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Registration of "Singitan" a newly Released Malt Barley (*Hordeum vulgare* L.) Variety for Highland Areas of Bale

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Singitan (IBON-MRA P#26) is two-row malt type barley developed from introduced exotic germplasm and released in 2016 for highland areas of Bale. The new variety was tested along with the two standard checks (Bekoji-1, and Holker) at four environments during 2013 to 2014 cropping seasons. The two consecutive year's data proved its superiority in grain yield performance, stability, and wide adaptation. The new variety has good protein content, good physical grain quality, moderate resistance to common leaf diseases and scald, moderate tolerance to barley shoot fly and lodging resistance. The variety Sing it an demonstration and seed multiplication is underway. Hence, cultivation of the new variety in the higher altitude areas of major barley growing environments of the country is highly recommended.

Keywords: Barely variety, grain yield, grain quality, protein content

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INTRODUCTION

Barley (*Hordeum vulgare* L.) is one of the most important cereal crops cultivated in Ethiopia. In Ethiopia, barley is the fifth important cereal crop next to Tef, Maize, Sorghum and Wheat in total area coverage of 993, 918.89 hectares and total annual production of about 1.9 million tons in main season (CSA, 2015). It is also the most demanded cereal crop in the highlands of Bale, South-eastern Ethiopia. Barley can be cultivated at altitudes between 1500 and 3500m, but predominantly grown between altitudes of 2000 to 3000m above sea level and it is cultivated in every regions of the country. In Ethiopia, barley is mainly produced for human consumption, malt and animal feed (Bekele *et al*., 2005; Horsley and Hochhalter, 2004). Furthermore, it also provides useful material for thatching roofs of house (Bekele *et al.,* 2005). In spite of the importance of barley as a food and malting crop, and the efforts made so far to generate improved production technologies, its productivity in production fields has remained very low (about 1.9 t/ha compared with the world average of 2.4 t/ha). This is primarily due to the most important biotic and a biotic factors that reduce yield of barley in Ethiopia are poor yielding varieties, insects, diseases, poor soil fertility, water logging, and soil acidity and weed competition. Among these, lack of improved barley variety and barley shoot fly have been an important constraints in Bale highlands for many years that reduce the yielding potential of barley varieties in the area. Improved varieties have been released show highly susceptible to shoot fly. As a result of this, many barley varieties were unable to adapt to this condition except the local cultivar (Aruso). Aruso is early maturing and tolerant to shoot fly in the region but it is susceptible to lodging and low yielder. Therefore, to develop resistant barley

varieties with better agronomic traits, resistance to common leaf diseases and shoot fly, barley breeding program of Sinana has been conducting research by using different breeding approaches.

METHODOLOGY

Testing location and season

The experiment was carried out at four locations (Sinana, Goba, Dinsho and Dodola) for consecutive two years (2013 to 2014) during the main cropping seasons. Sinana Agricultural research center is located at 07° 07 N and 40°10 E in Bale zone, Southeastern Ethiopia, 463 km far away from Addis Ababa and 33 km east of Robe town at altitude of 2400 meters above sea level. The other location is located 48, 63 and 143 km far from Sinana, respectively and about 15, 30 and 110 km from Robe town in the southwest direction, respectively. Due to the suitability of the region for barley production, test genotypes expected to express their genetic potential to a higher extent for the traits under consideration.

The new variety was released after it has been evaluated at different testing environments for subsequent years. In the yield trials about 19 genotypes including the standard checks was evaluated using randomized complete block design with three replications at four locations for two consecutive years. During this time agronomic data was taken on days to heading, days to maturity, plant height, stand percentage, thousand kernel weight, test weight, and grain yield/plot on plot basis. The collected data subjected to analysis to select the best performing genotypes as compared to the checks. These nineteen genotypes were evaluated at multi-location for two years on verti-clay loam soil to express its stability across location during the main cropping seasons (August to December). Fertilizer at the rate of 150 DAP kg/ha only and seed rate at 100 kg/ha was applied and hand weeding was done twice. Agronomic parameters were collected and analyzed in order to select best genotypes out of the tested genotypes. Finally, Singitan (IBON-MAR P#26) was selected and verified along with two standard checks. The verification trial was evaluated by the National variety releasing committee at field condition and was released fully for the highlands of Bale and similar agro-ecologies.

RESULTS AND DISCUSSION

Varietal characters

Singitan has better shoot fly tolerance and moderate tolerance to common leaf diseases with better yield advantage as compared to the standard checks (Table 1). This variety has medium plant height, early maturity, lodging resistance and has good protein content for malt production (Table 1). On average this new variety needs 64.87 days for heading and 118.92 days to reach physiological maturity (Table 1). It has white seed color. The average weight of thousand kernel is 47.68 and test weight is 67.45 kg/hl (Table 1).Moreover, other characteristics of the variety were described in Appendix I.

Yield performance

The mean grain yield of Singitan combined over locations and over years is 2.49t/ha which is higher than standard checks, Bekoji-1 (2.36 t/ha), and Holker (2.27) (Table 2). The grain yield performance and stability parameters of Singitan (IBON-MRA P#26) and the checks are summarized in Table 1.The variety gives grain yield of 3.1 to 4.1 t/ha on the research field whereas it gives 2.1 to 3.5 t/ha on farmers field. This variety has grain yield advantages of the new variety over the standard checks, Bekoji-1, and Holker variety of the respective locations were 5.13%, and9.64%, respectively.

Reaction to insect pest and diseases

The diseases score for the new variety and the checks are summarized in Table 1. The resistance level of the new variety was better than the standard checks for shoot fly and leaf rust and comparable for net blotch and scald.

Quality

The variety is characterized by having low percent of protein content and good malt extract as compared with the standard checks, which is preferred by the malt factory (Table 1).

Adaptation

Singitan is released for the highlands of Bale and similar agro-ecologies. It performs very well in area having an altitude of 2200 to 2600 m a.s.l and annual rainfall of 750-1000 mm. This variety give better grain yield if it is produced with recommended fertilizer rate of 150 kg/ha DAP only and seed rate of 100 kg/ha in clay-loam soil for better performance of the variety it is better if planting is done from mid-July to early September in Meher (Bonaa) and to the end of March during belg (Gannaa) season.

Variety maintenance

Breeder and foundation seed of the variety is maintained by Sinana Agricultural Research Center.

Table 1. Mean grain yield, other agronomic traits, insect and disease reaction of Singitan and the checks in multi-location test during 2013-2014.in multi-location

Entry	DH	DM	PH (cm)	ST (%)	TKW (g)	HLW (kg/hl)	GY (t/ha)	Protein content (%)	Malt extract (%)	Sieve screening (%), ≥ 2.2mm)	NB (00-99)	SC (1-5)	LR (%)	BSF	
														Inf.	Dead plant
IBON-MAR P#26	65	119	84	72	47.68	67.45	2.49	10.5	78	98.3	82	0	5ms	10.33	4
Bekoji-1	74	126	96	81	42.14	70.1	2.36	10.8	77	98.2	83	1	15ms	12.67	5.5
Holker	73	125	98	77	39.83	66.35	2.27	11.2	76	98.1	84	0	10ms	10.83	4
Mean	70	123	92	77	43.21	67.96	2.37	10.8	77	98.2				11.27	4.5

DH= Days to heading, DM= Days to maturity, PH= Plant height (cm), ST= Stand count (%), TKW= Thousand kernel weight (gram), HLW= Hectoliter weight (kg/hl), GY= Grain yield (t/ha), NB= Net blotch (00-99), SC= Scald (1-5), LR= Leaf rust (%), BSF= Barley shoot fly (%)

Table 2. Combined mean grain yield and other agronomic traits of malt barley regional variety trial over years (2013-2014) and over locations (Sinana, Goba, Dinsho and Dodola).

SN	Genotypes	DH	DM	PH	ST (%)	TKW	HLW	GY
1	Bekoji	74.04	125.63	96.00	81.58	42.14	70.1	2368.6
2	IBON-MAR P#11	67.21	120.00	86.50	74.75	40.47	70.3	2560.5
3	IBON-MAR P#12	66.88	118.83	87.25	78.04	40.62	68.04	2594.5
4	IBON-MAR P#14	66.50	120.50	76.25	69.00	46.81	67.35	2360.5
5	IBON-MAR P#25	66.21	118.96	82.75	69.58	47.74	65.39	2472.4
6	IBON-MAR P#26	64.87	118.92	83.63	72.42	47.68	67.45	2490.3
7	IBON-MAR P#27	67.04	119.96	76.63	74.58	41.76	64.18	2163.5
8	IBON-MAR P#28	65.96	120.88	83.38	72.58	44.40	66.2	2319.5
9	IBON-MAR P#33	66.29	116.33	79.38	67.08	41.92	70.00	1956.6
10	IBON-MAR P#34	67.46	120.75	81.50	66.13	40.90	66.85	2167.9
11	IBON-MAR P#82	69.08	119.63	79.00	71.92	43.74	65.50	1915.5
12	IBON-MAR P#83	68.33	118.04	75.63	71.58	40.86	68.1	2511.0
13	IBON-MAR P#85	66.04	120.00	82.00	75.08	40.57	68.85	2549.9
14	IBON-MAR P#93	69.33	121.08	75.25	72.25	38.43	66.65	2398.9
15	IBON-MAR P#61	66.79	120.21	75.13	69.17	46.79	67.20	2521.3
16	IBON-MAR P#66	65.46	121.17	83.63	71.17	47.72	65.65	2456.5
17	IBON-MAR P#89	65.25	118.13	85.50	71.25	45.12	66.45	2482.5
18	IBON-MAR P#94	70.75	125.04	95.25	79.38	45.75	64.2	2191.9
19	Holker	72.75	125.00	98.13	76.96	39.83	66.35	2271.3
	Mean	67.87	120.74	83.81	73.32	43.48	67.06	2357.3
	CV (%)	3.56	5.23	13.40	18.48	3.95		978.9
	LSD (%5)	3.30	2.7	9.90	15.7	5.60		25.9

DH= Days to heading, DM= Days to maturity, PH= Plant height, ST= Stand (%), TKW= Thousand kernel weight, HLW= Hectoliter, GY= Grain yield, CV= Coefficient of variation, LSD= Least significance difference.

CONCLUSIONS

Singitan is the superior variety compared with the standard checks in grain yield performance in multi-location trails across the testing environments with good quality attribute and yield stability. It has better agronomic performance with moderate tolerance to barley shoot fly as compared to the standard checks. Hence, cultivation of the new variety is recommended in high altitudes of the major barley growing areas of the country having similar agro-ecologies with the testing sites.

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Appendix I. Description of variety Singitan

1. Variety :Singitan (IBON-MRA P#26)

2. Agronomic and morphological characteristics

2.1. Adaptation area: Highlands of Bale and similar agro-ecologies

Altitude (m. a.s.l): 2200-2600

Rainfall (mm): 750-1000

2.2. Seed rate (kg/ha): 100

2.3. Planting date: Mid July to early September

2.4. Fertilizer rate (kg/ha): 150 DAP only

2.5. Days to heading: 65

2.6. Days to maturity: 119

2.7. Plant height (cm): 84

2.8. Lodging : Resistance

2.9. Growth habit: Erect

2.10. Seed color: White

2.11. Row type: Two-row

2.12. Grain and malt quality:

- Protein (%): 10.5
- Grain size (≥2.2 mm (%): 98.3
- Malt extract (%): 78
- 1000 seed weight (g): 47.68
- Test weight (kg/hl): 67.45

2.13. Crop pest reaction: Moderately resistance to diseases and moderately tolerant to shoot fly

2.14. Grain yield (t/ha):

- Research field: 3.1-4.1
- Farmer's field: 2.1-3.5

2.15. Year of release:2016

2.16. Breeder/Maintainer: SARC/OARI