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Research Article

Evaluation of Improved Food Barley (*Hordium vulgare L.)* Varieties in Midland Area of Ari Zone

*Temesgen Jerjero [1,] Wondimu Adila [2] and Muhaba Sultan [3]

[1,2,3] South Ethiopia Agricultural Research Institute, Jinka Agricultural Research Center, Jinka, Ethiopia.

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Corresponding author:** ***Temesgen Jerjero
South Ethiopia Agricultural Research Institute, Jinka Agricultural Research Center, Jinka, Ethiopia.
Email: temejer@gmail.com

Abstract

Food barley is one of the most important crops in Ethiopia for production and consumption. Using unimproved variety and non-recommended midland variety was one of the production problems in the study area. The field experiment was conducted on three improved midland food barley varieties and one local check in Debub Ari District at Geder keble for two consecutive years during 2023/24 -2024/25 main cropping season. The objective of the study was to identify, select and recommend well adaptable and high yielding variety for the target area. The experiment was laid out in Randomized Complete Block Design with in replications in the plot size area of 4mx 4m (16m^2). Productive tiller per plant, plant height, spike length, number of rows per spike, seed per spike, grain yield thousand seed weight were *collected as the most important agronomic traits. The SAS software program was used to conduct data analysis of variance on the collected agronomic traits. Before conducting combined analysis of variance, homogeneity test was tasted. The combined analysis of variance detected significant difference among main effect of variety for productive tiller per plant, plant height, number of rows per spike, grain yield, and thousand seed weight while none significant for spike length. The combined analysis of variance detected none significant difference among main effect of year for all agronomic traits except for plant height and thousand seed weight. The interaction effect of variety by year imposed significant effect on plant height and number of seed per spike while none significant effect on the other traits. Among the evaluated varieties; Negle (2948.70 kg ha^{-1}) had significantly higher average mean value of grain yield over the rest Moreover, the variety had yield advantage of 67.70% was estimated over the local check (1758.30 kg ha^{-1}). Therefore, the identified varieties were suggested for further demonstration and popularization in midland areas of Debub Ari District and areas with similar agro-ecology. To the future another research will be very important on evaluation of including a number of other recently released varieties for increasing the production and productivity of midland food barely.*

Keywords: *Evaluation, food barely, varieties, year.*

1. Introduction

Food barley (Hordium vulgare L.) is recognized as one of the world's most ancient food crop, which is believed to have first domesticated about 10,000 years ago from its wild relatives in the Fertile Crescent of the Near East and Center of diversity in Ethiopia (Mekonnon, 2014). In Ethiopia, barley is also one of the oldest cultivated crops (Birhanu et al., 2020) and currently, it is the fifth most important cereal crop next to maize, tef, sorghum, and wheat with total area overage of land coverage (CSA, 2016/17). Food barley is used to producing and provides food in a short period of time because it is an early harvested crop and is a popular hunger breaker or relief crop during seasons of food shortage in some parts of the country (Baye and Berhane, 2006). Barley is one of the most important staple food crops in Ethiopia, mainly used for human consumption (Birhanu *et al*., 2005) and also used as homemade food, fodder and beverage. The grain is used for the preparation of different foodstuffs in the country, such as malt products, *injera basso, porridge, qolo*; and local drinks, such as *tela, Keneto, borde*, beer and the straw are used as animal feed. Food barley has been cultivated in diverse agro-ecologies in an area on which other cereal crops are not performing well (Martin *et al.,* 2006) It is cultivated at altitudes ranging from 1500 to 3500 above sea level and predominantly grown at elevation ranging from

2000 to 300 m.a.s.l. (Tamene, 2016). Being the most dependable and desirable crop for the resource poor highland farmers (Eticha et al., 2010), in some regions it is cultivated in two district seasons: belg which relies on the short rainfall period from March to April and Meher which relies on the long rainfall period from June to September (Hundie et al., 2005). Food barley is widely produced in the world and ranks fourth in production area next to wheat, rice and maize (FAO, 2016). In Ethiopia, the national average yield of food barley was estimated to be 1.60 t/ha and 1.664 t/ha during 2015/16 and 2016/17, respectively (CSA, 2016/17). In Ari Zone the productivity of food barely was low (13.5 %) The most important biotic and abiotic factors that reduce productivity of barley in the areas include; low yielding varieties, insect, disease, soil acidity and weed competition (Zonal Agricultural crop production data of 2016/17). Gradual increasing of this production constraints are held to be important for diminishing productivity of barley in the study areas. Evaluation of different food barley varieties is among alternative intervention approach through which productivity of the crop could be alleviated. Therefore, the main objective of the study was to evaluate performance of improved food barley varieties and to recommend the adaptable and high yielding variety for midland areas of Debub Ari District.

2. Materials and Methods

2.1 Description of the study sites

The experiment was conducted during the 2023/24 - 2024/25 main cropping season. Ari Zone, Debub Ari District at Geder keble. Geder keble is located at Debube Ari District of South Ethiopia. It is altitude range from 1900-2600 meters above sea level and the rainfall distribution of the area is bimodal, with the primary rainy season lasting from March to May and the secondary little wet season lasting from June to December.

2.2 Experimental design and treatments

The experimental materials comprise three improved food barley varieties and one local cultivar. The improved varieties were; Negele, Bantu and Gobe. The experiment was conducted by a Randomized Complete Block Design (RCBD) with four replications. The experimental plots consisted of 15 rows of 4 meter length and 3 meter width and 0.2 meter and 1 m between rows and blocks respectively. The Seed was sown at 125 kg ha-1, while fertilizers were applied uniformly at a rate of 100 kg ha-1 DAP and 100 kg ha-1 urea respectively for both years. During sowing urea, was applied in split form half at sowing and stem elongation stages, respectively. Weed management and all other agronomic practices were carried out uniformly for all plots as required in both years.

2.3 Data collection

Productive tiller: Recorded as the number of tillers from single plant which produced productive yield. Plant height: Measured as a height in centimeter from the soil surface to the tip of the spike excluding the awns at maturity and expressed as an average of ten plants per plot.

Spikes length: Spike length of the main tiller measured in centimeter from base to tip excluding the awns and expressed as an average of ten plants in a row. The number of seeds per plant: Determined by counting the number of seeds produced on the single main in single head of barely. Number of rows per spike: Determined by counting the number of rows produced on the single main head of barely. Grain Yield: Five central rows were harvested, thrashed and adjusted to 12.50 % moisture content and measured, converted and expressed in kg ha-1. Thousand seed weight: Weight in a gram of random sample of thousand seeds counted by seed counter machine and measured by sensitive balance.

2.4 Data analysis: The data were subjected to analysis of variance using SAS software 2008 version 9.2 and Treatment means were separated using LSD test.

Table 1. List of breeding materials/varieties used during the study

Varieties	Source / Orgion	Year of release
Negle	Kulumsa ARC/EIAR	2020
Bantu	KARC/EIAR	2006
Gobe	KARC/EIAR	2012
Local	-	-

3. Results and Discussion

3.1 Analysis of variance (ANOVA)

The combined analysis of variance was carried out to determine the main effect of varieties, year and their interaction on yield and other traits. The combined analysis of variance detected significant difference ($P \leq 0.05$) among main effect of variety for productive tiller per plant, plant height, number of rows per spike, grain yield, and thousand seed weight while none significant ($p>0.05$) for spike length. The combined analysis of variance detected none significant difference among main effect of year for all agronomic traits except for plant height and thousand seed weight. The interaction effect of variety by year imposed significant effect on plant height and number of seed per spike while none significant effect on the other traits (Table 1).

3.2 The average mean performances of barley varieties for growth, yield and yield related traits across years

Productive tiller per plant: The average mean value of tiller numbers ranged from 5.66 to 7.82 and 6.47. The variety Negle had greater tillers number (7.82 while the minimum tiller number was recorded to local cultivar (5.66) (Table 3). Similar results were reported by Tesfay (2022), who stated that, there were significant differences in productive number of tillers and improved varieties had more tiller numbers than local variety. Plant height: Plant height ranges from 65.47 to 82.28 cm. Among the evaluated varieties, the longest plant height measured to local cultivar (82.28 cm) and the shortest plant height was measured to variety Gobe (65.47 cm). There was height difference among the evaluated varieties this was due to genetic potential of the varieties. Spike length: spike length revealed none significant differences and the mean value of spike length ranges from 14.87 cm to 27.90cm (Table 3). From the evaluated varieties, Negle variety had long spike length (27.90cm) while the shortest spike length was measured to variety Gobe (14.87). This research finding result was dis agreed to the finding of (Hailu *et al.*, 2015), who pointed out two- row varieties have a large spike length than six rows. Number of rows per spike: From the evaluated varieties, only Gobe variety pointed out two- rows per spike and other varieties had four pointed out four rows per spike (Table 4). Number of seeds per plant: number of seeds per plant revealed that were none significant variations among the evaluated varieties and the number of seeds per plant ranged from 33.33 to 25.28. The maximum number of seed were counted to variety Negle (33.33) and followed by Bantu (32.99) but, the least numbers of seed result was counted to variety. Gobe (25.28). Grain yield: Grain yield also revealed significant differences among varieties. The mean value ranged from 2948.7 kg/ha to 1758.30kg/ha. The highest mean of grain yield was obtained to variety Negle (2948.7 kg/ha) and it had a yield advantage of 40.37 over local check while local cultivar showed the minimum grain yield (1758.30kg/ha) (Table 5). Thousand seed weight: thousand seed weight yields result showed significant differences among the varieties. Its mean values ranged from 46.88gm to 38.13gm. The maximum mean of thousand seed weight recorded to variety Negle (46.88gm) while the minimum thousand seed weight was recorded to local cultivar (38.13gm) (Table 5).

Table 2. Significance of mean square for traits of food barley varieties during 2023/24 -2024/25 main cropping season

SV	DF	PT	PH	SL	NR	NS/ P	GY	TSW
Rep	3	1.21	31.27	341.58	0.50	26.51	72843.2	25.374
Year	1	3.85^{ns}	5481.05^{*}	1166.44^{ns}	24.50^{ns}	32.36^{ns}	1.00^{ns}	345.84^{*}
Vr	3	4.63^{*}	436.82^{*}	314.83^{ns}	0.50^{*}	107.98^{*}	2011011^{*}	140.97^{*}
Vr*Y	3	1.09^{ns}	248.88^{*}	316.82^{ns}	0.08^{ns}	204.61^{*}	447147^{ns}	16.64^{ns}
Error	31	0.51	28.06	291.76	0.50	53.109	275223	23.1

Note: SV= source of variance, Vr= variety, Y= year, DF= Degree of freedom, PT= productive tiller per plant, PH= plant height, SP= spike length, NR= number of rows, NS/ P= number of seed per plant, GY= grain yield, TSW= thousand seed weight

Table 3. The average mean performance productive tiller per plant, plant height and Spike length of improved food barley varieties during 2023/24 – 2024/25 main cropping season at Debeb Ari District, Geder Kebele

Varieties	PT			PH (cm)			SPL (cm)		
	2023/24	2024/25	Average mean	2023/24	2024/25	Average mean	2023/24	2024/25	Average mean
Negle	6.55^{a}	7.90^{a}	7.82^{a}	55.70^{b}	83.05^{a}	69.38^{ab}	12.85	19.00	15.92
Bantu	6.35^{ab}	7.40^{ab}	6.88^{b}	50.00^{ab}	87.65^{a}	68.88^{ab}	12.40	18.35	15.37
Gobe	7.25^{a}	6.90^{b}	7.08^{ab}	51.00^{b}	79.95^{ab}	65.47^{c}	12.10	17.65	14.87
Local	5.20^{b}	5.92^{c}	5.66^{c}	76.85^{a}	87.70^{a}	82.28^{a}	12.45	18.10	15.27
LSD (0.05)	1.28	0.61	14.88	6.91	2.2	6.72	NS	NS	NS
CV (%)	10.67	5.45	12.66	7.40	6.04	3.10	2.2	8.09	8.22

Note: PT= productive tiller per plant, PH=plant height, SP= spike length. Means with the same letters within the columns are not significantly different at $P \leq 0.05$.

Table 4. The average mean performance of number of rows and number of seed per plant of improved food barley varieties during 2023/24 – 2024/25 main cropping season at Debeb Ari District, Geder Kebele

Varieties	NR			NS/P		
	2023/24	2024/25	Average mean	2023/24	2024/25	Average mean
Negle	6.00[a]	6.00[a]	6.00[a]	36.55 [a]	35.99[a]	33.33[a]
Bantu	6.00[a]	6.00[a]	6.00[a]	30.75[b]	35.213[a]	32.99[a]
Gobe	2.00[b]	2.00[b]	2.00[b]	20.00[c]	30.57[b]	25.28[b]
Local	6.00[a]	6.00[a]	6.00[a]	31.95[ab]	24.318[c]	30.63[ab]
LSD (0.05)	0.596	0.7998	0.4605	7.11	6.88	6.99
CV (%)	12.04	13.79	12.78	5.07	9.63	7.51

Note: NR= number of rows, NS/P= number of seed per plant. Means with the same letters within the columns are not significantly different at $P \leq 0.05$.

Table 5. The average mean performance of grain yield and thousand seed weight of improved food barley varieties during 2023/24 – 2024/25 main cropping seasons at Debeb Ari District, Geder Kebele

Varieties	GY (kg/ha)			TSW (gm)			Yield Advantage (%)
	2023/24	2024/25	Average mean	2023/24	2024/25	Average mean	
Negle	2847.40[a]	3191.7[a]	2948.7[a]	45.00[a]	48.750[a]	46.88[a]	67.70
Bantu	2336.10[a]	2737.50[ab]	2536.80[ab]	35.62[ab]	43.875[b]	39.75[bc]	-
Gobe	1709.5[b]	2437.5[bc]	2073.50[bc]	42.87[ab]	47.425[ab]	45.15[ab]	-
Local	1166.7[b]	2350.5[c]	1758.30[c]	33.25[b]	43.00[b]	38.13[c]	-
LSD (0.05)	566.34	382.87	858.01	10.19	4.547	6.12	
CV (%)	17.00	9.05	9.20	6.26	6.26	13.98	

Note: GY= grain yield, TSW= thousand seed weight. Means with the same letters within the columns are not significantly different at $P \leq 0.05$.

Conclusions and Recommendation

The analysis of variance among the evaluated varieties for productive tiller per plant, number of rows, grain yield and thousand seed weight revealed significant differences ($P<0.05$) while none significant differences in plant height, spike length, and number of seeds per plant. Among the evaluated varieties, Negle variety had good performance for yield and yield components as well as yield advantage (67.70 %) over local check. Therefore, this variety was recommended for the study areas to improve the production and productivity of food barely. To the future another research will be very important on evaluation of including a number of other recently released varieties for increasing the production and productivity of midland food barely.

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Fig 1. Field status of the experiment

Reference

1. Baye, M., & Berhane, L. (2006). Barley research and development in Ethiopia: An overview. In B. Mulatu & S. Grando (Eds.), Barley research and development in Ethiopia: Proceedings of the 2nd national barley research and development review workshop (pp. xx–xx). 28–30 November 2006, Holetta Agricultural Research Center (HARC), Holetta, Ethiopia.
2. Berhanu, B., Fekadu, A., & Berhane, L. (2005). Food barley in Ethiopia (pp. 53–82). [Publisher not specified].
3. Birhanu, A., Tahir, Z., Tilahun, M., Tilahun, M., & Hailu, A. (2020). Performance evaluation and adaptation of food barley (Hordeum vulgare L.) varieties in the highlands of North Gondar, Ethiopia. American Journal of Agriculture and Forestry, 8(6), 252–257. https://doi.org/10.11648/j.ajaf.20200806.15
4. Central Statistical Agency [CSA]. (2016). Agricultural sample survey 2016/17: Report on area and production of crops (Private peasant holdings, Meher season). Addis Ababa, Ethiopia.
5. Eticha, F., Sinebo, W., & Grausgruber, H. (2010). On-farm diversity and characterization of barley (Hordeum vulgare L.) landraces in the highlands of West Shewa, Ethiopia. Ethnobotany Research and Applications, 8, 25–34.
6. FAOSTAT. (2016). Crop prospects and food situation. Food and Agriculture Organization of the United Nations. http://data.fao.org/
7. Hailu, A., Alamerew, S., Nigussie, M., & Assefa, E. (2015). Performance evaluation of introduced barley (Hordeum vulgare L.) germplasm for yield and its related traits at Atsbi, Ofla and Quiha, Northern Ethiopia. Middle-East Journal of Scientific Research, 23(12), 2888–2894. https://doi.org/10.5829/idosi.mejsr.2015.23.12.22266
8. Hundie, B. (2005). Infection biology, epidemiology and resistance of barley land race lines to Pyrenophora teres (Doctoral dissertation). Graduate School of Kasetsart University, Thailand.
9. Martin, J. H., Walden, R. P., & Stamp, D. L. (2006). Principles of field crop production. Pearson Education, Inc.
10. Mekonnon, B. (2014). Selection of barley varieties for their yield potential at low rainfall area based on both quantitative and qualitative characters, North West Tigray, Shire, Ethiopia. International Journal of Plant Breeding and Genetics, 8(4), 205–213. https://doi.org/10.3923/ijpbg.2014.205.213
11. SAS Institute. (2009). SAS user's guide. SAS Institute Inc.
12. Tamene, M., Hiwot, S., & Kasahun, T. (2016). Registration of "Singitan" newly released malt barley (Hordeum vulgare L.) variety for highland areas of Bale. Research Journal of Agricultural Science, 4, 241–244.
13. Tesfaye, W. (2022). Performance evaluation of food barley (Hordeum vulgare L.) varieties for yield and related traits in mid-altitude agro-ecologies in Hadiya zone, southern Ethiopia. International Journal of Botany Studies, 7(1), 376–379.

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