

---

## Pre-Extension Demonstration of Improved Durum Wheat Varieties in Growing Areas of Amhara and Oromia Regions of Ethiopia

**Abune Gudeta, Habtamu Geremew, Wubishet Chiche and Mohammed Ahmed**

Ethiopian Institute of Agricultural Research Debre Zeit Agricultural Research Center, P.O.Box  
32. Bishoftu, Ethiopia.

Email: [abunegudeta2006@gmail.com](mailto:abunegudeta2006@gmail.com)

doi: <https://doi.org/10.37745/ijaerds.15/vol10n36472>

Published December 04, 2023

---

**Citation:** Gudeta A., Geremew H., Chiche W. and Ahmed M. (2023) Pre-Extension Demonstration of Improved Durum Wheat Varieties in Growing Areas of Amhara and Oromia Regions of Ethiopia, *International Journal of Agricultural Extension and Rural Development Studies*, Vol.10, No.3, pp.64-72

---

**ABSTRACT:** *In Ethiopia Durum wheat has been traditionally grown on heavy black clay (vertisols) on the residual moisture and recently being grown on light soils under rainfed conditions and it is consumed as leavened bread, common bread, macaroni, spaghetti, biscuits, and pastries. The national average yield is low because of the use of unimproved local cultivars, abiotic and biotic stresses. This research activity was conducted to create demand and awareness on the availability of the newly released varieties and evaluate the performance of the variety under farmers' condition for further wider scaling up of the technology. The study went further to evaluate the preference of farmers concerning the demonstrated technology. Totally, fifty target farmers were selected for the research from ten kebeles of selected Districts. Training was provided for farmers, development agent and District experts. The newly released durum wheat varieties were planted on plots of 10 meter by 10 meter at Farmers' Training Center and on 0.125 hectare of land on farmers' field according to the recommended rate of fertilizer 100 kilo gram per hectare NPS and 150 kilo gram Urea with seed rate of 100 kilo gram per hectare. The results indicated that the highest average yield 3.5 tons per hectare was obtained from Utuba variety at Gelan Arabsa District of Sheger City. Utuba variety was preferred because of its higher yield, big grain seed size, heavy spike, market preference, good tillering capacity and palatable straw for animal feed while Tesfaye variety was preferred first by its disease resistance. Based on the findings, it is recommended that promotion of improved durum wheat varieties can contribute to durum wheat production and productivity improvement.*

**KEYWORDS:** demonstration, durum wheat, improved, Amhara, Oromia

---

## INTRODUCTION

Wheat is an important and most widely cultivated food crop in the world and quantity produced is more than that of any other crop, feeding about 40% of the world population [20]. Durum wheat (*Triticum durum* L.) is a monocotyledonous plant of the Gramineae family of the Triticeae tribe that belongs to the genus *Triticum* [21]. In Ethiopia Durum wheat has been traditionally grown on heavy black clay (vertisols) on the residual moisture and recently being grown on light soils under rainfed conditions [3]. Durum wheat grain is also consumed traditionally in Ethiopia in the form of whole wheat, fermented and leavened local bread. Durum wheat is produced by smallholder farmers in the highlands, where the environmental characteristics range from low to high temperature [7], [12]. The crop is planted late in the growing season to avoid early waterlogging, and it continues to grow during the dry period on residual moisture at altitudes between 1800 and 2800 m.a.s.l [17].

Durum wheat is grown in Ethiopia since antiquity because of its wide adaptation to the different agro-ecologies of the country, and resistance to biotic and abiotic stress. Annually, it occupies 500 thousand hectares. However, the national average yield of durum wheat is low 2.4 t ha<sup>-1</sup>. The use of unimproved local cultivars and biotic and abiotic stresses are partially attributed to the low yield of the crop [19]. Compared to bread wheat, the most common alternative, durum wheat is appreciated by farmers mainly for its resistance to biotic and abiotic stress, better food quality, better weed competition, and straw production. Durum wheat is consumed as leavened bread, common bread, macaroni, spaghetti, biscuits, and pastries. Furthermore, it is particularly suitable for the preparation of certain traditional dishes such as kinche (cracked and boiled grain), genfo (porridge), nifro (boiled grain) and kolo (roasted grain) [5], [15], [16].

Besides the role of grain in traditional food and processed products, durum wheat straw is also greatly appreciated for its high palatability for livestock in the mixed farming systems of the highlands of Ethiopia. The global production of cereals straw, a by-product left after grain harvest, represents an abundant source of biomass for lignocellulosic-based biorefineries [6]. Recently, improved durum wheat varieties have been highly demanded by agro-industries because of their best qualities for fast and tasty foods. Owing to its economic importance, however, both the area under durum wheat production and the national average yield have been lower (2.78 t/ha) compared to the bread wheat production, which is much lower than the potential yields of 8 to 10 t/ha [2]. The agricultural research and extension systems of the country have been making efforts to overcome these challenges and enhance durum wheat yield through the generation of improved varieties along with their management practices. To this end, the Ethiopian Agricultural Research System released 36 improved durum wheat varieties by 2018 [19]. The agricultural extension system has also been demonstrating, popularizing, and scaling-up the improved durum wheat

varieties and the associated input package and management practices using different extension approaches like pre-extension demonstration and popularization.

According to the study of Kansime et al., farmer-to-farmer exchange and information sharing is a good proxy for its perceived value [11]. It is also an indicator of how far - information is likely to spread within any given farming community, giving an estimate of the potential 'reach' for the service in broad terms, although this would need further and more detailed investigation. Despite the efforts made so far to generate and transfer durum wheat technologies, the adoption of these technologies by farmers remains very low [1]. The reason of low adoption was primarily because of the inadequate capacity to multiply source technologies and uncoordinated demand creation demonstration activities. According to Assefa et al.,) moreover, the extension approaches commonly used so far to disseminate the research outputs have not been visible enough to create excitement among the wider community [3]. In order to address some the problems faced by small holder farmers, the Ethiopian agricultural extension system promotes improved agricultural technologies [4]. Hill, suggested that extension will be more efficient in meeting the farmers' information needs if designed with an understanding of the farmers' decision-making processes and search behavior in mind [10]. Improved Durum wheat varieties were released by Debrezeit Agricultural Research Center. The current activity is aimed to demonstrate the newly released durum wheat varieties and their associated management practices.

## **MATERIALS AND METHODS**

### **Description of the Study Areas**

This research was conducted in selected districts of Oromia and Amhara regions of Ethiopia. Shebel Berenta, Minjar shenkora, Gimbichu, Gelan arabsa and Bishoftu Districts were selected for this research. Menjar Shenkora ("Menjar and Shenkora") is one of the districts in the Amhara Regional state of Ethiopia. It is situated at the southern end of the North Shewa zone and shares borders with the Oromia Regional state to the east, south, and west. Shebel Berenta District is located in East Gojam Zone, situated in the North Central Highlands of Ethiopia in the Amhara region. It extends from 10° 15' N to 10° 30' N latitude and from 38° 15' E to 38° 27'. Bishoftu is the Town in East Shewa Zone of Oromia Region. Gimbichu District is also part of East Shewa Zone of Oromia and bordered on the South by Lume District, on the Southwest by Ada'a District, on the Northwest by Amhara Region and on the East by Afar Region. Gelan Arabsa in one of the newly established Districts of the Koye Feche Sub- City of the Sheger City. The former name of the district was Akaki.

### **Site and Farmers Selection**

Based on agroclimatic conditions and the existing potential for Durum wheat production, as well as the accessibility for supervision, representative kebeles were selected from each District in

consultation with development agents and experts. A total of ten kebeles and Farmers' Training Centers (FTCs) were selected from the respective Districts as a demonstration site for the varieties. The selection criteria included the willingness of farmers and accessibility of the sites for technology demonstration. Five target farmers from each kebele were selected for the activity. Farmers those who have willingness to implement and adopt the technology, have suitable and sufficient land. that is 0.125 hectare for each variety per head, proximity to roadsides. The farmer selection was carried out by teams of researchers in collaboration with District agricultural development office experts, development agents of each kebele

### **Implementation Design**

For the activity, Utuba and Tesfaye varieties with their full production packages were demonstrated. Each variety was planted on plots of 10m x 10m at Farmers' Training Centers (FTCs) and 0.125 hectare of land at farmer's plots respectively. The seed was broadcasted at the recommended rate of 150 kg/ha and fertilizer rate of 100kg/ha NPS and 150kg/ha Urea were applied. Standard agronomic practices were followed throughout the growing season. Weeding, fertilizer application, pest and disease management were employed based on the research recommendation.

### **Input Supply and Field Management**

The successful introduction and demonstration of new technologies needs practical enhancement of farmers' knowledge and skills. Therefore, before the implementation of the activity training was provided to farmers, development agents and other agricultural experts of Districts and kebeles. The recommended seed rate of 18.75kg for 0.125 hectare of land from each variety was distributed for target farmers free of charges. Fields were managed by target farmers as per the recommendations for all demonstration plots with guidance and regular follow up by researchers and development agents from land preparation to harvesting stage.

### **Field Day and Experience Sharing Events**

Appreciating the importance of field days to technology adoption, Emerick & Dar, brought forward that the field days increased adoption by 12.2% [8]. Field days and experience sharing events have broader implication not only for the target farmers but also their neighbor communities. These events create an opportunity for farmers to collaborate and exchange information with experts, researchers and amongst each other in the fields. Field days were undertaken at maturity stages to evaluate the performance of the varieties and create awareness on the availability and importance of the technology demonstrated for beneficiaries.

### **Data Collection and Analysis**

Both quantitative and qualitative data were collected through direct field observation and Focus Group Discussions (FGDs). Data on grain yield of the demonstrated varieties, farmers'

preferences and feedback on the demonstrated technology were collected via structured checklist and guide. Descriptive statistics like percentages, mean and frequency were employed to analyze the collected data.

## RESULTS AND DISCUSSION

### Grain yield performance of Durum wheat

The study assessed the grain performance of newly released Durum Wheat varieties *utuba* and *Tesfaye* were compared at FTCs and on farmers' fields in all Districts. The results indicated that the highest grain yield 3.5 t ha<sup>-1</sup> and 3.5 t ha<sup>-1</sup> was obtained from *Utuba* variety during the study season at Gelan Arabsa District of Sheger City while the lowest yield 0.6 t ha<sup>-1</sup> and 1.2 t ha<sup>-1</sup> also recorded from the same varieties *Tesfaye* and *Utuba* respectively at Shebel Berenta District of Amhara region. *Utuba* variety performs better at Gimbichu, Bishoftu and Minjar when compared with *Tesfaye* variety. The findings of Temtme, indicated that *Utuba* variety was released with advantages of grain yield performance ranging from 2.5t ha<sup>-1</sup>-4.5 t ha<sup>-1</sup> on farmers field [19].

Table 1. Grain yield performance of Durum Wheat

Districts	Yield (t ha <sup>-1</sup> ) Vs varieties					
	Tesfaye 2013/14	Tesfaye 2014/15	Average	Utuba 2013/14	Utuba 2014/15	Average
Gelan arabsa	3.6	3	3.3	3.5	3.5	3.5
Gimbichu	1.9	3.5	2.7	2.3	3.5	2.9
Bishoftu	1.6	3	2.3	1.8	4	2.9
Minjarshenkora	1.7	3.5	2.6	2.5	3.25	2.875
Shebel Berenta	0.6	3.4	2	1.2	2.5	1.85

Source: field data, 2021/2022

### Preferences Ranking of the Demonstrated Technologies

According to the research of Gashaw et al., plant height, number of kernels per spike, grain yield per plant and thousand kernel weight had significant positive phenotypic correlation with grain yield [9]. Similarly, Pandey et al., confirmed that plant height, number of tillers per plant and Spike length was found higher in demonstrated wheat variety compared to local check [14]. Considering the farmers' viewpoint and knowledge in the evaluation and selection process of durum wheat varieties ensures that the preferred variety align with their needs and preferences. Participatory variety evaluation was carried out at the maturity stage of the crop by inclusive group of farmers. Farmers were allowed to set their own evaluation criteria like disease resistance, yield performance, seed thickness, weight per spike, market preference, tillering capacity and feed palatability. This is in agreement with the methodology used by Teklay, which was based on farmers' experiences [18]. Farmers had set out their own evaluation criteria second.

A total of seven selection criteria were commonly suggested by group of farmers across study districts. The farmers were asked to rank the demonstrated varieties according to their own ranking criteria. Farmers preferred Utuba variety followed by Tesfaye variety because of its higher yield, big grain seed size, heavy spike, market preference, good tillering capacity and palatable straw for animal feed. Tesfaye variety was preferred first by its disease resistance followed by Utuba. This is in argument with the finding of Mekuriaw & Ahmed, which revealed that the beneficiary farmers stated that the demonstrated durum wheat Utuba variety was found superior to the local cultivar they used to plant because of its long spike, tillering capacity, relative resistance to rust and frost, and grain yield [13]. The authors investigated the performance of Utuba comparing local variety and found that Utuba was more resistant to disease and frost than the local durum wheat variety they used as check. But the current study investigated the performance of Tesfaye and Utuba variety and found that Tesfaye variety was even more resistant to disease than Utuba variety.

Table 2. Preferences Ranking of the Demonstrated Technologies

Selection Criteria	Rank of Demonstrated Varieties	
	Utuba	Tesfaye
Disease resistance	2	1
Yield performance	1	2
Grain seed size	1	2
Weight per spike	1	2
Market preference	1	2
Tillering capacity	1	2
Straw palatability	1	2

Source: Field Data 2021/2022

## CONCLUSION AND RECOMMENDATION

Durum wheat is grown in Ethiopia since antiquity because of its wide adaptation to the different agro-ecologies of the country, and resistance to biotic and a biotic stress. Annually, it occupies 500 thousand hectares. However, the national average yield of durum wheat is low 2.4 t ha<sup>-1</sup>. The use of unimproved local cultivars and biotic and abiotic stresses are partially attributed to the low yield of the crop. The study was conducted to demonstrate the availability of improved Durum Wheat varieties and create demand on the newly released Durum Wheat varieties with their associated management practices so as to increase production and productivity of the crop. Based on the study findings authors recommended that newly released Durum wheat variety demonstration and popularization should be encouraged to enhance the production and productivity of Durum Wheat

## ACKNOWLEDGEMENT

The authors would like to acknowledge Ethiopian Institute of Agricultural Research and Debre Zeit Agricultural Research Center for their coordination and support given for this activity. The authors are also grateful to the host farmers and District as well as kebele development agents for their cooperation throughout the activity implementation.

## REFERENCES

- [1]. Alemu, D. (2011). Farmer-Based Seed Multiplication in the Ethiopian Seed System. Approaches, priorities and Performance. *www.future-agricultures.org. Working Paper 036, December, 13.*
- [2]. Alemu, T., Zegeye, H., Kassa, D., Asnake, D., Solomon, T., & Asefa, A. (2019). *Wheat Product Concepts Validation and Assessment of Dissemination and Utilization Constraints* (Issue 126). Research Report No 126
- [3]. Assefa, A., Derebe, B., Gebrie, N., Shibabaw, A., Getahun, W., Beshir, O., & Worku, A. (2023). Grain yield and quality responses of durum wheat ( *Triticum turgium* L . var . durum ) to nitrogen and phosphorus rate in Yilmana Densa , Northwestern Ethiopia. *Heliyon*, 9(7), e17262. <https://doi.org/10.1016/j.heliyon.2023.e17262>
- [4]. Aweke, C. S., Hassen, J. Y., Wordofa, M. G., Moges, D. K., Endris, G. S., & Rorisa, D. T. (2021). Impact assessment of agricultural technologies on household food consumption and dietary diversity in eastern Ethiopia. *Journal of Agriculture and Food Research*, 4(July 2022), 100141. <https://doi.org/10.1016/j.jafr.2021.100141>
- [5]. Ceglar, A., Toreti, A., Zampieri, M., & Royo, C. (2021). Global loss of climatically suitable areas for durum wheat growth in the future. *Environmental Research Letters*, 16(10). <https://doi.org/10.1088/1748-9326/ac2d68>
- [6]. Danzi, D., Marino, I., De Bari, I., Mastrolitti, S., Petretto, G. L., Pignone, D., Janni, M., Cellini, F., & Venditti, T. (2021). Assessment of durum wheat (*Triticum durum* desf.) genotypes diversity for the integrated production of bioethanol and grains. *Energies*, 14(22). <https://doi.org/10.3390/en14227735>
- [7]. Desta, B. T., Gezahegn, A. M., & Tesema, S. E. (2021). durum wheat in Ethiopia Impacts of tillage practice on the productivity of durum wheat in Ethiopia. *Cogent Food & Agriculture I (Print) (Online) Journal Homepage: <https://www.tandfonline.com/loi/Oafa20>*. <https://doi.org/10.1080/23311932.2020.1869382>
- [8]. Emerick, K., & Dar, M. H. (2020). Farmer Field Days and Demonstrator Selection for Increasing Technology Adoption. <https://www.researchgate.net/publication/339773633>, 103(4), 680–693. [https://doi.org/10.1162/rest\\_a\\_00917](https://doi.org/10.1162/rest_a_00917)
- [9]. Gashaw, A., Mohammed, H., & Singh, H. (2010). Selection criterion for improved grain yields in Ethiopian durum wheat genotypes. *African Crop Science Journal*, 15(1), 25–31. <https://doi.org/10.4314/acsj.v15i1.54407>
- [10]. Hill, M. (2009). Using farmer’s information seeking behaviour to inform the design of

- extension. *Extension Farming Systems Journal*, 5(2), 121–126.  
<http://www.csu.edu.au/faculty/science/saws/afbmnetwork/efsjournal/index.htm>
- [11].Kansiime, M. K., Alawy, A., Allen, C., Subharwal, M., Jadhav, A., & Parr, M. (2019). Effectiveness of mobile agri-advisory service extension model: Evidence from Direct2Farm program in India. *World Development Perspectives*, 13, 25–33.  
<https://doi.org/10.1016/j.wdp.2019.02.007>
- [12].Legesse, Z., Abduselam, F., & Berhanu, H. (2019). Performance Evaluation and Adaptability Study of Durum Wheat ( *Triticum turgidum* var . durum ) Varieties in Moisture Stress Areas of East Hararghe , Oromia. *Agri Res & Tech: Open Access J*, 21(4), 4–7. <https://doi.org/10.19080/ARTOAJ.2019.21.556174>
- [13].Mekuriaw, T., & Ahmed, M. (2022). Promotion of Durum Wheat ( *Triticum turgidum* var . durum ) Technologies Through Cluster-Based Large Scale Demonstration in Potential Growing Areas of Ethiopia. *European Journal of Biophysics* 2022; 10(1): 1-6  
<Http://Www.Sciencepublishinggroup.Com/j/Ejb> Doi: 10.11648/j.Ejb.20221001.11 ISSN: 2329-1745 (Print); ISSN: 2329-1737 (Online), 10(1), 1–6.  
<https://doi.org/10.11648/j.ejb.20221001.11>
- [14].Pandey, N. K., Kumar, S., Tiwari, D., & Somvanshi, S. P. S. (2022). Adoption & yield gap analysis of improved durum wheat technology of HI-8713 ( Pusa Mangal ). *The Pharma Innovation Journal* 2022; 11(10): 1193-1195, 11(10), 1193–1195.
- [15].Saini, P., Kaur, H., Tyagi, V., Saini, P., Ahmed, N., Dhaliwal, H. S., & Sheikh, I. (2023). Nutritional value and end-use quality of durum wheat. *Cereal Research Communications*, 51(2), 283–294. <https://doi.org/10.1007/s42976-022-00305-x>
- [16].Sall, Chiari, Legesse, Ahmed, Ortiz, Ginkel, and B. (2019). Cultivation and Potential Expansion in. *Agronomy*, 9, 1–20. <https://doi.org/doi:10.3390/agronomy9050263>
- [17].Shiferaw, B., Bank, W., Sonder, K., & Smale, M. (2013). *The Potential for Wheat Production in Africa: Analysis of Biophysical Suitability and Economic Profitability Tropical legumes View project Economy-wide Impacts of Technological Change in Agriculture View project* (Vol. 3, Issue August 2015).  
<https://www.researchgate.net/publication/281375711>
- [18].Teklay, Z. T. Y. (2015). Demonstration of improved bread and durum wheat varieties in South Tigray, Ethiopia. *Journal of Resources Development and Management*, 10, 122–127.  
<http://iiste.org/Journals/index.php/JRDM/article/view/24532%5Cnhttp://iiste.org/Journals/index.php/JRDM/article/download/24532/25108>
- [19].Temtme, M. (2018). Durum wheat (*Triticum durum* Desf) Variety “Utuba” Performance in Ethiopia. *Agricultural Research & Technology: Open Access Journal*, 18(3), 5–8.  
<https://doi.org/10.19080/artoaj.2018.18.556063>
- [20].Wardofa, G. A., Mohammed, H., Asnake, D., & Alemu, T. (2019). Genotype X Environment Interaction and Yield Stability of Bread Wheat Genotypes in central Ethiopia. *Journal of Plant Breeding and Genetics*, 7(2), 87–94.



<https://doi.org/10.33687/pbg.007.02.2847>

- [21]. Wolde, T., & Eticha, F. (2016). Trait Associations in Some Durum Wheat (*Triticum durum* L.) Accessions among Yield and Yield related Traits at Kulumsa, South Eastern Ethiopia. *Advances in Crop Science and Technology*, 4(4). <https://doi.org/10.4172/2329-8863.1000234>