by barley under private peasant holdings and contributes nearly 30% of the total cereal production, whereas the present production land allocated for barley is decreasing. Malt barley improved varieties are introduced to suitable agro-ecologies of Ethiopia funded by Asella Malt Factory to produce the crop in the country in order to save expenditures invested to import the produce from abroad. Its research and extension is going on in satisfactory manner to reach potential areas of production to benefit farmers. Hence, the overall objective of this research characterizing malt barley production system in Bale highlands. More specifically, this study seeks for i) Identifying malt barley production potential of the study areas ii) Identifying problems or constraints related to malt barley production in respective areas iii) Identifying problems or constraints related to malt barley production in respective areas iv) Assessing and identifying possible solutions and intervention to increase malt barley production area in coverage and productivity per unit area.

**METHODOLOGY**

**Selection of the study area**

Bale and West Arsi highlands are known for their potential production of barley in Ethiopia. So that characterization of malt barley study was carried out in purposively selected districts that represent major and potential barley producing environments in both highlands of Bale and West Arsi zones. Accordingly from Bale highlands Dinsho and Gasara districts were selected purposely and Adaba district was selected from West Arsi zone.

**Features of the Study Area**

Bale zone is one of the 18 administrative zones in Oromia regional state which is located in south-eastern Ethiopia. It has 18 districts out of which 9 of them are located in highland agro ecology. The total area of Bale zone is about 63,555 KM2 which is 16.22% of Oromia region. About 10.6% of the land is arable land used for crop production, 24.6% grazing land, 41.8% forest, and others 25% (BZADO, 2012). Most of the districts in Bale highlands are known for their bimodal rainfall patterns and are therefore highly suitable for agriculture. They have two distinct seasons i.e. Belg (from March to July) and Meher (from August to January). About 274,785 hectares of land in Bale zone is cultivated during Belg season while 371,628 hectares is cultivated during Meher season. Total production was 4,631,417 and 7,316,287 quantals during belg and meher 2011/12 respectively.

West Arsi Zone is located approximately at a distance of 251km from Addis Ababa. It shares bounder line with East Shewa zone in the north, SNNPRS in the west, Arsi in the northeast, Guji in the south and Bale zone in the east. Most parts of the zone have elevations of ranging from 1500 to over 2300m. Shashemene town is the administrative center of the zone. It has 11 districts and having the total area of 12409.99km2. Geological Survey shows that about 76.19% of the zone are flat plain, while about 23.81% are ragged or unutilized terrain which including valley, gorges, hills and dissected plateaus (BOFED, 2009).

**Sampling procedure**

Multi stage sampling techniques were used to carry out the data collection. At the first stage, representative districts were purposely identified from both zones. From the identified districts, one district (Adaba from West Arsi zone) and Dinsho and Gasara districts from Bale highlands were purposively selected based on their barley production potential as located on (figure 1) above. At the second stage, two peasant associations (PAs) were randomly selected from the district. And accordingly, six PAs were selected and used for the survey. At the final stage of sampling procedure, lists of household heads (HHH) with in a PA (peasant association) was made and total of 120 household heads from all districts were selected by simple random sampling technique with PPS (probability proportional to size).

**Data types and collection methods**

The data used for this study were collected from both primary and secondary sources. Primary data pertaining to demographic and socio-economic characteristics, participation in agricultural extension activities of farmers, access to institutions and infrastructure and crop management, access to agricultural inputs, trends of barley production and constraints of barley production were collected from sampled farm households using structured questioner. Close field supervision of the process of the data collection and on spot checking and correction of major mistakes in data-recordings have been made by the investigator together with the respondents while data were being collected and necessary correction had been made.

To supplement the primary data results secondary data was also gathered from concerned Zonal and District Bureaus of Agriculture and Rural Development offices and from published and unpublished sources.
Table 1. Socioeconomics characteristics of the respondents

<table>
<thead>
<tr>
<th>Socioeconomics Characteristics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no education</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>junior (5-8)</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>Secondary</td>
<td>19</td>
<td>23.75</td>
</tr>
<tr>
<td>primary (1-4)</td>
<td>25</td>
<td>31.25</td>
</tr>
<tr>
<td>Age of hh head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>31-40</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>41-50</td>
<td>17</td>
<td>21.25</td>
</tr>
<tr>
<td>&gt;50</td>
<td>23</td>
<td>28.75</td>
</tr>
<tr>
<td>Farming experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6-10</td>
<td>9</td>
<td>11.25</td>
</tr>
<tr>
<td>11-15</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>16-20</td>
<td>29</td>
<td>36.25</td>
</tr>
<tr>
<td>21-30</td>
<td>18</td>
<td>22.5</td>
</tr>
<tr>
<td>&gt;31</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: Survey result

Data analysis

The quantitative and qualitative data collected through questionnaire based survey were subjected to Statistical Package for Social Sciences (SPSS) program and analyzed using appropriate descriptive statistics.

Results and Discussions

Socioeconomics and Demographic Characteristics

The socio-economic and demographic characteristics of farm households play key roles in the agricultural performance of certain areas since they influence the adaptive behaviour of technologies, resource use and decision making. In this study, the most important socio-demographic characteristics of the sample households are categorized into personal and household characteristics. Some of the most important personal characteristics considered in this study are age, sex, level of education, religion and farming experience of the household head.

Age distribution of Respondents

Age is one of the important characteristics of the community. It reflects on the productivity of the population as it has a bearing on the overall health situation within the community. In developing countries, aged members are more prone to diseases and thus are less productive. It has a bearing on the employment pattern, spatial mobility and quality of work done. Age plays a significant role in any kind of business, particularly in agriculture, because the use of child labor on the farms is quite high.

The variable age of respondents was categorized in three ranges. Accordingly, household heads age that ranges from 20 – 31 was 10%, from 31 – 40 was 40%, from 41 – 50 was 21.25% and who were greater than fifty (>50) was 28.75% (Table 1). These result showed that most respondents of the area falls in the productive age category.

Education Background

Education is one of the influential socio-economic factors which play's essential roles in the lives of the community. The educational level of a person represents the development of character or mental power. It helps the farmers in raising their understanding and the level of acceptance of, or receptivity to, new farming techniques. Educational level of the household head can influence how he or she views the new technologies and new ways of doing business. It can affect whether to adopt or not to adopt a new farming technology. Education can also contribute to decision-making processes that alter the paths people take in life.

Educational level of the sample household heads in three study sites ranges from illiteracy to tertiary levels. The survey result indicated that, the proportion of household heads that were illiterate was 10%, those who were at Junior; secondary and primary education levels were 35%, 23.75%, and 31.25% respectively (Table 1). This statistic depicts that the majority of household heads (90%) were literate, and only 10% of them were illiterate i.e. unable to read and write (Table 1).

Farming Experience

Most farmers who participated on this study have an experience between 16 and 20 years (Table 1). It was believed as farmers experience increased, the knowledge of farmers towards using improved technologies will increase and that can enhance an increase in productivity of agricultural ventures they use for livelihood making.

Crop production pattern

The average area of land holding of respondents was 3.58 hectare for the three districts. Since cereal crops are the majorly produced crops of the study area, farmers allocated more of their land to wheat and barley...
respectively. From there total land the respondents allocated most of their plots for wheat production since Arsi and Bale zones are known as wheat belt of the country (Table 2).

### Barley production Trends

The highlands of Arsi and Bale are among major barley producing areas in Ethiopia. According to Bekele et al., 2004 and (Mengistu et al., 2004), in Ethiopia, Bale zone is the second both in barley area and production volume next to Arsi. In Bale, more than 30% of the total area allocated for cereals was covered by barley under private peasant holdings and contributes nearly 30% of the total cereal production, whereas the present production land allocated for barley is decreasing.

According to this survey finding, barely production is declining through time as farmers indicated because of its low price in market, disease and low yield. The majority of farmers (67.5%) who were interviewed indicated that, the area allocated for barley crop was decreasing. Barley contributes for the major share of daily consumption demand in Bale and West Arsi highlands. Its straw is more preferable than wheat straw for animal feed. However due to its ease of mechanization, yield advantage and marketability of the product; farmers in Bale and West Arsi are producing wheat in large scale than barley. In addition to marketability, profitability and high yielding, mechanization has a significant implication on the response of crop type to be produced. Wheat production is greatly dependent on mechanization especially combine harvester. Even though mechanization can be used for barley production, its large scale production is not important as it is not industrial crop.

The other problem that was the cause for barley crop area shrinkage was lack of improved varieties released by research centers. Based on the survey result there is no/less improved barley technologies that provide increased yield per unit area. Farmers responded that no improved barley varieties were supplied to them. Technology improvement shifts production curve in which production efficiency is coming from technology improvement. So that, farmers prefer to increase area of wheat due to the availability of improved technologies and its market advantage compared to barley. Resource allocation is based on the venture having efficient productivity and better return in market.

### Malt barley production

The research system has produced substantial amount of technologies, information, knowledge and practices. However due to the weak linkage between research, extension, farmers and other development partaker stakeholders, extension, multiplication and utilization these technologies delayed to reach the majority of small scale poor farmers particularly and the growers generally to increase production and productivity and to bring the required impact.

Four improved malt barley varieties (Miscal-21, Holker, Beka and Sabani) were distributed to farmers of the three districts where the study were conducted. Almost all varieties performed well in all districts except knowledge gap in utilization of full package technologies as per the recommendations.

### Information of farmers towards malt barley production

Farmers have acquired information about malt barley from Assela malt factory, Sinana Agricultural Research Center, neighbor districts and Development Agents that were working on their kebele. Farmers stated that, they have got orientation on production knowledge, land preference (soil characteristics suitable for malt barley) and quality importance. Since it has yield advantage over food barley and industrial crop, almost all farmers were willing toward the production of malt barley. Farmers also indicated that if proper agronomic practices and other additional crop management practice were applied according to its recommendation, the yield of malt barley per hectare can be comparable with wheat.

### Malt barley marketing

Availability of efficient marketing system has considerable importance in improving the productivity of agriculture by providing incentives to farmers and raises farmers’ income. It also enables the farmers to produce a particular crop which may provide the best advantage.Farmers’

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### Table 2. Cropping pattern and area of production

<table>
<thead>
<tr>
<th>Types of crops produced</th>
<th>Area in hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Barley</td>
<td>.16</td>
</tr>
<tr>
<td>Wheat</td>
<td>.00</td>
</tr>
<tr>
<td>Field pea</td>
<td>.00</td>
</tr>
<tr>
<td>Teff</td>
<td>.00</td>
</tr>
<tr>
<td>Faba bean</td>
<td>.00</td>
</tr>
<tr>
<td>Emmer wheat</td>
<td>.00</td>
</tr>
<tr>
<td>Linseed</td>
<td>.00</td>
</tr>
<tr>
<td>Maize</td>
<td>.17</td>
</tr>
<tr>
<td><em>Gaayoo</em> (grass pea)</td>
<td>.00</td>
</tr>
</tbody>
</table>

Source: Survey result
household level decision-making process to choose what to plant in crop production is micro decision in relation to some specified farming system but it’s cumulative is what determines the macro level crop diversification or specialization. Helping and simplifying farmers’ complex decision objectives, the result of seeking fin-tuned strategies aimed at poverty-reduction and bringing growth in Ethiopia proposed market oriented agricultural production and commercialization of small-scale agriculture.

Commercialization by itself promotes specialization in production. The principle of farmers specialization and market participation is founded on the Recardian theory of trade, stating farmers participate in trade (sell of agricultural produce in which it has comparative advantage and buy from market a commodity in which it has no comparative advantage) resulting in welfare improvement. These indicates that technology promotion success will come if it is correlated with better market development for the product of technology and important market linkage or synergy of farmers and users of their product is well developed. Technology intervention without sustainable market chain development that benefits all actors involved in the product transaction cannot succeed.

Malt barley production is tied with the vision to have sustainable supply from the side of malt factory and sustainable market from the side of producers. In some peasant associations, especially where the varieties were produced well like Birbirsa in Gasera district, farmers are complaining for lack of marketing. There was lack of accessibility to road in order to transport the produce to the nearest market site or urban area i.e. Gasera. In other peasant associations where the seed was introduced by scaling up program, producers were willing to produce with having good hop and other farmers who didn’t get seed were trying to acquire seed from other farmers and asking for the supply of malt barley.

Even though farmers were highly interested in malt barley production they were feeling unsecured market linkage for their product. The aim of malt factory and other supporting stakeholders that were involved malt barley promotion were to develop malt barley marketing through cooperative and existing unions in the districts. But according to farmers’ response, none of cooperative organizations or unions were involved in malt barley marketing. Farmers responded that, it was difficult to sell their product to malt barley individually since hiring track and paying transaction costs become difficult for them.

District cooperative bureaus and cooperatives available at kebele level were not working on malt barley product marketing according to their agreement with malt factory. This market channel break and lack of mandated institution to handle is on the way of challenging malt barley technology extension and/or scaling up and production.

Farmers expect higher produce as precise more than any agricultural production and expected malt factory to assemble at the site of production. They miss understood the scaling up objective, comprehending it as contractual agreement rather than production option delivered to them. The associated risks are of a polarisation between agribusiness and small-scale farming systems, and a reduction in benefits derived from the enterprise due to problems of market structure may slow the production of malt barley in the study area.

Opportunities of Malt Barley Production in Bale and West Arsi

It seems only natural that barley, one of the first grains used by humans (Wendorf et al., 1979), is the major grain used in various alcoholic beverages, which have become part of social customs and economic endeavour. Barley is the primary cereal used in the production of malt. Malting barley is malted for the preparation of lager, pilsner and other beers. Currently, the major Ethiopian users of malt are the domestic breweries. Their annual demand has not so far been met by the local malt supply, and consequently the breweries have long been dependent on heavy importation. Bale and Arsi highlands have an immense potential for producing malt barley in Ethiopia.

According to the survey result, respondents reveal that malt barley varieties supplied to farmers were high yielder compared to food barley. They replied that, yield of malt barley per hectare can be comparable to wheat crop if appropriate agronomic recommendations were applied. Farmers also added that as malt barley is industrial technology which is suitable to their agro-ecology, they were eager to produce and deliver to market if conditions were arranged for them. Farmers also indicated that compared to food barley, malt barley was resistant to disease and pests that reduce barley production in the study areas. This depicts that, there is potential to produce a quality product with small scale awareness creation of producers at the best quality level demanded by agro-industry.

Constraints of Malt Barley Production in the Study Areas

Weak linkage between farmers and malt factories

The concept of ‘value chain’, integrated end-to-end linkage among stakeholders that add value to the product is little understood. Therefore, market value chain concept is important systematic thinking in which linkage of every concerned institutions participating in value adding activity can bring sustainable and efficient linkage for complete marketing solution. Our farmers were unable to react solely in marketing of malt barley directly to the malt factory due to many other externalities.
Disease and pests

The perception of farmers towards disease and insect pests were also in comparison of occurrence and severity of loss due to disease and insect pests of different crops especially using wheat as a bench mark. Most of the farmers interviewed responded that they are familiar with a pest that is locally known as Meseki (cutworm), an insect that attacks barley seedlings. Farmers have also observed that aphids cause more serious damage under dry conditions, whereby the yield losses may be very high. The participants in the study districts comply on the lack of technologies or knowledge towards technologies controlling barley disease and insect pest (barley shoot fly). Their response confirms research result conducted on the Participatory on farm evaluation of barley production packages in Bale, reported as shoot fly damage to barley seedlings followed by good rain fall allow profous re-growth of tillers and low/no and even better impact on yield (Mengistu et al., 2004). But, an early off set of rain fall will cause 100% yield loss.

Higher costs and shortage of farm inputs

Farmers in the study area indicated that supply of improved varieties of barley was slow and constrains the wide range of production. They also added that the higher price of farm inputs such as fertilizer, pesticides, and combine harvesters leads them to diseconomies of scale. The profit margin acquired by farmers will not encourage them for the production of surplus which was marketable.

CONCLUSION

This study was conducted in Bale and West Arsi zones highlands where are known for their potential production of barley in Ethiopia. So that characterization of malt barley study was carried out in purposively selected districts that represent major and potential barley producing environments in both highlands of Bale and West Arsi zones. Accordingly, from Bale highlands Dinsho and Gasara districts were selected purposely and Adaba district was selected from West Arsi zone. The finding of the study indicated that the average area of land holding of respondents of three districts were 3.58 hectares. Since cereal crops are the majorly produced crops of the study area, farmers allocated more of their land to wheat and barley crops respectively. According to this survey finding, barely production is decreasing through time as farmers indicated because of its low price in market, disease and low yield. The majority of farmers 67.5%) who were interviewed indicated that, the area allocated for barley crop was decreasing.

The research system has produced a substantial amount of technologies, information, knowledge and practices. However due to the weak linkage between research, extension, farmers and other development partaker stakeholders, extension, multiplication and utilization these technologies delayed to reach the majority of small scale poor farmers particularly and the growers generally to increase production and productivity and to bring the required impact. Additionally, prevalence of disease and pests are the major constraints of producing barley in the study area. Weak market linkages between producers and malt factory also constrains the expansion of malt barley production in the study areas.

RECOMMENDATIONS

✓ Seriously review opportunities to re-regulate commodity markets, using progressive supply management that reduces volatility and avoids surpluses, as well as building in social and environmental objectives.
✓ Develop a far better information base on the degree of market transition from bulk commodity/staple production to buyer-driven chains.
✓ There is a need to work on strengthening market channel linkage and stakeholders have to be identified and identify their value in marketing linkage system. This could include rethinking supply chain management in favour of smallholders, and ensuring the inclusion of the standards ‘takers’ in standards-setting processes.
✓ Developing varieties that are resistant to barley shoot fly is still a challenge and needs to be addressed.

REFERENCE


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