

Research Article

Registration of “Ikhulule” Finger Millet (*Eleusine coracana* (L.) Gaertn) Variety

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Abstract

Although finger millet is grown extensively in Ethiopia, the national average yield is much less than the crop's genetic potential. This is due to a lack of stable, high-yielding, and disease-tolerant finger millet varieties. Thus, the current study was conducted to find stable, high-yielding, and disease-tolerant genotypes for increasing production. A randomized complete block design was used to evaluate twelve finger millet genotypes under a regional variety trial at Mechara and Habro for three consecutive years (2017 to 2019) against standard checks (Maba, Addis01, and Axum). The tested genotypes were brought from the Melkasa Agricultural Research Center. Further, some of these genotypes were collected from different areas of Oromia and the remaining were introduced from Kenya including Ikulule through Melkasa Agricultural Research Center. At the multi-environment evaluation, the yield advantage of the new variety is 18% higher than the best-performed standard check Maba (5.8tha⁻¹). Additionally, the GGE biplot analysis showed that the Ikulule variety is high-yielding across locations and years. Also at the variety verification trial, the overall mean grain yield of (Ikulule) at on station and farmers' fields is 3.81 t tha⁻¹ whereas the standard check kumusa is 2.91 tha⁻¹. The new variety is not only high-yield but also resistant to blast rust and shoot flies relative to standard check. As a result, this new variety of Ikulule was released for the west Hararghe zone districts and similar agroecologies.

Keywords

Finger Millet, *Ikulule*, *GGE*

1. Introduction

Finger millet (*Eleusine coracana* L.) is an allotetraploid ($2n = 4 \times = 36$) annual cereal crop [7] It is important in the semi-arid and tropical regions of the world where other crops cannot perform well [8] especially in East Africa, India, and other Asian countries [10]. Potentially a climate-resilient and

nutritious crop with highly nutritive and antioxidant properties [9]. Further, it is a reach reservoir for different micronutrients particularly high amounts of calcium, and iron, and is gluten-free as a result has a health benefit [1]. Consequently, it is a critical crop for poor farmers who inhabit arid, infertile, and

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Received: 9 October 2024; **Accepted:** 4 November 2024; **Published:** 28 November 2024



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marginal lands [3]. In most growing areas, grain is mainly utilized to make traditional food and drinks whereas stalks are for livestock feed [1]. Additionally, in Ethiopia, it is a widely produced and important staple food crop in most regions.

The second-largest producer of finger millet in the world followed by India is Ethiopia [6]. It is the sixth most important cereal crop in total area and production after teff, maize, sorghum, wheat, and barley in Ethiopia [11]. Further, it accounts for 5% of the total area allocated to cereal crops [1]. Despite this crop was widely produced as well as a center of origin and diversity in Ethiopia [4]. However, the average productivity is 2.5 and 1.4 tha^{-1} in the national and west hararghe zones respectively [2] which is by far lower than it is potential 6 tha^{-1} [1]. This is mainly due to constraints like little research attention, poor agronomic management, high lodging, disease (mainly blast) and weed [5], and lack of stable and high-yielding varieties [3]. Therefore, to address these problems, developing adaptable, stable, high-yielding, and disease-resistant varieties is important.

1.1. Varietal Origin and Evaluation

Ikhulule was originally introduced from Kenya and other genotypes were collected from different parts of Oromia regional state through Melkasa Agricultural Research Center. At regional variety trials fifteen genotypes including the standard checks Maba, Axum, and Addis 01 evaluated for three consecutive years (2017-2019) at locations Mechara (on station) and Habro district. The new variety Ikhulule showed relatively better performance consistently across years and locations. The variety verification trial was conducted during the 2020 cropping season at on-station and field of farmers the variety Ikhulule was better than the standard check Kumusa for most of the traits Table 2.

1.2. Agronomical and Morphological Characteristics

Ikhulule, the released variety, has light red-brown seeds, an average height of 103 cm, is less prone to lodging than standard checks, and 131 days to maturity. The detailed agronomic characteristics of the newly released variety are presented in Table 3.

1.3. Yield Performance

The mean of grain yield at two locations across three years for Ikhulule showed a relatively consistent and average yield (6.38 tha^{-1}) with an 18% yield advantage over the best standard check Maba (5.8 tha^{-1}) Table 1. Further, at variety verification trials the mean of the candidate (Ikhulule) was 4.11 tha^{-1} grain yield at the research station, while on-farm (farmers' field) evaluation was 3.51 tha^{-1} with an overall mean of 3.81 tha^{-1} . On the other side, the mean of standard check kumusa was 2.90 tha^{-1} Table 2.

1.4. Reaction to pest

Ikhulule was tested for its reaction to diseases blast rust and shooting flies, it showed moderate resistance to these pests Table 3.

1.5. Stability Analysis

Using GGE biplot analysis the yield stability of tested genotypes was examined.

The result showed that the Ikhulule was located closer to the concentric circle (Figure 1) this justifies, that the released variety (Ikhulule) was ideal.

Table 1. Mean grain yield (tha^{-1}) of 15 genotypes across three years at two locations.

Genotypes	Habro			Mechara			Mean
	2017	2018	2019	2017	2018	2019	
Addis 01 (check)	7.29	5.76	5.14	2.70	3.38	4.17	4.74
KNE#814	7.50	5.41	7.43	5.48	3.81	5.69	5.88
GBK-008328A	3.54	4.91	5.94	5.29	5.26	7.57	5.41
KNE#1124	5.21	5.95	6.88	5.00	3.42	7.43	5.64
ENGENY	3.75	5.64	6.74	5.03	3.94	6.60	5.28
KNE#1012	5.21	5.90	6.94	6.05	5.10	7.08	6.04
KNE#624	5.42	5.92	6.60	4.67	2.73	7.64	5.49
Maba (check)	8.06	6.08	6.25	5.36	4.40	4.65	5.8
P224	5.63	4.90	7.36	4.99	3.73	5.76	5.39
GBK-000399A	9.31	5.09	6.67	6.06	4.07	3.92	5.85

Genotypes	Habro			Mechara			Mean
	2017	2018	2019	2017	2018	2019	
Ikhulule	8.06	6.16	7.57	5.97	3.03	7.50	6.38
Axum (check)	7.78	4.60	7.92	3.04	4.38	3.85	5.26
Acc.#14FMB/0	3.67	4.85	6.46	4.39	3.60	6.46	4.90
KNE#688	6.81	4.71	6.95	4.39	3.92	5.11	5.31
KNE#622	4.10	4.45	6.74	5.39	2.70	6.67	5
Grand mean	6.08	5.35	6.77	4.92	3.83	6	5.49
F-value	**	*	*	*	*	**	

Table 2. Grain Yield data for Finger millet Variety Verification Trial at Mechara and Tulo districts of west Hararghe Zone in 2020 cropping season.

Finger millet	On-station GY (tha-1)	On-farm GY (tha-1)	Overall GY (tha-1)
Ikhulule/Candidate-1	4.11	3.51	3.81
Kumsa (Check)	3.35	2.45	2.90

GY= Grain Yield

Table 3. Agronomic/morphological characteristics of finger millet variety, Ikhulule.

Variety name	Ikhulule
Adaption areas	Mechara, Habro, and similar agro-ecologies
Altitude (m.a.s.l.)	1700-1900
Rainfall (mm)	800-1200
Seed rate (kg/ha ⁻¹)	8-10
Row Spacing (cm)	40
Planting date early to late May	Earl to late May
Fertilizer rate kg ha ⁻¹	
Nitrogen (N)kg ha (urea)	100
NPS/NPSBn (kg ha ⁻¹)	100
Days to maturity (days)	131
Plant height in (cm)	73
Seed color	Light brow
Growth Habit	Erect
Crop disease and insect Reaction	
Blast	2
Shoot fly	2
Grain Yield (t ha ⁻¹)	

Variety name	Ikhulule
Research field	4.11
On-farm	3.51
Year of Release	June, 2021
Breeder Seed Maintainer	Mechara Agricultural Research Center

Note: m a.s.l. = meters above sea level.

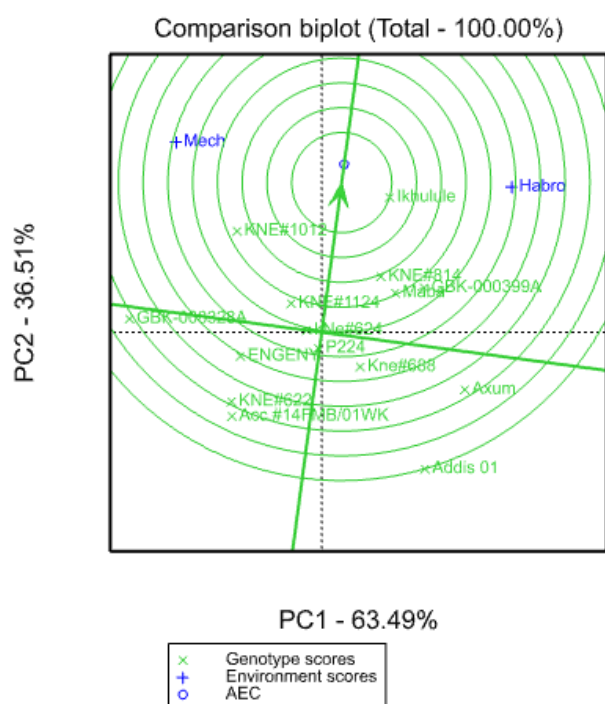


Figure 1. The average genotypes coordination (AGC) views rank genotypes relative to the center of concentric circles.

2. Conclusions and Recommendations

The national average productivity of finger millet is below its genetic potential although it is a commonly grown and reliable food crop in Ethiopia. This is because of a number of biotic and abiotic stresses, as well as a lack of access to improved varieties, particularly in the west Hararghe zone. In order to address these issues, the new variety Ikhulule was released for districts in this zone because of it demonstrated a comparatively high grain yield, greater adaptability, and stable performance compared to the other evaluated genotypes and standard checks. It is also resistant to blast disease and shoots flies. Therefore, farmers in West Hararghe, particularly those in Mechara and Habro, and other similar ecologies, should be using this new finger millet variety (Ikhulule) to boost their productivity.

Abbreviations

AGC Average Genotypes Coordination
GGE Genotype Mean Effect (G) Plus Genotype by Environment Interaction (G*E)

Acknowledgments

The authors greatly acknowledged the Oromia Agricultural Research Institute for funding the research. The authors also express their gratitude to all former and present staff members of the cereal research team of the Mechara Agricultural Research Center for the execution of the experiment.

Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

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