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Evaluation and adaptability study of improved bread wheat varieties to irrigated areas of Chiro Districts of West Harerghe Zone, Eastern Ethiopia

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ABSTRACT

Aim: The main aim of this study was to evaluate the performance of improved bread wheat varieties to irrigation.
Materials and Methods: Twelve improved bread wheat varieties were evaluated in randomized complete block design in 2020 offseason cropping to identify and recommend the best fit varities to irrigation farming. Data were recorded on days to maturity, plant height, spike length, hundred seed weight, rust disease and grain yield.
Results: The analysis showed significant differences among varieties for grain yield and some of traits, implying that there was best fit variety for the studied location. ETBW9554, Wane, Shorima and Dendea were top four varieties with high yield scorers, disease tolerance and early mature varieties.
Conclusion: It was concluded that improved bread wheat varieties can be promoted for multiplication and distribution to farmers for irrigation farming system for chiro and its similar agro ecological zones of the West Harerghea of Eastern Ethiopia.

Keywords: Irrigated wheat, grain yield, variety, harerghea

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Introduction

Bread wheat (*Triticum aestivum* L.) is a valuable commodity crop for local, regional and global markets. Ethiopia is a major producer of cereals such as teff, maize, wheat, sorghum and rice and the largest wheat producer in sub-Saharan Africa. The wheat sub-sector is strategic for the Government of Ethiopia (FAO, 2019). The major wheat producing areas are mainly found in the mid-altitude (1900 to 2300 m above sea level) and high-altitude (2300 to 2700 m above sea level) regions of the country that are regarded as high-potential environments due to their high and reliable rainfall (Tadesse *et al*., 2016).Regional production shares are as follows: Oromia (57.4%), Amhara (27%), South Nation Nationality and People (8.7%) and Tigray (6.2%) (CSA, 2018).

In Ethiopia wheat is a major staple crop and is consumed heavily in different forms (FAO, 2019). In the country, wheat has several food uses which can be prepared in modern or culturally processed technique. Ingera is one of the traditional foods that can be prepared by using wheat. Besides, pasta and macaroni can also prepared in industrial processed way (Nigussie et al., 2014). At the same time, wheat straw is commonly used as a roof tacking material and as a feed for animals (Anteneh *et al*., 2020).

Ethiopia is the third largest wheat producing country in Africa, next to Egypt and Morocco. About 1.8 million hectares (ha) of land areas are covered by wheat production with an estimated annual production of 50 million quintals at an average productivity of 28 quintals/ ha, which has been improving constantly over the past 25 years but remains lower than the world average of 33 quintals/ha. Over the last three years, encouraging results have been registered in increasing irrigation-based wheat production. Last year, from the 20,000 ha of irrigated wheat land, about 600,000 quintals of wheat were

harvested. Irrigation-based wheat cultivation piloted in the lowland areas of the country is now being replicated and expanded to the highland areas. Despite increasing wheat production trend in the country, the demand for it has been continuously increasing, and still falls short of satisfying the annual need of the country. The demand for wheat is growing at an average rate of 9% annually, while the local production is growing only at a rate of 7.8%. (https://www.brusselstimes.com/170354/ethiopia-to-boost-irrigated-wheat-production).

Ethiopian wheat yield is still relatively low by global standards. The increasing population size, changing food preference, low wheat production yield due to climate change ,limited storage capacity, lack of demand due to poor quality of local wheat, lack of grade and standardization, existence of crop worm and diseases, shortage and price of input, shortage of infrastructure, subsistence or traditional production system, farmer price cheating by traders and very limited irrigation access are main reasons attributing to the demand and supply gap (Anteneh *et al*.,2020; FAO,2014). Varity development under irrigated areas of Ethiopia is the key to utilize the potential of the Agro-ecology untouched resources to balance is needed (Skovmand *et al*., 2001). Therefore, to minimize the imbalance between supply and demand for wheat, the government is heavily expanding irrigated wheat cultivation throughout the country as this enables to yield more harvest compared to the rainy fed cultivation.

Although different improve irrigated bread wheat varieties were released by the national agricultural research system which are suitable for irrigated agro-ecologies of Ethiopia, adaptability study is not yet conducted on bread wheat production areas of West Harerghea zone using irrigation.

So, it is essential to undertake a quick adaptation trial in the area for selection and promotion of irrigated bread wheat genotypes which are ecological suitable, easily adaptable and economically profitable to enhance the net regional and national crop production. Therefore, the objectives of this study was to evaluate and identify the best performing high yielding and best adapted bread wheat varieties for highland irrigated areas of West Harerghea Zone and to advance for demonstration program.

Materials and Methods

*Experimental locations:*The field adaptation experiment was conducted at West Hararghe zone, particularly at Chiro District (Arberekete kebele) during 2020 offseason cropping using irrigation. Chiro is located at 09005'N latitude and 40088'E longitude at an altitude of 1856 m.a.s.l. It is 328 kilometers far away from Addis Ababa in the eastern part of the country in the Oromia Regional State and where the highland sorghum is intensively and extensively produced by farmers. The area has the average minimum and maximum temperature of 120 c and 230 c respectively and receives 950 mm annual rainfall. The soil type of the experimental station is classified as black Vertisols (Gosa, 2016).

Planting Materials: For this particular study, twelve previously released bread wheat varieties targeted for mid/highland of the country were used.

Experimental Design and Trial Management: The experiment was arranged in a completely randomized block design with two replications at 2020 offseason cropping to evaluate the genotypes. Irrigation interval was every 15 days using furrow method. UREA and DAP fertilizers were applied at the rate of 100 and 50 kg/ha, respectively. UREA fertilizer was applied in split, half at seedling stage and at booting stage while DAP whole at sowing time. Each entry were planted in 3m by 2m plot dimension keeping standard distance between rows(30cm) and 1m between replications.

Data Collection and Statistical Analysis: Data were collected on days to maturity, plant height, spike length, 100 seed weight, yellow rust score and grain yield. The collected data were compiled and subjected to statistical analysis using the appropriate R- software (R version 3.4)

Results and Discussion

Analysis of variance for Yield and Yield Related Traits: The analysis of variance for spike length, days to maturity, yellow rust, plant height, grain yield and hundred seed weight is presented in table 1.The result revealed that there were a significant difference ($p<0.05\%$) among genotypes for spike length. while a highly significant difference ($p <0.001$) were observed on days to maturity, grain yield and hundred seed weight. On the other hand, plant height and yellow rust were non-significant for the tested genotypes (Table 1).

Table 1. Mean values of different traits of bread wheat varieties at Arberekete kebele in 2020 off season cropping

Variety	DM	HSW	SL	GY	YR	PH
ETBW9554	77.5	4	10	5083	1	91.4
Wane	72.5	3.9	8.2	4444	1.5	91.1
Dandea	82	3.8	8.1	4222	1.5	96.5
Shorima	83	3.6	9.9	4322	1.5	88.9
Deka	79	3.7	9.2	4166	1.5	88
Hibist	74	3.5	10.1	3750	2	87.6
Balcha	82.5	3.25	9	3250	1	93.4
Kakaba(check)	75	3.65	8.2	3111	1.5	87.5
Ogolcho	73.5	3.51	10	3055	1	90.3
Sofumar	79	3.2	9.4	3000	1.5	89.7
Obora	84	3.5	10.3	2638	1.5	85.3
Liben	80.5	3.45	9.4	2055	1	86.9
Grand Mean	***78.54167***	***3.645833***	***9.316***	***3583***	***1.375***	***90.216***
CV(%)	***2.74***	***4.56***	***6.11***	***12.24***	***34***	***4.8***
F-test	***	***	*	***	***NS***	***NS***

****, *, ns= Significant at P <0.01, significant at P < 0.05 and non-significant respectively, DM=days to physiological maturity,SL=spike length, PH=plant height (cm),HSW= hundred seed weight (gm),YR=Yellow rust(score) and GY= grain yield (Kg ha-1), CV (%)= Coefficient of variation in percent.*

Mean Performance of Bread wheat Genotypes for Yield and Yield Related Traits: The mean grain yield ranged from 2055kgha^{-1} to 5083kgha^{-1}. Among all the genotypes studied, ETBW9554 and Wane were recorded as high yielding varieties. Dandea, Shorima and Deka were recorded the next high grain yielder bread wheat varieties at the studied site. Minimum grain yield was obtained from liben and obora. Therefore, the result indicates that the superior varieties ETBW9554(5083kgha^{-1}),Wane(4444kgha^{-1}),Shorima (4322kgha^{-1}) and Dendea (4222kgha-1) showed chance of wider dissemination to the farmers in the study area. All varieties were matured between 72 to 83 days and five genotypes attained the physiological maturity stage earlier than the mean value (78 days of from sowing) ,which is very desirable character for irrigated areas. The range of spike length was 8.1 to 10.3 cm with mean values of 9.3cm. Five genotypes were taller than the mean height (90.2 cm) of the range is 85.3 cm to 96.5 cm on plant height. Another yield component measured was hundred seed weight which ranged from 3.2gm to 4.0gm.ETBW9554, Wane and Dandea were possessed highest in hundred seed weight, 4gm, 3.9gm and 3.8gm respectively, as compared to the other tested varieties. All the genotypes showed tolerance to disease and pest ranged from 1 to 2with mean values of 1.37.

Conclusions

Twelve improved bread wheat varieties were tested to evaluate for yield performance and adaptability to irrigated areas of Chiro Districts of Arberekete kebele of West Harerghea Zone of Oromia region Eastern Ethiopia. The analysis showed a significant difference among the varieties for grain yield, days to maturity, hundred seed weight, spike length and hundred seed weight implying that there was best fit varieties for the studied location. From this work, it was observed that each of the tested variety showed different performance for different characters. Grain yield is an important character to be considered for variety selection to address the objective of the conducted activity. Accordingly,ETBW9554,Wane,Shorima and Dendea were top four varieties with high yield scores as well as disease tolerance and early maturing varieties and could be promoted and recommended for wider dissemination to the farmers in the study area and its similar agro ecological zones to irrigation farming system for further popularization. Generally, to advance the wheat production marketing area at the crucial

level, the following recommendations will have significant contribution: Routine awareness creation to the irrigated wheat producing farmers through training on how to select improved bread wheat seed, what type of improved production technologies they used and how they can increase the productivity of wheat on their limited land size are very important issues which enable the farmers to gain a high return. The quality aspect also requires strengthening in facility and capacity building. Therefore, in future, the wheat variety evaluation trials have to be conducted for irrigated farming not only for lowland areas, additionally for highland and intermediate irrigation accessed areas of the country to develop and release wide and location specific adaptable varieties having grain quality standard for securing the food self-sufficient policy of the country.

References

Anteneh A and Asrat D (2020). Wheat production and marketing in Ethiopia: review study. Cogent Food Agric. 2020. https://doi.org/10.1080/23311932. 2020.1778893.

CSA (2018). Agricultural sample survey; report on area and production of major crops, Vol I, CSA, Addis Ababa. 2017/2018.

FAO (2014). Analysis of price incentives for wheat in Ethiopia, Technical notes series, MAFAP. Rome: Wakeyo MB, Lanos B.

FAO (2019). Strategic analysis and intervention plan for wheat and wheat products in the Agro-Commodities Procurement Zone of the pilot Integrated Agro-Industrial Park in Central-Eastern Oromia, Ethiopia

Gosa Alemu (2016). Characterization and analysis of farming system in Chirp district ,West Hararghe zone. Journal of Natural Science Research. https://www.brusselstimes.com/170354/ethiopia-to-boost-irrigated-wheat-production,2021

Nigussie A, Kedir A, Adisu A, Belay G, Gebrie D and Desalegn K (2014). Bread wheat production in small scale irrigation users agro-pastoral households in Ethiopia: case of Afar and Oromia regional state. J Dev Agric Econ., 7(4): 123–30.

Reynolds, M.P., J.I. Ortiz-Monasterio, and A. McNab (eds.) (2001). Application of Physiology in Wheat Breeding. Mexico, D.F.: CIMMYT

Skovmand B, Reynolds MP and Delacy IH (2001). Searching Genetic Resources for Physiological Traits with Potential for Increasing Yield.

Tadesse W, Solh M, Braun HJ, Oweis T and Baum M (2016). Approaches and strategies for sustainable wheat production. Beirut: International Centre for Agricultural Research in the Dry Areas (ICARDA).

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