Registration of New Sesame (*Sesamum indicum* L.) Varieties: *BaHa-zeyit* and *BaHa-necho*

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Abstract: Improving seed yield, seed oil content, and other desirable traits is indispensable for sustainable production of the sesame crop. Twelve elite sesame (*Sesamum indicum* L.) genotypes were evaluated at three locations over two cropping seasons for seed yield and other agronomic traits in a complete randomized block design with three replications. The genotypes evaluated were W-103(WSS), W-104(SSM), W-106(SSM), W-107(WSS), W-109(WSS), W-110(WSM), W-119(WSM), W-120(WSM), W-122(WSM), W-124(SSM), W-125(SSM), and local check. Two sesame varieties, namely, *Abasena* and *Adi* were planted side by side with the 12 accessions for use as standard checks. The inter-row and intra-row spacing used was 0.40 and 0.10 meters, respectively. *BaHa-zeyit* (1.3 t ha^{-1}) and *BaHa-necho* (1.2 t ha^{-1}) were found to be superior in seed yields by 27 and 23% to the respective checks (*Abasena* and *Adi*). *BaHa-necho* is white-seeded, which is preferred for export while *BaHa-zeyit* is gray-seeded. *BaHa-zeyit* has high protein (27.1%) and crude oil (56%) contents; such an amount of oil content has not yet been reported for any sesame varieties developed and registered in Ethiopia. Both varieties were found to be moderately tolerant to bacterial leaf blight. As a result, these two varieties were released for cultivation in 2016, considering their contribution mainly to the improvement of sesame seed, protein, and oil yields. Thus, *BaHa-zeyit and BaHa-nacho* are sesame varieties released for the first time for East Hararghe Zone in Ethiopia, and can be cultivated in the region and other areas with similar agro-ecologies.

Keywords: Eastern Ethiopia; Seed color; Seed oil content; Seed protein; Seed yield

1. Introduction

Ethiopia has a suitable climate for the production of annual and perennial oil crops, and the oilseed sector provides immense benefit to millions of stakeholders. It is an oilseed plant that belongs to the family *Pedaliaceae*, which is cultivated mainly for oil and protein. Sesame is a high potential crop of industrial priority, which is underutilized crops (Williams and Haq, 2002). Currently, however, it is the main exported oilseed crop in Ethiopia, and increasingly taking a significant role next to coffee in generating foreign earnings for the country (Monitor, 2012). Ethiopia is among the five countries identified as a center of diversity for the sesame (*Sesamum indicum* L.) crop (Hernán and Petr, 2006). Ample genetic diversity of sesame in Ethiopia (Daniel and Parzies, 2011) creates an opportunity to develop new varieties of the crop through selection.

Improving seed yield and other traits of sesame as affected by the environment (Abate *et al*., 2015), requires genotypic evaluations across locations and over seasons. Thus, 14 elite sesame genotypes were evaluated mainly for seed, protein, and oil yields in 2013 and 2014 main cropping seasons at three locations (Babile, Iffa, and Likale) in East Hararghe Zone. *Abasena* and *Adi* are high-yielding compared to the other commercial sesame varieties in the region. *Abasena* is gray-seeded whereas *Adi* is white-seeded. Thus, these two varieties were used as standard checks for evaluating the varieties. The results of this study ultimately revealed two best performing sesame varieties, namely, 119/WSM and W-109/WSS. The two varieties were found to be superior to the two standard checks in terms of seed, protein and oil yields. Consequently, the National Variety Release Committee approved the varieties for release with the suggested local names '*BaHa-zeyit' and* '*BaHa-necho'*. The varieties were given the names *BaHa-zeyit* and *BaHa-necho* by the breeder, which generally mean oil-rich and white-colored, in the order listed here, in the local languages. Furthermore, in the local Oromo language, 'Baha' means "east". In the names, the upper case "*Ba'* suits to stand to represent Babile, and the upper case 'Ha' suits to stand for Haramaya, indicating the main research stations used for the variety development and institution that executed the research, respectively (Kebede and Bushra, 2012).

2. Agronomic and Morphological Characteristics

Seeds of the released varieties *BaHa-zeyit* (Figure 1) and *BaHa-necho* (Figure 2) are gray and white in color, respectively. The seed size of *BaHa-zeyit* is comparatively larger than that of *BaHa-necho*. Except in seed color and size, the two released varieties are morphologically similar.

The thousand seed weights of the varieties were nearly the same (Table 1). The number of pods per plant was also not associated with yield differences between the newly released varieties and the standard checks. Thus, the yield differences among the genotypes could be attributed to the number of seeds per pod. However, more research is required to use number of seeds per pod as the best attribute for evaluating genotypes.

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ISSN 1993-8195 (Online), ISSN 1992-0407 (Print)

Figure 1. *BaHa-zeyit*

Figure 2. *BaHa-necho*

Table 1. Agronomic and morphology description of *BaHa-zeyit*, *BaHa-necho* and two checks.

Variety	Seed yield (t ha^{-1})	TSW (g)	DF	DM	PH (cm)	NPPP
BaHa-zeyit	1.31	2.60	64.22	124.61	113.68	73.69
Abasena[a]	1.03	2.60	66.11	124.44	114.20	78.80
BaHa-necho	1.20	2.57	64.44	123.17	110.39	65.21
Adi[b]	0.97	2.62	63.39	124.94	113.73	65.72

Note: TSW=Thousand seed weight, DF=days to flowering, DM=days to maturity, PH=plant height, NPPP= number of pods per plant. 'a' and 'b' were released varieties and served as check for *BaHa-zeyit* and *BaHa-necho*, respectively.

3. Yield Performance and Stability /Adaptation

The seed yield of *BaHa-zeyit* and *BaHa-necho* in the three test locations over two seasons were consistent, indicating seed yield was stable. In addition, *BaHa-zeyit* and *BaHa-nacho* had seed yield advantages of 27 and 23% over *Abasena* and *Adi*, respectively (Table 2).

Table 2. Seed yield of *BaHa-zeyit, BaHa-necho* and two checks in three locations over two years.

Variety	Seed yield (t ha^{-1})								
	Babile			Likale			Iffa		
	2013	2014	Mean	2013	2014	Mean	2013	2014	Mean
BaHa-zeyit	1.39	1.17	1.28	2.07	1.02	1.54	1.02	1.17	1.09
Abasena (Check)[a]	0.88	1.02	0.95	1.48	0.93	1.20	0.81	1.06	0.93
BaHa-nacho	1.24	1.19	1.21	1.78	0.72	1.25	1.06	1.22	1.14
Adi (Check)[b]	0.95	1.02	0.98	1.37	0.56	0.96	0.86	1.09	0.97

Note: 'a' and 'b' were released varieties and served as check for *BaHa-zeyit* and *BaHa-necho*, respectively

In all, *BaHa-zeyit* and *BaHa-necho* showed stable and high seed yield over locations and years. Thus, these new varieties were recommended for cultivation in altitudes ranging from 560 to 1650 meters above sea level, which include the vicinities of Babile, Bisidimo, Kile, Error Guda, Gursum and areas with other similar agro-ecologies.

4. Disease Reaction

In the East Hararghe Zone of Ethiopia, diseases and pest pressure on sesame are less than other zones of the country in which the crop is grown, possibly due to lower practice of mono-cropping. *BaHa-zeyit, BaHa-necho* and checks (commercial varieties) showed moderate tolerance to bacterial leaf blight (Table 3).

Table 3. Seed oil, protein, and reaction to bacterial leaf blight of *BaHa-zeyit, BaHa-necho* and two checks.

Variety	Seed oil content (%)	Seed protein content (%)	Reaction to bacterial leaf blight (score)
BaHa-zeyit	56	27.1	3.3
Abasena[a]	52	23.63	4
BaHa-nacho	52	23.8	4
Adi[b]	50.8	24.24	4.7

Note: 'a' and 'b' were released varieties and served as check for *BaHa-zeyit* and *BaHa-necho*, respectively. Disease score: 1-9 scale; where 1- no disease (highly resistant), and 9- highly susceptible.

5. Other Desirable Attributes

The newly released variety *BaHa-zeyit* was found to have seed oil content of as much as 56%, which was the highest recorded for sesame varieties registered in Ethiopia (Table 3). *BaHa-nacho* has a white seed color. The high oil content and white seed color of the seeds are both desirable traits preferred by edible oil processors and exporters. In addition, the seed protein content of *BaHa-zeyit* was found to be higher than that of the check (*Abasena*). The seed protein contents of *BaHa-nacho* and *Adi* were found to be nearly equal. Furthermore, *BaHa-zeyit* is rich in linoleic acid (42.1%), oleic acid (42.2%), unsaturated fatty acids (84%) and unsaturated fatty acid and saturated fatty acid ratio. High seed crude fiber (7.7%) and linoleic acid (40.9%) were also recorded for *BaHa-necho* (Kebede *et al.,* 2017).

6. Conclusion

The results of this study demonstrated the superiority of the newly released varieties (*BaHa-zeyit* and *BaHa-necho*) to the standard checks (*Abasena* and *Adi*) in terms of seed yield. In addition, *BaHa-zeyit* was found to have a higher seed protein content than *Abasena*. *BaHa-necho* was found to be white-seeded, which is the preferred seed color for export. The newly released varieties were also found to have desirable seed physicochemical traits. Consequently, *BaHa-zeyit* and *BaHa-necho* got approval for cultivation and became the first sesame varieties to be released in eastern Hararghe Zone of Ethiopia like the groundnut varieties (*BaHa-gudo* and *BaHa-jidu*), which were released for the first time in the region in 2012. In conclusion, the newly released varieties (*BaHa-zeyit* and *BaHa-necho*) can be cultivated profitably and sustainably in the low to mid altitude (560 to 1650 meters above sea level) areas of eastern Ethiopia and in other areas with similar agro-ecologies, with good potential for export, industry, and enhanced income for farmers.

7. Acknowledgements

The author thanks the Ethiopian Institute of Agricultural research for funding the research and Haramaya University for facilitating release of the fund and logistics required to do the research. The author acknowledges technical staff members of the Oilseeds Research Program of Haramaya University: Azeb Tegenu, Tefera Birhanu, Nebiyou Mohammed, Abdulatif Abubeker, Obsitu Abrahim, Sheger Dawed, Zeyede Akale and Abrahim Yons and Gizachew Abera for facilitating, and managing field and laboratory experiments.

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