Trends in
TAS Agricultural Sciences

OPEN ACCESS

Cluster Based Large Scale Demonstration of Improved Food Barley Technology in Yem and Siltie Zone, Central Ethiopia Region

[1]*Abdirazak Abdala and* [2]*Muhammed Sitote*

[1]*Central Ethiopia Agricultural Research Institute Durame, Ethiopia, Worabe Agricultural Research Center, Agricultural Technology Extension Researcher, Worabe Ethiopia*

[2]*Central Ethiopia Agricultural Research Institute Durame, Ethiopia, Werabe Agricultural Research Center, Plant Breeding Researcher, Werabe Ethiopia*

ABSTRACT

Background and Objective: The Cluster Based Large Scale Demonstration (CBLSD) of food barley was conducted in Deri-Saja Zuria (Yem Zone) and Mirab Azernet Berbere (Siltie Zone) districts. The study aimed to demonstrate improved food barley technology in a cluster scenario. Two food barley potential Kebeles (Jiro and Deri-Tegu) were selected. **Material and Methods:** A purposive method was adopted for the selection of the study area and farmers were selected based on cluster base and their willingness. The study design was cluster-based with a total sample size of 48 farmers'. The potential participants in the field day and training were host farmers, or non-host farmers, development agents, and agriculture office experts. Farmers with land in clusters were chosen based on their willingness. Training, field day, farmer's perception, and yield data were collected and analyzed using SPSS software. **Results:** A popular variety known as HB1307 was demonstrated, together with its production packages. A total of 48 participants received awareness creation training, with 42 being male and 6 being female. A field day was held to demonstrate food barley technology, with several stakeholders participating. As a result, 129 people participated (100 men and 29 women). Regarding to the yield, the improved food barley technology produced an average grain yield of 48.15 and 42.08 quintal/ha in the Mirab Azernet Berbere and Deri Tegu Saja Zuria District, respectively. **Conclusion:** The food barley variety 'HB1307' is the top performing variety in the research region. Therefore, the district extensions should be broadly applicable to the study area community and similar agro-ecologies.

KEYWORDS

Cluster, HB1307, perception, training, field day, yield

INTRODUCTION

Barley is an important food crop in Ethiopia's highlands[1]. Barley (*Hordeum vulgare* L.) has a long history as a domesticated crop, as one of the first to be adopted for cultivation and the crop is now virtually produced worldwide[2]. In Ethiopia, barley is also one of the oldest cultivated crops[3] and currently, it is the fifth most important cereal crop next to maize, tef, sorghum, and wheat with a total area coverage of over

ISSN: 2957-9449 (Online)
ISSN: 2957-9430 (Print)
https://doi.org/10.17311/tas.2025.52.59

Received: 19 Feb. 2025
Accepted: 10 Mar. 2025
Published: 31 Mar. 2025

0.94 million ha of land[1]. These days, it is processed into a variety of foods, including roasted grain, soup, porridge, bread, and powder. During the 2022-2023 production season, barley (food and malt) accounted for 944,401.34 ha of the 9,974,316.28 ha of land allocated for cereals. It produced 18,567,042.76 quintals of grain with a productivity of 19.66 quintal/ha[4]. Area coverage is lower than the global average of 3.095 ton/ha in the Guraghe Zone (9,850.65 ha and 268,605.17 quintals) than in the Siltie Zone (6,177.80 ha and 148,401.07 quintal)[4].

Despite its tremendous economic and nutritional value, production is quite low when compared to other grains (1.2 ton/ha). Many factors led to the crop's low productivity. Low soil fertility, water logging, leaf and grain diseases, pests, weed competition, poor agronomic and crop management practices, and insufficient demonstration of improved varieties are the main contributing factors[5]. Additionally, in barley growing agro-ecologies, one way to improve production for smallholder farmers who have limited access to desired seeds of improved varieties is through better food barley technology transfer[5]. Due to a lack of improved seeds and poor communication between the agriculture and research offices, the rate at which new technology was transferred from research to farmers was severely constrained. One of the factors limiting yield was the low rate of farmers' adoption of modern inputs like fertilizer and improved varieties[6]. In a similar vein, only 0.6% of barley grower farmers used improved seed, and roughly 50% of them applied inorganic fertilizer at a rate of less than 100 kg/ha[7]. Less than 1% of barley growers were using improved food barley varieties, according to Tadesse and Derso[5] findings. This was primarily due to the improved food barley varieties' inaccessibility. Farmers' decisions to use improved technologies are mostly influenced by the technology's characteristics as well as the accessibility and availability of improved seeds parameters[6].

The nation's national and regional research systems have released several varieties and carried out a number of agricultural enhancement research operations in order to address the productivity issue in the study area. In order to increase barley productivity in the midland region of the target Zone, the Worabe Agricultural Research Center (WARC) carried out adaptation trials and a participatory variety selection of the best-performing and high-yielding food barley variety (HB1307). However, farmers have not yet been shown the highly-performing and chosen varieties[8]. In spite of the availability of this variety, most farmers in the Zones do not yet have access to it and continue to use native varieties that have low production and are susceptible to disease. It is most often produced and consumed by subsistence farmers in the highlands of Yem and Siltie Zones, particularly in Deri Saja Zuria and Mierab Azernet District. Lack of better seed types, limited usage of improved production technology, and a significant infestation of rust diseases caused by both edaphic and biotic factors contributed to low production yields in the area. Farmers have minimal experience with enhanced seed varieties and other agricultural inputs; instead, they are familiar with the usage of local cultivators in the area's traditional barley production system. As a result, this activity was begun to show and promote superior food barley technology at big and clustered farms, organizing farmers in groups with its complete package in the highlands of Yem and Siltie Zone, to boost production and productivity.

Objectives:

- To increase awareness among farmers, DAs, and specialists on enhanced maize technology with recommended packages
- To improve maize production and productivity in study areas
- To assess farmers' perceptions and feedback on technology

MATERIALS AND METHODS

Description of study area: This research was carried out in the Mirab Azernet Berbare District of the Siltie Zone and the Deri Saja Zuria District of the Yem Zone during the year 2023/24 growing season. Mierab Azernet Berbare is situated Southwest of Hadiya Zone, Northwest of Guraghe Zone, and East of Mesirak Azernet Berbere District. Yem Zone is a Zone in Central Ethiopia Regional State. The Oromia Region

borders Yem to the West and North, with the Omo River separating it from Gurage to the Northeast and Hadiya to the East. Cereal and Enset are the main crops grown in this region for income. Teff, wheat, barley, and pulses are major cash crops. Butter sales and remittances are two other major non-agricultural sources of income.

Site and farmer selection: Mirab Azernet Berbare from Siltie Zone and Deri Saja Zuria from Yem Zone were selected. The districts were selected based on their potential for food barley production and ease of supervision. In collaboration with the District Agricultural Office and the Extension Department, two potential Kebeles from each district were selected based on their accessibility and potential for food barley production. As a result, Jiro and Deri Tegu Kebele from Mirab Azernet Berbare and Deri Saja Zuria District were selected, respectively. Communication was established in each Kebele between Kebele extension agents and selected farmers who own land in each Kebele cluster, based on their willingness and availability. Each Kebele strictly enforced gender and youth balance. To select sites and farmers, professionals, researchers, and development agents collaborated. Each Kebele covered a total of 15 ha, for a total of 30 ha across the two districts. Each Kebele established a Farmers' Research and Extension Group (FREG) with 20 members, comprising 6 women and 14 men. The FGERs were composed of development agents, Kebele leaders, and participating farmers from each Kebele.

Implementation procedures: Following the selection of farmers, development agents, experts, researchers, and farmers were to participate in a theoretical and practical training session. The 48 participants received training from a multidisciplinary team of researchers from the Worabe Agricultural Research Center (WARC). Discussions on "the relevance of cluster-based labor, suitable agro-ecologies and meteorological conditions for food barley production and management packages, agronomic approaches, the economic and nutritional value of food barley, post-harvest management, and storage facilities" were held among farmers (33), development agents (3), researchers (4), and experts (4). Mirab Azernet Berbare, Deri Saja Zuria District, and Kebele oversaw the timely procurement and delivery of inputs to farmers as part of the implementations. The clusters were adequately ploughed and prepared for planting before the planting date. The improved HB1307 food barley variety was distributed in both districts. For food barley, rows were spaced 20 cm apart. The recommended seed rate of 100 kg/ha was applied by drilling in the prepared rows. Shallow planting of 2-4 cm depth was used when there was enough soil moisture. The prescribed fertilizer rates of UREA 100 kg/ha and NPS 100 kg/ha were used. All NPS was applied at sowing/planting time, while half of the UREA was applied at sowing/planting and the other half was applied when the crop was tillerd. Farmers found in each district prepared their fields adequately before sowing, planted the variety on time, and performed necessary management such as hand weeding and pesticide application.

Responsibility sharing and the method of follow-up: Based on responsibility sharing, all responsible bodies were involved, such as the Worabe agriculture research center, which facilitated logistics and inputs; extension researchers, who helped develop activities and raise farmer awareness at all stages; and Woreda experts and DAs, who provided potential Kebele and model farmers. Following sowing, suitable follow-up was planned and carried out in detail in communication with the concerned parties. Weed management, disease and pest control, data collection, and other relevant tasks are carried out in accordance.

Evaluation and monitoring: For joint monitoring and evaluation, the demonstration sites were supervised at least once every 15 days to check on their progress and identify shortcomings. The evaluation was conducted with researchers, Da, specialists, and farmers at all stages of growth. The cultivar was evaluated at several stages with the participation of farmers. Farmers and researchers took use of opportunities to evaluate cultivars through observation, particularly during germination, flowering, and harvesting.

Data collection methods: Both qualitative and quantitative data will be collected utilizing appropriate approaches such as the Farmers' Research Extension Group (FREG), direct field observation, and measurements. Data on grain yield were collected by sampling a (2×2 m) quadrant. The total number of farmers that participated in extension/promotional activities. The total number of farmers who attended extension/promotional events such as training, field visits, and mini-field days was reported by gender. Feedback on farmers' perceptions of the technology (likes and dislikes) and their preferences for the technology's performance were also identified by ranking the average.

Data analysis methodologies: The acquired data were analyzed using SPSS (version 26), Farmers' preferences data were measured using descriptive statistics such as minimum, maximum, and mean, standard deviation, and a Likert scale (average score). The farmers' preferences were analyzed using a Likert scale, which posits an ordinal scale ranging from poor to outstanding. Each Likert scale response carries a number used to assess farmer preferences. Each of the five responses would be assigned a number value, which was used to assess the preferences under consideration.

RESULTS AND DISCUSSION

Training for stakeholders: A total of 48 participants in Merab Azernet Barbare Woreda and Deri Saja Zuria Woreda received participatory training from a multidisciplinary team of WARC researchers, including breeders, agronomists, pathologists, economists, and agricultural technology extension researchers. Farmers, DAs, and experts from the Woreda-level Agriculture Office were invited to participate in the training and consultation. A multidisciplinary team of researchers from the Worabe Agricultural Research Center provided training to the participants. As shown in Table 1, training was provided on the importance of cluster-based work, agronomic practices of food barley, such as land preparation, seed rate, and fertilizers per ha; chemical applications, safety mechanisms, disease, economic, and nutritional importance of food barley; and post-harvest management. As a result, 48 farmers participated, with 42 being male and 6 being female (Table 1).

Field day organized: At the crop's maturity stage, a field day was organized by inviting several stakeholders such as Worabe Agricultural Research Center management members (16 male, 0 female, total 16), Woreda experts (3 male, 0 female, total = 3), Merab Azernet Barbare Woreda communication media (2 male with no female); DA male 1 with no female; and farmers male 31 female 17 with a total of 70 participants in Deri Tegu Saja Zuria Woreda, Worabe Agricultural Research Center management members (16 male female 0 total 16), Woreda experts (male = 4, female = 1 and total = 4), Mierab Woreda communication media (2 male with no female); DA male 1 and female 1, total 2, and farmers male 23 female 12 with a total of 35 participants. About 129 people (100 males and 29 females) participated in the field day, which was highly interesting, as shown in Table 2. The field day program comprised a field visit, a detailed discussion of the activity, and reflections from farmers and stakeholders on the performance of the variety.

Furthermore, participants agreed on future directions for the seed exchange system, seed collection, and commercialization.

Grain yield of the technology: Production estimates samples were collected from farmers and calculated to estimate the variety's production. As a result, the mean grain yield was provided in Table 3. The descriptive statistics results suggest that the mean yield of food barley was 48.15 and 42.08 quintal/ha in Mierab Azernet Barbare District (Jiro Kebele) and Deri Tegu Saja Zuria District (Deri Tegu Kebele), respectively (Table 3). These findings indicate that the HB 1307 variety has a high production potential in the study area and that the yield produced in the study area was higher than the national yield. As indicated in Table 3, the results show the importance of the districts. This demonstrates the disparities

Table 1: Number of participants during training

Number	Participants	Gender		Total
		Male	Female	
Merab Azernet Barbare Woreda (Jiro Kebele)				
1	Farmers	13	4	17
2	Experts	2	-	2
3	Das	1	-	1
4	Researchers	4	-	4
Deri Saja Zuria Woreda (Deri Tegu Kebele)				
1	Farmers	14	2	16
2	Experts	2	-	2
3	Das	2	-	2
4	Researchers	4	-	4
	Grand total	42	6	48

Table 2: Number of participants during field day

Number	Participants	Gender		Total
		Male	Female	
Merab Azernet Barbare Woreda (Jiro Kebele)				
1	Farmers	31	17	48
2	Experts	3	-	3
3	Das	1	-	1
4	Researchers	16	-	16
5	Woreda communication media	2	-	2
	Total	53	17	70
Deri Saja Zuria Woreda (Deri Tegu Kebele)				
1	Farmers	23	12	35
2	Experts	4	-	4
3	Das	2	-	2
4	Researchers	16	-	16
5	Woreda communication media	2	-	2
	Total	47	12	59
	Grand total	100	29	129

between farmers, DAs, and professionals in terms of field management, communication, and follow-up. As a result, we can conclude that great teamwork and activity both individually and in groups can increase productivity during food barley production in the research area. This means that for the same variety, the grain yield of Mierab Azernet Berbare District is greater than that of the Deri Tegu Saja Zuria District eating barley. This is why the DAs, experts, and farmers in Mierab Azernet Berbare District worked so well together. A similar report has been done in the previous study that supports the current findings (Kemal and Abdala[9], Alemnew[10], Milkias *et al.*[11] and Abebe and Abebe[12]).

Farmer's perception and feedback about the technology: Several farmers gave and put their idea, "the performance of the crop was interesting so that we will continue to plant this variety if we have market demand or linkage". Lack of sufficient market demand was one of our primary challenges, and we attempted to address it through cooperatives, but they were ineffective. For example, one farmer 'Habib Dawud' of Mierab Azernet District, Jiro Kebele stated that before this year; they did not receive the predicted harvest owing to low production and productivity as a result of a lack of superior food barley varieties. This means that before the advent of this technology, they used different varieties, and cluster-based work was unknown in the research area. The farmers were so impressed by the crop's superior performance that they began to express gratitude to the Worabe Agricultural Research Center. Farmers were grateful to the various stakeholders who helped them with their work. Cluster demonstration was a very successful strategy for observably spreading awareness of the new technology. The primary

Table 3: Grain yield of food barley in both districts

Participants	Yield of food barley (HB1307) in Mierab Azernet Berbare District	Yield of food barley (HB1307) in Deri-Tegu District
F1	49.25	42.25
F2	51	42
F3	51.75	41
F4	48.77	43.65
F5	43.5	37.75
F6	45	39.25
F7	52.5	38.15
F8	43	41
F9	49	45
F10	49.6	47.35
F11	48	42.5
F12	47.55	42
F13	47	44
F14	46	41
F15	48	47
F16	50.5	39.5
Maximum	52.5	47.35
Minimum	43	37.75
Average	48.15	42.08
S.D	2.76	2.81

Table 4: Farmers perception of improved food barley technology (n = 31)

		Responses					
Number	Items	Strongly agree	Agree	Disagree	Strongly disagree	Mean score	Rank
1	Grain Yield	31	0	0	0	4.00	1st
2	Early maturity	30	1	0	0	3.87	3rd
3	Spike length	28	3	0	0	3.61	5th
4	Disease resistance	29	2	0	0	3.74	4th
5	Seed per spike	26	5	0	0	3.35	7th
6	Lodging resistance	27	4	0	0	3.48	6th
7	Marketability	31	0	0	0	4.00	1st

feedback and interest of farmers is that working in clusters fosters a sense of teamwork in our work and thinking because, as humans, we all have different ways of thinking and working. As a result, the cluster worked together to support and educate one another in the field.

After feedback from specialists and administrative bodies: According to experts, the improved technique helped farmers boost food barley production and productivity in their region, and the modified variety is a high-yielding variety. Food barley was able to avoid frost and terminal moisture deficits by being planted early. Market connectivity is essential for the region because the food barley variety is not very popular in their local market. They added that they are in charge of bringing the technology to Kebeles and other potential districts. To link consumer marketplaces in the study area, researchers also encouraged farmers to become members of cooperatives.

Farmers perceptions: According to farmers' perspectives, all farmers strongly agree on early maturity, good disease resistance, good quality market demand, and good grain yields (perception score of 4 = very agree, 3 = agree, 2 = disagree, and 1 = strongly disagree) as indicated in Table 4. Other stakeholders indicated that the cultivars have optimal grain size, higher grain yields, good seed-bearing potential, and better flour quality than what they were using previously.

Lessons learnt: Researchers impart scientific knowledge about the whole package of technology, while farmers share their indigenous wisdom with the researchers. Farmers learned about the amount of input utilized per hectare and the spacing between plants and rows. Furthermore, they learnt about the general

techniques of land preparation and harvesting, as well as the study area's planting and harvesting times. Following these processes, the lessons learned from the demonstration were successful, as evidenced by the high output.

CONCLUSION AND RECOMMENDATIONS

Cluster Based Large Scale Demonstration of food barley technology was demonstrated in Yem and Siltie zone. To fill skill, attitude and knowledge gaps; training was given for farmers, development agents (Das) researchers and experts before and during the activity is conducting. Field day was carried out at both Yem and Siltie Zone; to share experiences and promote the technology on participant and non-participant farmers, experts, development agents (Das), and researchers. Communication media like, Debub TV, Halaba TV, Siltie FM and banners were used to promote beyond the study area. Farmers were positively perceived the demonstrated food barley technology and gave positive feedback about the technology in both districts. The strong institutional linkage is needed to sustain the demonstrated food barley technology through developing awareness of extension experts, development agent's farmers. Therefore, agricultural extension subsectors of each respective district should have provided proper technical support to the farmers through development extension methods. Farmers should design sustainable seed exchange mechanisms for better food barley productions in the districts. Indeed, Mierab Azernet Berbare and Deri Tegu (Yem) District can be used food barley variety (HB1307), and recommended for wider production in the study areas and similar agro-ecological settings too.

SIGNIFICANCE STATEMENT

Barley is an important food crop in Ethiopia's highlands. The study aimed to demonstrate improved food barley technology in a cluster scenario. One of the most important points here the Food barley variety 'HB1307' is the top performing variety in the research region. A popular variety known as HB1307 was demonstrated, together with its production packages. Therefore, the district extensions should be broadly applicable to the study area community and similar agro-ecologies.

ACKNOWLEDGMENT

The authors wish to thank the Food System Resilience Program (FSRP) for its financial assistance (grant no. P176167). They also give grateful to Werabe Agricultural Research Center, for their logistical support. The author would also like to thank all of the farmers, researchers, district experts, and Development agents who helped us develop a suitable environment.

REFERENCES

1. Birhanu, A., Z. Tahir, M. Tilahun, M. Tilahun and A. Hailu, 2020. Performance evaluation and adaptation of food barley (*Hordeum vulgare* L.) varieties in the highlands of North Gondar Ethiopia. Am. J. Agric. For., 8: 252-257.
2. von Bothmer, R., K. Sato, T. Komatsuda, S. Yasuda and G. Fischbeck, 2003. The Domestication of Cultivated Barley. In: Diversity in Barley (*Hordeum vulgare*), von Bothmer, R., T. van Hintum, H. Knüpffer and K. Sato (Eds.). Elsevier Science B.V., Amsterdam, Netherlands, ISBN: 978-0-444-50585-9, pp: 9-27.
3. Harlan, J.R., 1969. Ethiopia: A center of diversity. Econ. Bot., 23: 309-314.
4. Abdala, A., 2023. Cluster based large scale demonstration of improved food barley technology in gurage and silte zone, Southern Ethiopia. Ukr. J. Ecol., 13: 50-57.
5. Tadesse, D. and B. Derso, 2019. The status and constraints of food barley production in the North Gondar highlands, North Western Ethiopia. Agric. Food Secur., Vol. 8. 10.1186/s40066-018-0248-3.
6. Asfaw, S., B. Shiferaw, F. Simtowe and M. Haile, 2011. Agricultural technology adoption, seed access constraints and commercialization in Ethiopia. J. Dev. Agric. Econ., 3: 436-447.
7. Aman, S., D. Hordofa and N. Temam, 2024. Pre-extension demonstration and evaluation of improved food barley varieties in Chora and Gechi Districts of Buno Bedele Zone Southwestern Oromia, Ethiopia. Int. J. Food, Agric. Nat. Resour., 5: 114-119.

8. Shibeshi, S. and M. Mekiso, 2022. Performance evaluation and yield stability test of released food barely (*Hordeum Vulgare* L.) varieties in highland areas of Siltie and Gurage Zones. Res. Rev.: J. Biotechnol., 12: 1-10.
9. Kemal, S. and A. Abdala, 2022. Cluster based large scale demonstration of improved malty barley technology in Gurage Zone, SNNPR, Ethiopia. Res. Rev.: J. Crop Sci. Technol., 11: 1-7.
10. Alemnew, W., 2025. Cluster based large scale demonstration and yield gap analysis of food barely variety (HB-1307) in Hula District, Sidama Region, Ethiopia. Global J. Res. Agric. Life Sci., 5: 77-84.
11. Milkias, D., Y. Duguma and S. Gerbi, 2024. Cluster based pre scaling up of improved malt barley technologies: Evidence from West Shewa Zone, Oromia Region, Ethiopia. East Afr. Scholars J. Econ. Bus. Manage., 7: 1-4.
12. Abebe, S. and L. Abebe, 2021. Cluster-based improved malt barley technology demonstration in selected districts of Arsi and West Arsi Zones of Oromia Regional State, Ethiopia. Open J. Plant Sci., 6: 82-86.