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Pre-extension Demonstration and Evaluation of Drought Tolerant and Early Maturing Food Barley Varieties in Eastern Hararghe Zone, Oromia, Ethiopia

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ABSTRACT

The study was conducted in Fedis, Gursum, and Chinaksan Districts of East Hararghe Zone with areas of major food insecurity due to the influence of shortage and uneven distribution of rainfall patterns. Introducing drought-tolerant crops is an option to reduce this food insecurity problem. The objectives of this activity were to demonstrate and evaluate the productivity of adapted drought tolerant and early maturing food barley varieties by building farmers' knowledge and skills through training on food barley production and management techniques in farmers' fields at the target areas. The activity was conducted for consecutive two years of the main cropping season. A total of 60 farmers and 4 FTCs (Farmer Training Centers) were involved in the activity duration. Two improved lowland food barley (Aquila and Golden Eye) and local check varieties were used on plot sizes of 10mx10m for all sites. Since the technology was new in the areas, target farmers, Development agents, and experts of the districts were trained before intervention. Awareness creation was done through different extension approaches and materials such as field day, field visits, manuals, and leaflets. The result indicated that demonstrations of improved Food barley varieties of Aquila and Golden Eye recorded higher grain yield (25.3 qt/ha and 23.83 qt/ha) compared to local check (18.2 qt/ha), respectively. The result obtained from the demonstration plot was very encouraging. Moreover, the varieties were identified and ranked based on the criteria set by farmers (Early maturity, yield, Disease tolerance, seed color, seed size, tillering effect, performance throughout the growing stage, and biomass). Therefore, the result indicated that using improved varieties of Aquila and Golden Eye food barley varieties was more advantageous for farmers than using the local ones. As a result, both Aquila and Golden Eye varieties were recommended for more promotion in the area and other similar agroecological situations to reduce the problem of food insecurity.

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INTRODUCTION

Barley is the fourth most important cereal crop in the world after wheat, maize, and rice, and is among the top ten crop plants in the world (Akar *et al*. 2004). Morocco, Ethiopia, Algeria, Tunisia, and South Africa were the top five largest barley producers for the year 2014 with an estimated production of approximately 2.1 million tones,1.7 million tones,1.3 million tones,0.9 million tones, and 0.307 million tons respectively. Barley is cultivated from 1400 to over 4000 m above sea level, and its importance increases in drought-prone areas and at higher elevations (above 2800m), where poor soil fertility, frost, water logging, and soil acidity and degradation are the major yield-limiting factors (Asfaw, 2000). Barley is an important grain crop in Ethiopia and has diverse ecologies being grown from1800 to 3400m altitude in different seasons and production systems (Muluken, 2013) and makes Ethiopia the second largest producer in Africa, next to Morocco, accounting for about 25% of the total barley production in the continent (FAO, 2014). In Ethiopia, the national average yield of food barley was

estimated to be 1.965 and 1.966 t/ha during 2014/15 and 2015/16, respectively. Similarly, an average grain yield of 2.228 t/ha (Oromia), 1.20 t/ha (West Wollega zone), and 1.613 t/ha (Kellem Wollega zone) was obtained (CSA, 2016). The major Market shares of barley in Africa are concentrated in three countries- Morocco, Ethiopia, and Algeria- accounting for 87% of the total barley production in the continent (Bezabeh, 2018).

Traditionally barley is used for making local recipes and drinks such as Injera, Bread, Roast, Porridge, 'Baso', Borde', and other types of food. Its straw is a good source of animal feed (Yosef et al., 2011). About 70% of the land mass of Ethiopia is prone to low rainfall, and genetic improvement for grain yield of different crops under this constraint has been very slow (Mulatu and Grand, 2011). As a result, farmers in dry areas live a precarious existence with few resources and the risk of drought discourages investment in inputs, particularly fertilizer. The national barley improvement program in Ethiopia has been working on barley with more focus on highland areas and can release many varieties to this agroecology. However, limited varieties were released for dry land areas with an average annual rainfall of greater than 500mm (EIAR, 2007). In the case of Fedis, it was uncommon to grow barley in the area. People in the area used to grow local sorghum which took around eight months to mature without rotating year after year. It is known that sorghum canopy coverage is not sufficient enough to protect the upper fertile soil from erratic and unevenly distributed rainfall. Moreover, there was no opportunity for farmers to sow other crops of small cereals such as barley which could help to cope with climatic disasters. Hence, this leads to the deterioration of soil fertility, redundant pest incidence, and crop failure.

Diversifying from the monoculture of traditional staples can have important nutritional benefits for farmers in developing countries and can support a country to become more self-reliant in terms of food production (Smale *et al*., 2003). Diversification can also manage price risk, on the assumption that not all products will suffer low market prices at the same time (Ojasti, 2001). Compared to producing monocultures, management techniques for diversified crops generally consist of more sustainable natural resource practices. Therefore, to address the problems stated above, the extension research team aims to demonstrate and evaluate those selected technologies in farmers' fields. These in turn increase household income and contribute more to food security to alleviate food shortage. Hence this proposal was initiated based on the yield performance of the adaptation trial of Golden Eye and Aquila gave 29.86 and 26 qt/ha respectively.

Objectives

- To evaluate the productivity and profitability of Food Barley varieties under farmers' management.
- To collect farmers' feedback regarding the technologies
- To create awareness of the importance of drought tolerant Food Barley varieties

Materials and Methods

Description of the study area

The project was Gursum, Chinaksan, and Fedis districts of East Hararghe Zone. The zone consists of 19 districts and Harar is the capital town of the zone and is located at a distance of 525 km from the capital city of the country. The agro-climatic range of the Zone includes lowland (*Kola*, 30-40%), midland (*Weyna Dega*, 35-45%), and highland areas (*Dega*, 15-20%), with lowest elevations at around 1,000m a.s.l. culminating at 3,405m, at the top of Gara Muleta mountain. Three districts that classified into three agro-ecological zones such as highlands 5.28%, mid-highlands 44.36% and lowlands 50.36%. The altitude of this district ranges from 1200 to 2950 meters above sea level. The total household head of the district was 28,140 of whom 25,020 were men and 3,120 were women (CSA, 2007). The annual average temperature varies 15^{o}c -24^{o}c. The rainfall is erratic with an annual average ranging from 600 mm to 750 mm. The district has a bimodal rainfall distribution, with a short rainy season from March to May and a heavy primary rainy season from July to September.

Chinaksan is located in the East Hararghe zone of the Oromia region. It has a latitude and longitude of 9°30′N 42°42′E with an elevation of 1816 meters above sea level. Based on figures from the CSA in 2005, Chinaksan has an estimated total population of 11,558 of whom 5,981 are men and 5,577 are women. Fedis district has a latitude between 8°22' and 9°14' North and a longitude between 42°02' and 42°19' East, in middle and low land areas: altitude range is from 1200 – 1600m.a.s.l, with a prevalence of low lands. The area receives an average annual rainfall of 400 - 804 mm. The minimum and maximum temperature of the area is 20 – 25^{o}C and 30 – 35^{o}C, respectively. The population's livelihood mainly consists of agriculture, husbandry, and small-scale trade. The farm units are small family holdings with an average agricultural land area of less than one hectare. Agriculture is mainly rain-fed. The cropping system is classified as intensive with cereal mono-cropping mainly sorghum and maize.

Sites and farmer selection

The activity was conducted in selected districts of East Hararghe Zone for the consecutive two years of the cropping season. Fedis, Gursum, and Chinaksan districts were selected based on the potentiality of food barley production and accessibility for close monitoring. 4 representative potential kebeles were selected purposively in collaboration with Experts and Development Agents of the Agriculture Office based on accessibility and potentiality for food barley production. From each kebele, 1 FRG (Farmer Research Group) member considering gender and youth consisting of 15 farmers was established. 1 FTC from each kebele and 3-4 representative trial farmers from 1 FRG were selected purposively. For this experiment, a 10mx10m area was used for each plot of land.

Table 1: Summary of selected site and farmers with area coverage of the experiment

Districts	kebeles	No. of trial farmers	FTCs	Area covered
Fedis	U/kule & B/Arba	7	2	10mx10m for each plot
Gursum	Ibsa	3	1	
Chinaksan	Yugyug	3	1	
Total		13	4	

Source: Own computation

Research Design

Two improved Food Barley (Aquila and Golden eye) and local check varieties were planted on the plot size of 10mx10m for each site. The spacing of 30 cm between rows and seed rate of 85 kg/ha was used by drilling in the prepared rows. Shallow planting of 2-4 cm depth was used in the presence of ample soil moisture. A fertilizer rate of 85 kg/ha for both NPS and urea was applied. Urea is half at sowing and half at the stem elongation stage. Two effective weeding were applied; one month after sowing and the other two months after sowing. Frequent visiting, monitoring, and provision of technical advice were undertaken by stakeholders

Technology evaluation and demonstration methods

The evaluation and demonstration of the trials were implemented on farmers' fields to create awareness about the Food barley varieties. The evaluation and demonstration of the trials followed a demonstration approach by involving FRGs, development agents, and experts at different growth stages of the crop. The activity was jointly monitored by FRGs, researchers, experts, and development agents.

Data collection

Both quantitative and qualitative data were collected through personal field observation, individual interviews, and focus group discussion using a checklist and datasheet. Types of collected quantitative data were the number of farmers who participated in FRG, yield performance, and the number of stakeholders who participated in training and field days while qualitative data were farmers' perception toward the new technology, awareness created, and farmers' technology selection criteria.

Data analysis

Quantitative data was summarized using simple descriptive statistics such as mean, frequency, and percentage while the qualitative data collected using group discussion, key informant interviews, and field observation was analyzed using narrative explanation and argument. Data from different sources was triangulated to get reliable information.

Result and Discussion

Training provided for stakeholders

Training is the most important component of the extension approach. During this stage, stakeholders are developing knowledge and skills to adapt new practices. The team members involved in the training delivery were research-extension, socio-economic, and crop agronomics. The training was given on improved food barley production, market information and knowledge, skill, and experience sharing, and technology transfer approaches.

Table 2: Type of profession and number of participants in the training at Chinaksan

No.	Participants	Chinaksan		
		Male	Female	Total
1	Farmers	21	7	28
2	DAs	4	0	4
3	District experts	1	1	2
	Total	26	8	34

Source: Own computation

Among the training participant stakeholders, 82.35% were farmers. This showed that most of the training participants were farmers. Of those farmers, 25% are female farmers' participants.

Field day organized

Table 3: Type of profession and number of participants during field days at two districts

No.	Participants	Fedis		Chinaksan		
		Male	Female	Male	Female	Total
1	Farmers	43	10	30	6	89
2	DAs	4	0	3	0	7
3	District experts	3	0	2	0	5
	Total	50	10	35	6	101

Source: Own computation

Different extension materials were utilized and distributed to the participants. 85 leaflets and 40 manuals on the technology organized in Afaan Oromoo and English languages were distributed. During mini-field days and farm visits, different questions, opinions, and suggestions were raised and reacted to by the concerned bodies. Most farmers showed high interest in improved lowland food barley technology production because of better grain yield and earned income by selling seeds for different stakeholders (neighbors' farmers and non-governmental organizations) as compared to the local seeds. All farmers were very interested in having the technology for their future production.

Agronomic and yield performance

The performances of the food barley varieties during their growing season together with their total yields were collected and analyzed. The yield performances for different varieties differed in all districts. The result showed that the grain yield of food barley (qt/ha) ranges from 18.20 to 25.30. Aquila variety gave a higher grain yield (25.30 qt/ha) followed by Golden eye (23.83 qt/ha) and local check (18.20 qt/ha). Both improved varieties used for the experiment showed better mean grain yield in all districts. Independently in the Fedis district, the yield performance of the varieties ranges from 17.60 to 25.90, at Gursum 16.30 to 23.80, and from 20.70 to 26.20 quintal per hectare at Chinaksan district. This indicated that the result obtained from the Chinaksan district was better than the other districts.

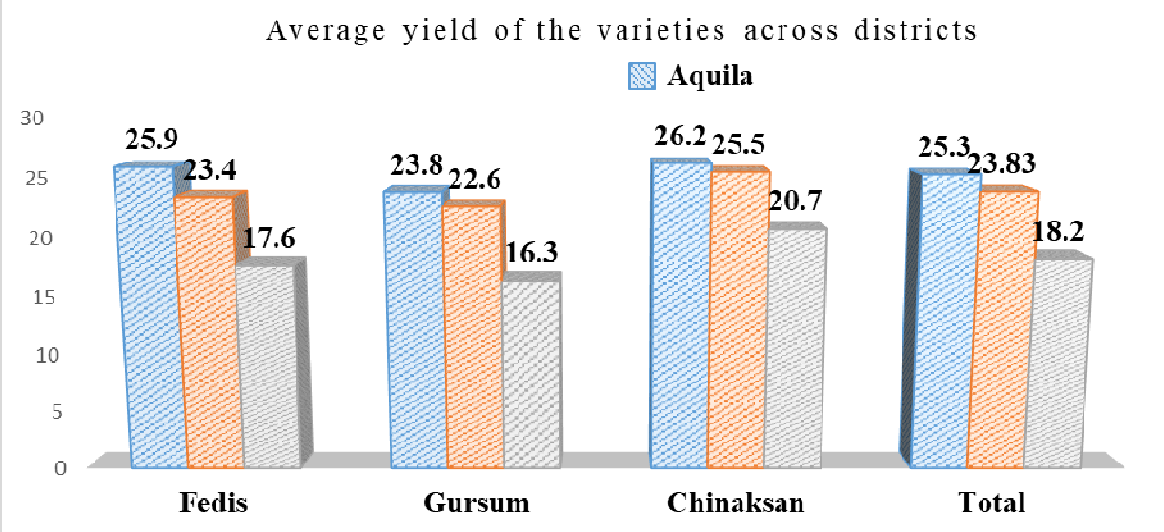

Fig. 1: Yield performance of early maturing food barley varieties across districts.

The percentage increases of the improved varieties over the local check were 39.01 % by Aquila and 30.93 % by Golden Eye under farmer conditions. This showed that improved food barley varieties had advantages over the local check.

Table 4: Summary of yield performance in study areas.

Varieties	Average yield qt/ha	Yield difference	Yield advantage over the local check (%)
Aquila	25.30	7.10	39.01
Golden eye	23.83	5.63	30.93
Local check	18.20	-	-

Source: Own computation

Farmers' perception

Farmers selected the best-performing improved lowland food barley varieties by using their criteria. The major criteria used by farmers were maturity, grain yield, disease, seed color, seed size, number of effective tillers, variety performance throughout the growing stage, and biomass. Based on the above criteria; farmers evaluated the varieties and ranked Aquila first followed by Golden eye variety. Farmers identified that local seed varieties have poor performance as compared to the improved ones.

Table 5: Ranks of the varieties based on farmers' selection criteria.

Crop varieties	Farmers rank	Reasons
Aquila	1st	Early maturity, Very good in yield, Disease tolerance, Good seed color attractiveness feature, Very good seed size, High number of effective tillering, Very good performance throughout the growing stage, Very good biomass yield
Golden eye	2nd	Early maturity, Good yield, Relative to disease tolerance, High seed color attractiveness feature, Good seed size, Good number of effective tillering, Good performance throughout the growing stage, Good biomass yield
Local check	3rd	Early maturity, low yield, low disease tolerance, Good seed color attractiveness feature, Low seed size, Low number of effective tillering, Poor performance throughout the growing stage, Low biomass yield

Table 6: Pair-wise ranking matrix result to rank variety traits.

Code no.	Traits	Early maturity	Overall yield	Disease tolerance	Seed color	Seed size	Tillering capacity	Performance at the growing stage	Biomass yield
1	Early maturity		2	3	1	1	6	1	1
2	Overall yield			2	2	2	2	2	2
3	Disease tolerance				3	3	6	3	3
4	Seed color					5	6	4	4
5	Seed size						6	5	5
6	Tillering capacity							6	6
7	Performance at the growing stage								7
8	Biomass yield								

Table 7: Matrix Ranking of Farmers' Selection Criteria

S. no.	Traits	Frequency	Percentage (%)	Rank
1.	Early maturity	4	14.81	4th
2.	Overall yield	7	25.93	1st
3.	Disease tolerance	5	18.52	3rd
4.	Seed color	1	3.70	6th
5.	Seed size	3	11.11	5th
6.	Tillering capacity	6	22.22	2nd
7.	Performance at the growing stage	1	3.70	6th
8.	Biomass yield	0	00.00	7th
Total		27	99.99	

Conclusion and Recommendation

Food barley is one of the important small cereal crops in the East Hararghe Zone. However, its productivity is low as compared to improved varieties. To address this low productivity, the demonstration was undertaken to implement early maturing food barley technology under farmers' conditions. The result indicated that demonstrations of improved Food barley variety of Aquila and Golden eye recorded higher grain yield (25.30 qt/ha and 23.83 qt/ha) compared to local check (18.20 qt/ha). Suitable and widely accepted improved food barley varieties for the study areas were identified and ranked based on farmers' set criteria. Awareness of the advantages of improved food barley technology for farmers was increased through the promotion of this technology. Using improved varieties of Aquila and G/eye food barley varieties was more advantageous for farmers than using the local ones. Therefore, Aquila and Golden Eye varieties were recommended for more promotion in the area and other similar agro-ecological situations to reduce the problem of food insecurity.

References

[1] Akar, T., M., Avci and F. Dusunceli, 2004. Barley Post-harvest operations. Available at: http://www.fao.org/inpho/content/compend/ text/ch31/ch31.htmRetrieved May 5, 2012.

[2] Asfaw Z. 2000. Genes in the Field: On-farm Conservation of Crop Diversity. Brush SB, editor. Boca Raton: Lewis Publishers. The barleys of Ethiopia. pp: 77–107.

[3] Bezabeh A. 2018. Malt barley commercialization through contract farming scheme: A systematic review of experiences and prospects in Ethiopia. African Journal of Agricultural Research 13: 2957-2971. Link:https://bit.ly/2VEVWMo

[4] Central Statistical Agency (CSA). 2016. Agricultural Sample Reports on Area and Production for Major Crops (Private peasant holdings main season). The FDRE Statistical Bulletin, Addis Ababa, Ethiopia.

[5] Ethiopian Agricultural Research Institute (EIAR) 2007. Crop Technologies Manual, Addis Ababa, Ethiopia. pp: 10-12. Available online http://www.eiar.gov.et.

[6] FAO, 2014. Crop Prospects and Food Situation. No. 4

[7] Mulatu, B., and S. Grando (eds). 2011. Barley Research and Development in Ethiopia. Proceedings of the 2nd National Barley Research and Development Review Workshop. 28-30 November 2006, HARC, Holetta, Ethiopia, ICARDA, PO Box 5466, Aleppo, Syria. pp: xiv + 391.

[8] Mulukenbantayehu, 2013: study on malting barley genotypes under diverse agroecologies of northwestern Ethiopia: Adet Agricultural Research Center, p. O. Box 08, Bahir dar, Ethiopia.

[9] Ojasti, J. 2001. Especies exóticas invasoras. Estrategia regional de biodiversidad para los países del trópico andino. Convenio de Cooperación Técnica ATN/JF-5887-RGCAN-BID. Venezuela.

[10] Smale, M., M.R. Bellon , J.A. Aguirre, I. Manuel Rosas, J. Mendoza, A.M. Solano, R. Martínez, A. Ramírez, and J. Berthaud. 2003. The economic costs and benefits of a participatory project to conserve maize landraces on farms in Oaxaca, Mexico. Agricultural Economics. 29:265–275.

[11] Yosef GH, Kebede T, Senayt W.2011.Achievement of food Barley breeding research for low moisture stressed environment of northeast Ethiopia. Barley Research and Development Ethiopia, 28-30 November 2006 Holetta Agricultural Research Center, Ethiopia