

Registration of Newly Released Food Barley (*HondiumVulgare L.*) Variety ‘Geshe’ for High Potential Barley Growing Areas in Ethiopia

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Abstract: Twenty-three food barley (*HondiumVulgare L.*) genotypes including with three standard check varieties were evaluated at three locations (Sinana, Robe area and Bekoji) for two years from 2020-2021. Data for grain yield and other important traits were generated and the Results of combined analysis and stability analysis showed that barley genotype coded as G8 and G18 exhibited the highest mean grain yield with high stability and good agronomic performance as well as good level of disease resistance across the testing environment. These two candidate genotypes were promoted to VVT (variety verification trial) along with two check varieties Adoshe and HB1966 to re-evaluated including farmers field using large plots for one year, in 2022. After critical evaluation of VVT by National Variety Releasing Committee (NVRC) and group of farmers, the first genotype, coded as G8, which has grain yield advantage 37.3% and 49.2% over standard checks Adoshe and HB1966 and later on given local name called “Geshe” was officially released for wider production for high potential barley growing areas of Ethiopia.

Keywords: Geshe, Variety Registration, Candidate Genotypes

1. Introduction

Ethiopia is one of the richest genetic resources centers in the world. Crop plants such as coffee(*coffee arabica. L.*), tef (*Eragrostistef*), and a staple small cereal grain, are also known to originate in Ethiopia [8]. Barley is the fourth most important cereal crop in the world after wheat, maize and rice [6]. In Ethiopia, it is fifth in yield after Tef, Maize, Sorghum and Wheat with productivity of 2.6 t/ ha⁻¹ [4]. Barley is a staple food grain, especially in the highlands of Ethiopia. It is used for food (bread, *injera* and *kolo*), beverages (local beer), livestock feed, and the straw are used for thatched roofing in the countryside of Ethiopia [12]. Barley is grown twice a year from August to December (main season) and from March to July (short season) in altitudes from 1800 to 3400 m.a.s.l. [2-9]. Among cultivated cereals in Ethiopia, barley has a large number of accessions preserved in the Ethiopian

gene [15]. However, several reports indicated that barley production has been negatively affected by both biotic and abiotic stresses [10, 11]. Diseases that include netblotch and scald have significant contributed to reduce barley productivity in the country [1-3, 13, 14]. The national barley research program objectively works to fill this gap through development and release of resistance barley variety for major barley disease with high grain yield and frequently, susceptible varieties replaced by new resistance varieties.

2. Material and Method

The national barley research program includesfor this study, twenty advanced genotypes and three checks (Adoshe, HB1965 and HB1966), a total of twenty-three entries set as Food Barley National Variety Trial for High potential Areas in 2020. The experiment conducted inRCBD design with

three replications at Sinana, Robe area, Bekoji, Shambu, Dinsho and Bore in 2020 and 2021. The two food barley genotypes, G8 and G18 were selected due to significant better mean grain yield and disease resistance to major barley disease across all test environments. In 2022, the two candidate food barley genotypes and check varieties, Adoshe and HB1966, were evaluated at research Stations and on farms using large plots. Farmers and NVRC evaluated all trials across on stations and on farms and the committee decided the first genotypes coded as G8 with the pedigree name *TRADITION/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA1/7/LEGACY//PENCOCHEVRON-BARCBSS02Y00571T-1-0M-0M-2Y-1M-0Y-0AP-0TR-0AREC* was official release and local name given “Geshe”.

3. Varietal Characteristics

Geshe is the improved food barley variety which originated from ICARDA and released in 2023 for high potential barley growing areas and similar agro-ecologies. As Geshe outshined many food barley lines obtained from ICARDA

and local crossing in observation and preliminary yield trials, it was advanced to a national variety trial to be tested across wide locations over years to further test its overall performances. This variety is characterized by an erect growth habit and compact ear types. It has white seed color. On average this variety required 72 days for heading, 135 days need to reach physiological maturity and the average plant height is 104 cm (Table 1). The average weight of thousand kernel is 37 g and test weight is 63 g/hl (Table 1). This variety is moderately resistant to major barley diseases.

4. Grain Yield Performance

Geshe is characterized by having higher seed grain than the standard check so far released. It has better grain yield advantage of 47.7%, 37.3% and 49.2% over standard check HB1965, Adoshe and HB1966, respectively (Table 1). The variety gives grain yield of 3.5 to 5.9 t/ha-1 on the research field whereas it gives 3.4 to 6.6 t/ha-1 on farmers' field (Table 2).

Table 1. Combined Mean of agronomic performance and disease reactions of 23 FB genotypes tested in National Variety Trial.

Entry	DH	DM	PH	TKW	HLW	NB	SC
G1	74.08	134.67	96.40	42.43	67.15	56.79	1.54
G2	72.71	135.21	98.09	42.48	67.91	60.21	1.71
G3	75.04	136.71	96.26	36.10	63.43	56.75	1.29
G4	72.38	135.00	93.10	39.95	65.09	50.50	1.79
G5	70.79	134.92	97.16	37.72	64.07	55.17	1.75
G6	70.83	133.92	93.26	37.63	68.00	53.17	1.33
G7	75.13	135.38	98.22	33.53	57.10	65.04	1.21
G8	71.92	134.50	103.47	36.54	63.01	51.92	1.07
G9	72.13	133.67	90.91	32.41	65.06	59.42	1.42
G10	74.29	135.88	84.05	35.68	61.03	55.96	2.08
G11	71.50	133.58	100.28	33.74	60.00	55.29	1.25
G12	67.63	133.50	87.81	37.55	64.12	51.46	1.83
G13	70.75	136.63	94.30	35.22	65.25	56.17	1.63
G14	74.81	135.31	97.11	35.99	63.33	58.16	1.59
G15	76.74	136.88	95.75	35.03	60.22	55.50	1.00
G16	69.88	133.50	98.64	43.69	62.33	58.88	2.56
G17	73.54	134.71	97.33	33.42	64.39	55.79	1.79
G18	70.79	135.83	94.71	36.15	64.02	53.50	1.12
G19	73.33	134.38	97.00	35.33	62.96	57.50	1.67
G20	73.96	136.21	87.16	36.14	64.15	59.63	1.92
G21	72.46	133.46	97.59	37.07	92.20	51.33	2.33
G22	75.04	136.33	88.68	35.66	65.45	54.29	1.50
G23	76.88	137.21	111.36	39.85	64.84	53.75	1.13
Mean	72.96	135.13	95.57	36.81	65.02	55.91	1.63
CV	3.3	1.5	6.01	9.5		10.3	
LSD	0.38	0.32	0.89	0.56		0.82	

DH-Days to heading, DM- Days to maturity, PH(cm)- Plant height, GY(kg/ha)- Yield per hectare, TKWThousand seed weight, HLW- hecto litter weigh, NB(00-99)- Net blotch, SC, Scald

Table 2. Agronomic and morphological characteristics of newly released food barley variety ‘Geshe’.

No	Agronomical and Morphological Characteristics	
1	Adaptation area	For high potential barley growing areas in Ethiopia
2	Altitude (m.a.s.l.)	2300-2800
3	Rainfall (mm)	750 – 1200
4	Seed Rate (Kg/ha)	125
5	Planting date	End of July to Early August
6	Days to Flower	72
7	Days to Maturity	135

No	Agronomical and Morphological Characteristics	
8	Plant Height (cm)	104
9	1000 Seed Weight (gm)	36.5
10	Test weight(kg/hl)	63
11	Seed Color	white
12	Growth habit	Erect
13	Crop pest reaction	Tolerant to major pests
14	Disease reaction	Moderately resistance to major barley diseases
15	Yield (t ha-1)	15.1. Research field: 3.5 to 5.9 t ha-1 15.2. Farmers field: 3.4 to 6.6 t ha-1
16	Spike density	Very dense
17	Flag leaf and stem color	Glucocity
18	Awns attitude	Medium
19	Glumes color	White
20	Seed size	Large
21	Seed shape	Moderately elongated
22	Year of release.	2023
23	Breeder/Maintainer	SARC/IQGO

5. Disease Reaction

Barley diseases are the major constraint of barley productivity and production in Ethiopia. Thus, the breeding program mainly targets to release of resistant varieties to major barley diseases. Resistance genotypes for these diseases are high yielders with plumb, vigor, and healthy seed. The major barley diseases according to their importance in the growing area, among many, are netblotch, Scald, stem rust and leaf rust. For rust diseases, the modified Cobb’s scale was applied and disease data over locations were scored and analyzed. Accordingly, *Gessee* scored 52 for net blotch, 5ms for leaf rust and 1.7 for scald which makes it resistant to the rust diseases (Table 1). The variety reaction to disease infection is moderately resistance to major barley disease.

6. Adaptation and Agronomic Recommendations

Newly released food barley variety, *Gessee* is recommended for high potential barley growing areas and for similar agro-ecologies. It performs very well at an altitude ranging from 2300- 2800 m.a.s.l. and in areas receiving annual rainfall of 750-1500mm. The seed and fertilizer rates recommended for *Gessee* variety are 100 kg/ha NPS and 50 kg/ha of UREA, respectively. UREA fertilizer application is in split form where 1/3 is applied at planting and the remaining 2/3 is applied at tillering stage. Favorable growing temperatures ranges from 10°C – 21°C through crop growing stages which, is optimum temperature for barley production in general.

7. Conclusion

Increasing the production of foodstuffs in developing countries against the background of rapid population growth, widespread food shortage, malnutrition and the destruction of the natural resource base still remains important for the future. Therefore, there is a need to intensify crop production

through application of relevant innovations including better crop varieties adapted to varying agro ecological conditions and socioeconomic set-ups. *Gessee* was the best yielding barley variety and it is stable ingrain yield performance over locations and years. It was resistant to major barley diseases that prevailed in the growing areas. During the NVRC evaluation farmers also preferred the variety for its superior performance over the existing local variety, which is manifested by better grain yield, and disease resistance. Hence, *Gessee* was verified and officially released for high potential barley growing areas of Ethiopia in 2023.

Conflicts of Interest

The authors declare no conflicts of interest.

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