Factors Affecting Adoption and its Intensity of Malt Barley Technology Package in Malga Woreda Southern Ethiopia

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Enhancing the probability of adoption and its intensity is not an easy task because there are numerous factors that affect producers' adoption decision. Hence, the study was aimed to investigate the factors that affect adoption and intensity of adoption among malt barley producers in southern Ethiopia. Using random sampling technique, 251 smallholder malt barley producers were selected to collect primary data through semi-structured questionnaires. Descriptive statistics and econometrics model (Tobit model) methods were used for data analysis. The study identified five major malt barley technology packages in the study area. Such practices are; improved seed, seeding rate, fertilizer rate, plowing frequency and row planting. Thus, non-adopter accounted for 7.5% of total sample, partial adopter (50.2%), fully adopter (42.3%) and intensity ranges from 0.12-0.84 for partially adopter and 0.85-0.96 for fully adopter. The results of Tobit model indicated that factors influencing adoption and its intensity are; education, family size, land size, access to credit, membership to cooperative, access to training, access to demonstration, total livestock unit and distance to nearest market. Which are affected farmers adoption decision and intensity of adoption significantly in one or another way. Therefore, government and any development interventions should give emphasis to improvement of such institutional support system so as to achieve wider adoption, increased productivity and income to small scale

Keywords: Adoption, Malt barley, technology package, Tobit Model, Ethiopia.

INTRODUCTION

In most developing countries wide-scale adoption of improved agricultural technologies is perceived as significant pathways to increase agricultural productivity and to decrease poverty this in turn enhances sustainable food and fiber production which is critical for sustainable food security and economic development (Mwangi and Kariuki 2015 and Simtowe et al., 2011). According to Beshir and Wegary (2014), a new agricultural innovation is assumed to offer a pathway to substantially boost production and income. Barley (Hordeum Vulgare) is the one of staple food and subsistence crop in the country; it is annual crop that cultivated in more than 800,000 ha between 2000 and 3500 meter above sea level. Barley classified into food barley and malt barley. Malt barley is an important cash crop for resource poor farmers in Ethiopia (Getachew et al., 2007). Malt barley production in Ethiopia covers about 150,000 ha with an estimated yearly production of 375,000 tonnes. In the country across different region, there are known potential areas for their agro ecology suitability and rich biodiversity to produce malt barley, but they are not producing to expected extent due to observable and unobservable reasons. For instance: Arsi and Bale zones are the known malt barley producers in Oromia region, west and east Gojam, north and south Gondar in Amhara region including Awi zones have been supplying for brewery factory. However, their supply of raw materials (malt barley grain) to brewery
factory is not enough to substitute import from abroad and alone couldn’t able to keep with expanded capacity (Minale et al., 2011). The farmers are unable to supply required amount of malt barley because of personal, demographic, socio-economic, institutional and other factors affecting their production and productivity. This indicates that there is gap between malt barley demand and supply which is unexploited opportunity for small scale farmers to raise their income if their productivity increased. In the study area, despite malt barley is cash crop which helps small scale farmers to raise their income various factors are constraining them from high productivity such as lack of functional and viable seed system, low productivity and impediments in malt grain marketing (CASCAPE, 2012). To solve this problem new malt barley technology package was introduced in different region of the country by CASCAPE project.

In Malga Woreda of Sidama Zone adaptation and demonstration of malt-barley was conducted in 2004 and consequently since 2005 production of the crop was started at farmers’ field (CASCAPE, 2013). With the introduction of new crop varieties, Participatory varietal selection, trial adaptation, training, demonstration, promotion and adoption are the key sequential steps foreseen by the Ethiopian agricultural research and extension system. Even though new malt barley technology package such as improved malt barley seed/varieties, new planting techniques (row planting and spacing) and new management practice (fertilizer application rate, seeding rate, chemical application) were introduced. The adoption and intensity of adoption of malt-barely technology package has not been evaluated. All farmers were not adopting the new technology package because of different adoption behavior and other exogenous factors. Many adoption studies have been conducted in different parts of the country at different times for various commodities and interventions. However, adoption of malt-barley technology package adoption has been less investigated than other crop these days at the country level except some areas specific studied conducted by both national and regional CASCAPE project that is included in the extensive drivers of adoption study (Komen et al., 2016).

Therefore, the aim of this study was analysis of personal, demographic, socioeconomic and institutional factors influencing adoption and intensity of adoption of malt barley technology package. The result of this study can help to develop improved technology diffusion strategies which may play a great role for increasing adoption and intensity of adoption in the study area.

RESEARCH METHODOLOGY

Description of the study area

Malga Woreda is one of the 19 Woreda in Sidama Zone of SNNP Regional State. The Woreda is divided in to 23 kebeles and 3 rural towns. The capital town of Malga Woreda is Manicho which is located at 26 km away from the regional capital, Hawassa and 299km from Addis Ababa. The total land size of the Woreda is 32,651ha of which the cultivated land is estimated to be 18,177 ha of which 6,988 ha used for cereal and enset production (WOA, 2013). Among the food crops, barley is the most dominant crop followed by Irish potato production in the area. Average annual temperature varies from 12.6-20°C. It receives an average annual rainfall ranges from 1201 mm -1600 mm. The Woreda has two agro-ecological zones, namely Dega (78.3%) and Woina Dega (21.7%). Regarding to road accessibility 65.22% of the kebeles are accessible throughout the year, 21.74% of kebeles are accessible only during the dry season of the year while 13.04% of them are inaccessible throughout the year (WOA, 2013). The altitude of the Woreda fall within 1501-3000 mean above sea level. The Woreda has an estimated total population of 109,793 persons, out of which of 55,676 were male while 54, 117 were female (CSA, 2007).

Sampling technique and sample size

This study defines survey population at farm household head level. After the researcher defined target population, the next task was the question of taking representative samples from the population. The research sample design was non-experimental based on purposive for selecting area of the study however random and systematic sampling techniques were used for sample selection. Malga Woreda was selected purposively among the malt-barely producer Woreda and South CASCAPE project intervention area in SNNPR due to its potential for malt-barley production. An important decision that has to be taken into consideration when adopting a sampling technique is about the size of the sample. Appropriate sample size depends on various factors relating to the
subject under investigation like the time and cost aspect, the degree of accuracy desired, etc. (Rangaswamy, 1995). If sample is too small, it might be difficult to achieve objective of inferences whereas when it is too large, it may require excess resource to collect the necessary data. Sample error occurs not because of studying the whole population. However, during sampling period, it is common to miss some helpful information about the population (Levin and Richard, 1989). The higher the desired precision or the level of confidence, the larger (more costly) would be the sample requirement. Sampling theory is of little help in arriving at a good estimate of the sample size in any particular situation (Gupta, 2002).

Therefore, based on this concept two kebeles of Malga Woreda were taken namely Guguma and Gomeshe Tulu purposively since these two kebeles were considered as potential kebeles and consists two malt barley seed producer cooperative and malt barley producers cooperative than the other kebeles in the Woreda. These kebeles are known to supply malt barley to Assela brewery factory based on information from South CASCAPE project. Lastly, sample from total household head of two kebeles were taken by using random sampling technique based on Yamane’s formula from each kebeles at 8% confidence interval.

\[ n = \frac{N}{1+N(e)^2} \quad \text{(1)} \]

Where \( n \) is sample size to be computed, \( N \) is the total size of malt barley producers in the study area, and \( e \) is the level of precision. The minimum level of precision is acceptable at 10%. However, for this study 8% of precision level was used.

Data source and method of data collection

Both quantitative and qualitative data gathered from both primary and secondary sources were used for this study. The interview schedule was administered on 251 sample household heads, which were the main source of the data-collection tool in the research work. Then using the amended structured interview schedule, primary data were collected by using personal interview technique from sampled farmers. The interview schedule was administered by using trained enumerators. In order to increase the reliability of the survey data and to reduce technical and linguistic problems at the farm level; the researcher (the author) spent much time with enumerators during all survey days. Besides primary source, secondary data was taken from Sidama Zone Bureau of Agriculture, SNNPR finance and economic development bureau and other sources such as published and unpublished sources.

Methods of data analysis and model specification

To analyze data descriptive statistics, inferential statistics analysis and Tobit econometric model were applied to meet the objectives of the study. Descriptive statistics applied were percentage, frequency and chi-square (cross tabulation) for discrete variables while mean, standard deviation and one-way ANOVA analysis for continuous variables. The choice of this technique was informed by (Adofu et al., 2007). To analyze determinants of farmers’ adoption behavior in malt-barley technology package in study area Tobit econometric model applied. Tobit econometric model is an extension of probit model and it is one of the approaches dealing with the problem of censored data (Johnston and Dandiro, 1997). Some authors call such model limited dependent variable model, because of the restrictions put on the values taken by the regressand (Getahun Degu, 2004).

Many researchers have used Tobit model to identify factors affecting adoption and intensity of adoption of improved agricultural technologies. To mention some of the researcher, for instance (Nkonya, 1997) used Tobit model to identify factors affecting adoption of improved maize seed and fertilizer in Northern Tanzania. He used area planted with improved seed and area receiving fertilizer as continuous dependent variables for running Tobit model. In the same country (Kaliba et al., 1998) used Tobit model to study factors affecting adoption of maize production technologies particularly maize variety and used proportion of area allocated to improved maize seed as continuous dependent variable. Besides the adoption studies from a broad there is also adoption studies conducted in Ethiopia, (Legesse, 1992) used Probit and Tobit model to identify factors affecting adoption of improved varieties, fertilizer and herbicide. Both of them used probit model to identify factors affecting adoption of improved variety and Tobit model to identify factors affecting intensity of fertilizer and herbicide use. On the other hand (Techane, 2002) used Tobit model to identify determinants of adoption and intensity of use of fertilizer in Ethiopia. In the same line, (Endrias, 2003) and (Getahun, 2004) used Tobit model to assess factors affecting adoption and intensity of adoption of sweet potato varieties and wheat technologies respectively.

Model specification

The econometric model applied for analyzing factors influencing adoption and intensity of adoption of malt barley technology package was the Tobit model shown in equation (Adofu et al., 2007). This model was chosen because, it has an advantage over other adoption models (LPM, Logistic, and Probit) in that, and it reveals both the probability of adoption and intensity of use of malt barley technology package. Following (Maddal, 1992; Amemiya, 1985; Johnston and Dandiro, 1997). Tobit model for the continuous variable adoption index, can be defined as:

\[ Al_{i}^* = \beta_{0} + \beta_{1}X_{i} + U_{i} \]
\[ Al_{i}=Al_{i}^* \text{ if } \beta_{0} + \beta_{1}X_{i} + U_{i} > 0 \]
\[ =0 \text{ if } \beta_{0} + \beta_{1}X_{i} + U_{i} \leq 0 \quad \text{(2)} \]

Where: \( Al_{i}^* \) is the latent variable and the solution to utility maximization problem of intensity of adoption subjected to a set of constraints per household and conditional on being...
above certain limit, \( A_i \) is adoption index for \( i \)th farmer, \( X_i \) = Vector of factors affecting adoption and intensity of adoption, \( \beta \) = Vector of unknown parameters, and \( U_i \) is the error term which is normally distributed with mean 0 and variance \( \sigma^2 \).

**Intensity of Adoption**

**Analytical techniques**

For multiple practices (package), there are two options of measuring adoption; (i) adoption index: measures the extent of adoption at the time of the survey or (ii) adoption quotient: measures the degree or extent of use with reference to the optimum possible without taking time into consideration. In this study, the first option was employed. Accordingly, adoption index which shows to what extent the respondent farmer has adopted the whole set of packages was calculated using the following formula. In order to know the intensity of adoption of malt barley technology package, adoption index of individual farmer was calculated as follows.

Intensity of adoption of malt-barely technology package for those of adopters can be computed using the following formula considering five package components. The adoption index of individual farmers can be computed:

\[
A_i = \sum_{i=1}^{n} \left( \frac{AT_i}{RT_i} \right)
\]

Where \( A_i \) is adoption index of \( i \)th farmer
\( AT_i \) is the level or quantity of input the farmer actually applied
\( RT_i \) is the recommended level or quantity of an input he ought to apply
\( NP_i \) is the number of practice

After summing up for all the elements of the package of recommendations, a maximum obtainable adoption score is fixed at 1 or 100%. Based on the above general formula, the following specific formula was applied for this study:

\[
A_i = \sum_{i=1}^{n} \left( \frac{SA_i + FA_i + PFA_i + MPA_i + MPFR_i + LCCS_i + LCTS_i}{NP_i} \right)
\]

Where \( A_i \) = adoption index of the \( i \)th farmer
\( I = 1, 2, 3...n \) is total number of farmers
\( SA \) = seed applied per hectare and \( SR \) = seed recommended per hectare
\( FA \) = fertilizer applied per hectare and \( FR \) = fertilizer recommended per hectare
\( PFA \) = plowing frequency applied and \( PFR \) = plowing frequency recommended
\( MPA \) = Method of planting applied and \( MPR \) = Method of planting Recommended
\( LCCS \) = land covered by improved seed and \( LCTS \) = land covered by total seed

On the basis of adoption index respondent farmers were classified into three categories, viz., non-adopter, partial and full adopter. Adoption index is thus a continuous dependent variable which is affected by different factors to be investigated.

**RESULTS AND DISCUSSION**

**Demographic and socioeconomic characteristics**

The result presented in Table 1 indicated that 95% of the respondents were male-headed, and the rest 5% were female-headed. This implies that male-household heads have access of adopting malt barley technology package than females who are in most cases restricted to home chores. Similarly, the mean age of household heads was 40.68 years, which implies most of the malt barley producers had more experience in barley production. Likewise, the mean family size and land size of households were 6.80 in man day equivalent and 1.49 ha, respectively. Moreover, on average the total livestock holding in tropical livestock unit was 0.28. This implies that households that owned large livestock have two competing ends, livestock production and crop production. Therefore, they will classify their land for both cases and this may affect adoption decision negatively and significantly. In addition, the majority of respondents (17%) were illiterate. Furthermore, most respondents had no off-/non-farm income source (81%) and no credit source (65%) (Table 1). On the other hand, mean distance to nearest market is 1.63 and mean oxen in TLU is 0.28 while mean labor in MDE is 1.72. Similarly, 65%, 61%, 50.2% and 50.6 has no access to credit, field day, training and demonstration respectively.

<table>
<thead>
<tr>
<th>Continuous Variables</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>40.68</td>
<td>12.93</td>
</tr>
<tr>
<td>Family size in AE</td>
<td>6.80</td>
<td>2.171</td>
</tr>
<tr>
<td>Land size in ha</td>
<td>1.49</td>
<td>0.998</td>
</tr>
<tr>
<td>Livestock number in TLU</td>
<td>5.26</td>
<td>3.89</td>
</tr>
<tr>
<td>Distance in km</td>
<td>1.63</td>
<td>1.130</td>
</tr>
<tr>
<td>Experience in years</td>
<td>14.64</td>
<td>8.914</td>
</tr>
<tr>
<td>Oxen in TLU</td>
<td>0.28</td>
<td>0.642</td>
</tr>
<tr>
<td>Labor adult</td>
<td>1.73</td>
<td>1.19</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Dummy variables</th>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>239</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Education status</td>
<td>Yes</td>
<td>43</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>208</td>
<td>17</td>
</tr>
<tr>
<td>Non-farm income</td>
<td>Yes</td>
<td>47</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>204</td>
<td>81</td>
</tr>
<tr>
<td>Hired labor</td>
<td>Yes</td>
<td>87</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>164</td>
<td>65</td>
</tr>
<tr>
<td>Access to credit</td>
<td>Yes</td>
<td>78</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>153</td>
<td>61</td>
</tr>
<tr>
<td>Participation field day</td>
<td>Yes</td>
<td>125</td>
<td>49.8</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>126</td>
<td>50.2</td>
</tr>
<tr>
<td>Participation training</td>
<td>Yes</td>
<td>124</td>
<td>49.4</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>127</td>
<td>50.6</td>
</tr>
<tr>
<td>Participation demonstration</td>
<td>Yes</td>
<td>73</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>178</td>
<td>29</td>
</tr>
</tbody>
</table>
Determinants of malt barley technology adoption and its intensity

In the study area, malt barley producer’s attempt to adopt different technology package. However, there are various factors that affect producers in selecting the appropriate technology packages. The decision of producers to adoption was determined by various demographic, socioeconomic and institutional factors. The Wald Chi-square statistic was used to test the overall significance of variables. This result implied that the model was significant at 1% level, and the explanatory power of the factors included within the model is satisfactory. The results of model revealed that among sixteen variables such as age, family size, land size, livestock unit, distance, experience, oxen, labor adult, sex, education status, non-farm income, hired labor, access to credit, participation in training, demonstration and field visit included in the model and eight variables such as education of household, livestock unit family size, land size, distance, access to credit, participation in training and demonstration were found to have significant effects on adoption and intensity of adoption (Table 2). The probability of adoption and its intensity were affected by education, family size, land size, participation on training, participation on demonstration and credit access positively and significantly, while Total livestock holding and distance to nearest market had a negative and significant effect.

As expected in the beginning education level of household head was affected the adoption decision and intensity of adoption of farmer in the study area positively and significantly at less than one percent significance level. As participation in formal education/as level of education increase the probability and intensity increased by 5.9 % and 13.7 % respectively (citrus paribus). Our result confirms with studies by (Nzomoi et al., 2007) education of household head affects positively and significantly effects on adoptions of production of horticultural export produce. Also, the studies by (Ozor et al., 2005; Motuma et al., 2010 and Isaiah et al., 2007) confirmed similar results. Family size expressed in adult-equivalent affects the adoption decision of farmers of the study area positively and significantly at 5% significance level. Increase in family size increase adoption and intensity of adoption by 1.8% and 19.5 % respectively (citrus paribus). The result is consistent with the study on adoption of improved maize seed by (Motuma, 2010). Land size of the household was found to be one of the factors that positively influence malt barley technology adoption and intensity of adoption. It was statistically significant at 5% probability level. An increase in land size increase the probability and intensity of adoption of malt barley technology package by 4% and 8.8 % respectively (citrus paribus). Our finding is consistent with earlier study of (Tesfaye et al., 2001). As expected, tropical livestock unit affects the adoption level of farmers negatively. Livestock possession decreases the intensity of malt barley adoption and statistically significant at 1% significance level. An increase in the tropical livestock unit will decrease adoption and intensity of adoption of malt barley technology package by 1.6 % and 15 % respectively (Citrus paribus). Livestock and crops were the two competitive enterprises as a result an increase in the land under malt barley production would decreases land under livestock thereby decrease pasture land which in turn decreases livestock holding. So in our study as expected in the beginning it had negative effect since farmers in the study area those who have large number of livestock unit preferred allocating their land partly or fully for grazing. The reason behind their allocation for grazing is that in study area there is no communal/range land. Our finding is inconsistent with the study of (Solomon et al., 2011). According to his study TLU affects adoption of agricultural technology positively and significantly. The farmers who are near to markets were better adopter than those who are far from the nearest market. Increase in distance from nearest market decrease the probability and intensity of adoption of malt barley technology package by 2.9 % and 9 % respectively (Citrus paribus). Our result agrees with the study by (Isaiah et al., 2007). As the Tobit model result indicates, the variable access to credit had positive and significant influence on the likelihood of adoption of malt barley technology package at less 1% significance level. From this result it can be stated that those farmers who have access to formal credit, from agricultural Office or from cooperative and cooperative farmers (farmers who are members of cooperative) are more probable to adopt malt barley technology package than those who have no access to formal credit. Increases in the probability of adoption and intensity of adoption of malt barley technology package resulting from having access to credit is 12 % and 4.9 % respectively (citrus paribus). In the study area, access to credit is determined by on membership to cooperative to access credit from cooperative and half amount of payment of inputs from the total on hand to access from agricultural office. On the other hand, farmers who are not member of the cooperative cannot use the opportunity. The earlier studies that agree with our result indicating that credit is one of factors that affect the probability of adoption of improved varieties and the quantity of fertilizer farmers apply (Legesse, 1992; Tesfaye and Shiferew, 2001). The attendance in training had positive and significant effect on adoption and intensity of adoption. Since it is one of the means through which farmers get information/knowledge about new technologies. Result of the finding indicated attendance in training was positively and significantly related to adoption of malt barley production package at 10% significance level. An increase in attendance in training increases probability of adoption and intensity of use of malt barley production package by 7.2 % and 5 % respectively (citrus paribus). The implication is that emphasis has to be given to farmers’ training to enhance adoption of malt barley production package. Our finding confirms with the findings of (Tesfaye and Shiferew, 2001) and he reported that participation in non-farm demonstration and attendance of training contributed.
positively to farmers’ adoption decision. Similarly, as expected attendance in demonstration had positive and significant effect on adoption and intensity of adoption. Since it is one of the techniques that extension agents share their skill to farmers and farmers try by themselves. Result of our finding indicated attendance in demonstration was positively and significantly related to adoption of malt barley production package at 5% significance level. Attendance in demonstration increases probability of adoption and intensity of adoption of malt barley technology package by 7.2% and 3.4% respectively (citrus paribus). The implication is that emphasis has to be given to farmers’ demonstration to enhance adoption of malt barley production package. The same findings (Yishak, 2005) in his study of determinants of adoption of improved maize technology in Damot Gale Woreda found that farmers’ participation in demonstration had positive and significant relationship with adoption.

**Table 2: Tobit model estimation for determinants of malt barley technology package**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Change in probability of adoption</th>
<th>Change in intensity of adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education of household</td>
<td>.0597477***</td>
<td>.1372541***</td>
</tr>
<tr>
<td>Land size</td>
<td>.0186395**</td>
<td>.1952941**</td>
</tr>
<tr>
<td>Family size</td>
<td>.0412838**</td>
<td>.0888577**</td>
</tr>
<tr>
<td>Tropical livestock unit</td>
<td>-.0163706***</td>
<td>-.0934921***</td>
</tr>
<tr>
<td>Distance</td>
<td>-.0291361**</td>
<td>.0493359**</td>
</tr>
<tr>
<td>Access to credit</td>
<td>.1205538***</td>
<td>.0456386***</td>
</tr>
<tr>
<td>Participation to training</td>
<td>.0721289**</td>
<td>.0518717**</td>
</tr>
<tr>
<td>Participation to demonstration</td>
<td>.0725387*</td>
<td>.0348644**</td>
</tr>
<tr>
<td>Constant</td>
<td>.2778153***</td>
<td>.3678254***</td>
</tr>
</tbody>
</table>

Log likelihood function = -13.392374

Observation summaries:
LR chi² (19) = 167.30***
19- left censored observation at Adoption index=0
Prob > chi² = 0.0000
232-uncensored observation
Pseudo R² = 0.8620
0-right censored observation

Dependent variables are probability of adoption and intensity; ***, ** and * are statistically significant at 1%, 5% and 10% level of significance, respectively.

**CONCLUSION AND RECOMMENDATION**

The role of malt barley in income generation and food security for smallholder farmers is very high in highland areas of Ethiopia. The production of malt barley among Ethiopian farmers reduces government’s expenditures by substituting import from abroad. Besides income, its straw can serve as both animal feed and as raw material for house construction. Adoption of the malt barley technology packages increases farmers’ incomes and with that they are able to improve their living conditions such as sending their kids to school, improve their housing, diversify their diets, and again invest more of their assets in increasing their productivity even more. These statements were common testimonies by the interviewed farmers, even farmers who did not adopt the full package were clear about the positive effects of the malt barley technology package on their farms and families. Despite its positive contribution, the emphasis given nationally to the malt barley technology package adoption is relatively low compared to other cereals such as wheat, teff and maize. As a result of this, institutional support provided to this sector, such as credit service, research and extension is not to the expected level. These factors together with several household personal, demographic and socio-economic factors greatly affect the adoption of the malt barley technology package and consequently production and productivity of the sub-sector. Broadly speaking three major areas that need policy interventions was identified if the adoption and intensity of adoption of malt barley is to be increased.

Depending on the result of the paper the following recommendations were forwarded: Members have a linkage with Assela malt factory; they have the opportunity of accessing seed and fertilizer, while non-members cannot access these inputs as easily. This may create difference between adopters and non-adopters and even in intensity of adoption among adopters. Again, access to credit was related to membership to cooperatives in the study area. There is no formal ways of obtaining credit except via the microfinance institution. Microfinance institution in the study area provides fertilizer for farmers. It requires half amount of cash up front. But during the production season most of the farmers were unable to provide cash up front and they indicated this as one of the main reasons to deviate from adopting malt barley technology package fully. This shows that it is not unwillingness among farmers, but limited access to inputs which impedes adoption. Moreover, facilitating the use of inputs in terms of establishing appropriate credit mechanisms would also increase the likelihood of adoption of the recommended seed varieties and fertilizer type and recommendations. For this reason, increasing membership to cooperative can open the way for farmers to access input and credit.

**ABBREVIATIONS**

CASCAPE: Capacity building and scaling up for evidence based- best agricultural practice in Ethiopia
CSA: Central Statistical Agency
e: error;
MDE: man day equivalent
n: sample size
N: target population
SNNPR: Southern nation, nationalities and peoples region
SD: standard deviation: SML: TLU: Tropical livestock unit
WoA: Woreda office agriculture

**AUTHORS’ CONTRIBUTIONS**

All authors read and approved the final manuscript.
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COMPETING INTERESTS

The authors declare that they have no competing interests.

AVAILABILITY OF DATA AND MATERIALS

The authors want to declare that they can submit the data at any time based on publisher's request. The datasets used and/or analyzed during the current study will be available from the authors on reasonable request.

CONSENT FOR PUBLICATION

Not applicable.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Ethical clearance letters were collected from Hawassa University. During survey, official letters were written for each district and kebele/villages/informed verbal consent was obtained from each client, and confidentiality was maintained by giving codes for each respondent rather than recording their name. Study participants were informed that clients have full rights to discontinue or refuse to participate in the study. Hence, all participants throughout the research, including survey households, enumerators, the supervisors and key informants, were fully informed of the objectives of the study. They were approached friendly in free moods until the end of this research.

FUNDING

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REFERENCES


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