



## Research Article

# Participatory Demonstration and Evaluation of Food Barley (*Hordeum vulgare L.*) varieties at Adami Tulu Jido kombolcha district, Central rift valley of Oromia, Ethiopia

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**Received:** 29 September, 2020

**Accepted:** 29 October, 2020

**Published:** 30 October, 2020

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**Keywords:** Food barley; Demonstration; Pre-extension; Rift valley; Adami tulu; East shoa zone

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## Abstract

Two improved food barley varieties (Gobe and Bentu) were demonstrated along with local check as a follow up of participatory variety selection activity. The objectives were to demonstrate and evaluate the performance of the varieties along with their management practices under farmers' circumstances and to raise farmers' knowledge and skill on food barley production and management practices. Sites were selected in collaboration with respective district agricultural offices. Trainings were given for farmers, Development Agents and experts and other stakeholders. The Participating farmers were also capacitated through follow up exchange visits and field days. Recommended seed and fertilizer rate were used for the demonstration trial establishment. According to the results, there was no statistically significant yield difference between the varieties at ( $p < 0.05$ ). However, both Gobe and Bentu varieties have shown higher yield advantage over local variety showing a yield advantage of 62% and 11.5% over the local variety respectively.

## Introduction

Barley (*Hordeum vulgare L.*) is one of the most important cereal crops in the world. It is widely grown fourth cereal and among top ten crop plants in the world [1]. In Ethiopian context barley is staple food grain. It's especially a major food crop across the Highlands of Ethiopia, where it is grown by approximately 4.1 million smallholder farmers on close to one million hectares [2]. Ethiopia is ranked twenty-first in the world in barley production with a share of 1.2 percent of the world's total production [3] with a national average production of 1.43t/ha [4]. Both malt and food barley are produced in Ethiopia. Barley is the fifth most important crop after teff, maize, sorghum and wheat [2]. Generally, traditionally it is used in different forms such as bread, porridge, soup, and roasted grain and for preparing alcoholic and non-alcoholic drinks. Its straw is also used for animal feed, hatch roofs and beddings.

Although barley is considered a highland crop, it is also grown in marginal and low rainfall areas of the country including the rift valley [5,6]. However, the availability and distribution of rainfall is the major limiting factor for yield in these areas. Thus, farmers in such areas use their own landraces or local varieties that are adaptable but with poor yield ability. Studies also report that critical shortage of improved barley varieties adapted to low-moisture conditions is a major problem; and hence, farmers are forced to grow low yielding varieties [6].

In central rift valley areas of Oromia, Ethiopia, barley is one of the crops under production next to maize, wheat and haricot bean. However, its production and productivity has been affected by different constraints apart from rainfall availability. Some of the constraints include limited knowledge about barley production and unavailability or lack of improved varieties. Studies also point out that barleys mediocre productivity in such areas is primarily due to the use of low yielding local cultivars

in the productive system of biotic and abiotic factors and the minimal use of improved barley production technologies [7]. Despite the constraints there are opportunities for barley production and improving its productivity in such areas. The national agricultural research system of the country have also released different varieties of barley for stress areas though not yet well adopted by farmers.

Basing this opportunity and to alleviate the problem of the dominance of maize in the dry land production system a project with an objective of introducing non-traditional crops in dry land Agricultural Production System using participatory variety selections (PVS) was conducted by Adami Tulu Agricultural Research center in the past years. One of the crops included in the PVS was barley. The PVS has tested four barley varieties namely *Gobe*, *Bentu*, *Diribie* and *HB1307*. *HB1307* was late maturing and highland barley but it is used as a check and also to try out its wider adaptability. From the study, though experiment was affected by severe shortage of rainfall caused by El Nino effect, promising results were found. In addition, with all the challenges, farmers have shown great interest in barley production and on the varieties tried.

Among the tested varieties *Gobe* variety was found outstanding followed by *Bentu* and *Dirbie* for its high grain yield. The late maturing variety *HB-1307* was found low yielding as compared to all varieties. *Gobe* showed relative yield advantage of 32%, 49% and 85% over *Bentu*, *Dirbie* and *HB-1307*, respectively while *Bentu* showed 12% over *Dirbie* and 29% over *HB-1307*.

The study also tried to see farmers' preferences among the tried varieties using matrix ranking. The ranking was done in such a way that farmers were let to rank preferred characteristics they look for in barley varieties first. After ranking the characteristics, the farmers then selected the tried varieties.

Accordingly, farmers ranked yield, seed per spike and early maturity respectively as major characteristics they want barley varieties to possess. Based on these characteristics farmers then selected *Gobe* and *Bentu* varieties, respectively. Therefore, this study was proposed with an objective of demonstrating these farmers preferred and better performing varieties (*Gobe* and *Bentu*) for improving barley production in rift valley areas of Oromia, Ethiopia.

### Objective

- To demonstrate and evaluate the performance of food barley varieties under farmers' conditions
- To enhance farmers' knowledge and skill on food barley production and management

## Material and methods

### Description of the study area

The study was conducted at Adami Tulu Jiddo Kombolcha (ATJK) district of East shoa zone, Oromia, Ethiopia where previous participatory variety selection of barley varieties

was done. ATJK district is one of the districts in central rift valley of Oromia, Ethiopia. Most of the district ranges at an altitude from 1500 to 2300 meters above sea level; Mount Aluto is the highest point. Rivers found in the district include the Bulbula, Jido, Hora Kalio and Gogessa. A survey of the land in this district shows that 27.2% is arable or cultivable, 21.6% pasture, 9.9% forest, 15.7% swampy and the remaining 25.6% is considered as degraded or otherwise unusable ([https://en.wikipedia.org/wiki/Adami\\_Tullu\\_and\\_Jido\\_Kombolcha](https://en.wikipedia.org/wiki/Adami_Tullu_and_Jido_Kombolcha)). The crops produced in the area are mainly maize, haricot bean, wheat, teff and barley.

### Site and farmers selection

The trial was conducted in two kebele's where the previous PVS was conducted. Trial farmers were selected in collaboration with Development agents. Farmers' Research Group (FRG) approach was followed to select and organize farmers. One group per Kebele consisting of 15 farmers was organized considering gender. From each FRG 3 trial farmers were then selected for the trial establishment; taking into consideration their interest to provide a land, previous production history of the crop, interest to involve in group and share his/her experiences.

### Planting material

Two adaptable early maturing barley varieties (*Gobe* and *Bentu*) were used for the demonstration compared with local variety that farmers were using. Planting material (Seed) was prepared in advance before the rainy season. Before planting germination test was conducted and the three varieties had similarity in their germination percentages which is greater than 95%.

### Experimental design and procedures

The experiment was conducted on two Kebele's of Adami Tulu Jido Kombolcha district. The demonstration fields were laid out on six farmer's field in both Kebeles, each having three trial farmers. Two barley varieties were demonstrated side by side along with one local check. The experimental field for each variety including the check was 10 X10m<sup>2</sup>. Farmers were used as replication. Land was prepared by farmer using oxen plow. Seeds were sown at the recommended rate of 85 kg ha<sup>-1</sup> in rows (20cm between rows). Fertilizer rate of NPS 100kg/ha was used. Plots were kept free of weeds using hand weeding to produce a successful barley crop.

### Capacity development

After group formation, different capacity development activities were undertaken. Training was given for the groups of farmers, DAs and SMS to improve their level of knowledge about barley production. Field visits were conducted for farmers to observe each other's field and understand the difference between their management.

### Data collected

Grain yield, costs involved and income gained were collected.

## Data analysis

The collected agronomic and financial data were also analyzed using SPSS and presented using table. Yield advantage of the improved varieties over local check was also calculated using the following formula and presented using table.

$$\text{Yield advantage\%} = \frac{\text{yield of improved variety} - \text{yield of local variety}}{\text{Yield of local variety}} \times 100$$

## Result

### Yield performance of the varieties demonstrated

The following table shows the combined analysis result on yield performance of the varieties demonstrated in the district. According to the result, a mean yield of 17.57 ± 3.28 qt ha, 13.55 ± 3.23 qt/ha and 12.15 ± 2.59 was harvested from *Gobe*, *Bentu* and *local* varieties, respectively. The analysis of variance among the yield of the demonstrated varieties show that the varieties have no statistically significant yield difference at ( $P < 0.05$ ) among themselves (Tables 1,2). Yet, the demonstration result obtained was lower than what was reported during their Participatory variety selection (PVS) stage (ATARC horticulture team, unpublished report) and also similar studies conducted at Dugda district [8]. This yield difference could be associated with the rainfall and management differences among the farmers and their respective districts.

### Yield advantage of the two demonstrated food barley varieties over the local

The following table shows the yield advantage of the demonstrated *Gobe* and *Bentu* food barley varieties over the local barley variety. The yield advantage was calculated using the following formula.

$$\text{Yield advantage\%} = \frac{\text{yield of improved variety} - \text{yield of local variety}}{\text{Yield of local variety}} \times 100$$

Accordingly, the yield advantage calculations show that *Gobe* and *Bentu* varieties have 62 and 11.5% yield advantage over the local variety, respectively Table 3.

In terms of profitability the financial analysis result show that an average return of 14,408.8 and 10,479.00 ETB per hectare can be gained by using *Gobe* and *Bentu* varieties, respectively. Whereas an average return of 9,107.00 can be obtained by using the local variety in one production season in the study areas Table 4.

### Capacity development

During the demonstration, after group formation, different capacity development activities were undertaken. Among which training is one of them. The training was conducted at on station. The training was given for the groups of farmers, and extension workers where a total of 33 participants have participated. The training was intended to enhance participant farmers' knowledge and skill on food barley production and management. Its scope is limited to only creating awareness

about the activity and the improved varieties and did not go up to analyzing the contribution of the training in improving barley yield. The following table describes who were the participants and presented in gender disaggregated form Table 5.

## Conclusion and recommendation

As a follow-up of participatory variety selection (PVS) activity, the results indicated that both varieties demonstrated

**Table 1:** Yield performance of the demonstrated varieties and the local check.

Variety	N	Mean	SD
Gobe	5	17.57 ± 3.28100	7.33654
Bentu	5	13.55 ± 3.23445	7.23245
Local	5	12.15 ± 2.59880	5.81109

**Table 2:** Analysis of variance for grain yield per hectare among the demonstrated barely varieties.

		Sum of Squares	df	Mean Square	F	Sig.
grain yield per ha * variety barley	Between Groups (Combined)	79.252	2	39.626	.850	.452
	Within Groups	559.608	12	46.634		
	Total	638.860	14			

**Table 3:** Yield advantage of improved barley varieties over local varieties at Adami Tulu.

Varieties	Yield advantage (%)
Gobe over local	62%
Bentu over local	11.5%

**Table 4:** Financial Analysis of demonstrated barley varieties along with their local check.

Location: Adami Tulu Jiddo Kombolcha			
Parameters	Varieties		
	Gobe	Bentu	Local
Yield qt/ha (Y)	17.56	13.55	12.15
Price (P)	980	980	980
TR= YxP	17208.8	13279	11907
Variable costs			
Seed cost	900	900	900
Fertilizer cost	1200	1200	1200
chemicals	150	150	150
labor cost	500	500	500
Transport	50	50	50
TVC	2800	2800	2800
Fixed costs			
Cost of land	0	0	0
TFC	0	0	0
TC = TVC+TFC	2800	2800	2800
GM = TR-TVC	14408.8	10479	9107
Profit= GM-TFC	14,408.80	10,479.00	9,107.00

**Table 5:** Gender disaggregated number of training participants.

Training topic	No of participants											Overall total	
	Farmers		Total	DA'S		Total	SMS		Total	Others			Total
	M	F		M	F		M	F		M	F		
Food barley, production and management	15	3	18	1	1	2	2	0	2	10	1	11	33



gave promising yield. They were also found to be profitable and had an extra yield advantage over the local variety. However, there is a lot to be improved in making this varieties feasible to the farming communities by decreasing the gap between demonstration yield and potential yield of the varieties. Therefore, the research system has to work on releasing more adaptable moisture stress food barley varieties. Yet, until new varieties are made available basing farmers' feed backs and the extra yield advantage of the varieties over the local one *Gobe* is recommended for further scaling up. Yet, *Bentu* is also an additional variety which can be used for further scaling up activities.

## References

- Akar T, Avci M, Dusunceli F (2004) Barley: Post-Harvest Operations. The Central Research Institute for Field Crops. [Link: https://bit.ly/3mBBmV7](https://bit.ly/3mBBmV7)
- CSA (Central Statistical Agency) (2016/17) Report on Area and Production of Major Crops. Statistical Bulletin 584. Addis Ababa, Ethiopia
- Tefera A, Tefera T (2014) Ethiopian Grain and feed Annual report. Global Agricultural information network. Grain report number ET1401.
- Rashid S, Abate GT, Lemma S, Warner J, Kasa L, et al. (2015) The barley value chain in Ethiopia. Research for Ethiopia's Agriculture Policy (REAP). International Food Policy Research Institute (IFPRI), Washington D.C. [Link: https://bit.ly/3eb3XxB](https://bit.ly/3eb3XxB)
- Debebe S, Alemu T (2011) Achievements of food barley breeding research in Arsi Highlands. 65-72. In: Mulatu B, Grando S. (eds). Barley Research and Development in Ethiopia. Proceedings of the 2<sup>nd</sup> National Barley Research and Development Review qorkshop. 28-30 November 2006, HARC, Holetta, Ethiopia. ICARDA, PO Box 5466, Aleppo, Syria xiv + 391.
- Shegaw D (2017) Adaptations of Exotic Barley Genotypes to Low-moisture Environments in Southern Ethiopia. Greener Journal of Agricultural Sciences 7: 126-131. [Link: https://bit.ly/35J1p68](https://bit.ly/35J1p68)
- Mulatu B, Lakew B (2011) Barley research and development in Ethiopia – an overview. 1–16. In: Mulatu B, Grando S (eds). 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. xiv + 391. [Link: https://bit.ly/3oC1M15](https://bit.ly/3oC1M15)
- Lule D, Daba C, Shenkute B, Ahimed K, Abebe Z, et al. (2017) Oromia Agricultural Research Institute workshop proceeding on adaptation and generation of agricultural technologies. 173. [Link: https://bit.ly/2HMhRui](https://bit.ly/2HMhRui)

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**Citation:** Gemechu T, Tadesse F, Sultan H (2020) Participatory Demonstration and Evaluation of Food Barley (*Hordeum vulgare* L.) varieties at Adami Tulu Jido kombolcha district, Central rift valley of Oromia, Ethiopia. Int J Agric Sc Food Technol 6(2): 186-189. DOI: <https://dx.doi.org/10.17352/2455-815X.000072>