The Release and Registration of *Bako-09* (Acc. 214995) Finger millet Variety

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Abstract

The name Bako-09 was given to the finger millet (Eleusine coracana sub spp. coracana) variety with the pedigree of Acc. 214995, which was introduced from Zambia through Ethiopian Biodiversity Institute and released as a variety by Bako Agricultural Research Center in 2017. Bako 09 and the other eleven pipeline genotypes were evaluated against standard check (Gute) at Bako and Gute sites from 2013 to 2015 and at Boneya Boshe in 2014 main cropping season. Additive main effect and Multiplicative Interaction (AMMI), Genotype and Genotype by Environment interaction (GGE) biplot analysis, and Eberhart and Russell regression model revealed that Bako 09 is stable and high yielding (2.99 t ha^{-1}) with a yield advantage of 21.99% over the standard check. Besides, the variety has purple leaf, nodes and finger color, which is a known trait for its resistance to diseases and dominant over green the other colored traits in finger millet. Therefore, Bako-09 was released in 2017 for its high grain yield potential and moderately resistant against Magnaporthe oryzea disease.

Keyword: AMMI, Finger millet (*Eleusine coracana* subsp. *coracana)*, GGE biplot, *Magnaporthe oryzea*

Introduction

Finger millet (*E. coracana* subsp. *coracana*, 2n=4x=36), is the most important subsistence crop of Africa and India (Babu *et al.*, 2007). It is potentially a climate-resilient and nutritious crop with highly nutritious and antioxidant properties (Kumar *et al.*, 2017). Very importantly, finger millet grain is gluten-free, rich in calcium, fiber, iron, and has excellent malting qualities (Chandrashekar, 2010 and Pradhan *et al.*, 2010). The major positive traits of finger millet is its adaptability to adverse agro-ecological conditions with minimal inputs, tolerant to moisture stress, produced on marginal land where other crops cannot perform and tolerant to acidic soil (Upadhyaya *et al*., 2007).

Despite its wider production coverage and immense nutritional importance, limited availability of stable high yielding and disease tolerant finger millet variety is one of the major production constraints in Ethiopia.

Therefore, the primary objective of this study was to develop adaptable, high yielding, stable and disease tolerant finger millet varieties for the test environments and similar agroecologies of the country.

Varietal Origin and Evaluation

Bako-09 (Acc. 214995) finger millet variety was originally introduced from Zambia through Ethiopian Institute of Bio-diversity (IBC). The *Bako-09* and other pipeline verities were evaluated against the standard check, Gute, for three consecutive years (2013-2015) at Bako and Gute and in 2014 at Boneya Boshe research stations.

Agronomic and Morphological characteristics

Bako-09 (Acc. 214995) is characterized by purple pigmented leaves, nodes and finger with brown seed color. Purple pigmented types of finger millet are more resistant to blast than non-pigmented ones and is dominant over green (Kenneth and LeRoy, 1977). The average 1000 seeds weight was 2.6 grams, and its average plant height was 88.8cm. The detailed agronomic characteristics of the variety is indicated in Table 2 below.

Yield Performance

The released variety Bako-09 showed higher mean grain yield (2.99 t h^{-1}) and more stable performance with yield advantage of 21.99% over the standard check, Gute (Table 1).

Table 1: Mean seed yield (ton ha^{-1}) of 11 finger millet genotypes tested in seven environments.

Genotype	Mean grain yield (ton ha^{-1})							Mean
	Bako			Gute			B. Boshe	
	2013	2014	2015	2013	2014	2015	2014	
214995	3.85	3.18	3.69	3.04	3.08	1.78	2.31	2.99
BKFM0058	2.79	2.00	4.04	1.72	3.26	2.04	1.74	2.51
BKFM0052	3.18	1.93	4.05	2.32	3.10	1.89	1.25	2.53
203547	3.79	2.64	3.29	2.33	2.93	1.75	1.33	2.58
229727	3.58	2.45	2.99	2.60	2.92	2.53	2.60	2.81
BKFM0063	3.67	2.24	4.14	2.20	2.98	1.54	2.17	2.70
203356	2.73	2.04	2.50	1.99	2.48	1.87	1.25	2.12
203351	3.09	2.31	2.93	3.10	2.86	1.98	1.85	2.59
BRCFM-8-04	3.19	2.29	3.23	1.79	2.79	1.93	1.22	2.35
Anno-1	2.64	2.01	3.73	2.15	2.16	1.67	1.43	2.26
Gute	2.56	2.78	3.32	2.62	2.93	1.69	1.26	2.45
Mean	3.19	2.35	3.4	2.35	2.86	1.88	1.67	2.54
CV (%)	10.8	9.3	5	19.9	11.2	19.7	15.2	
F- Value	**	**	Ns	*	**	Ns	**	

CV=*coefficient of variation,* ** highly significant, * significant

Table 2. Agronomic/morphological characteristics of finger millet variety Bako 09

Variety name and pedigree	Bako 09 (Acc. 214995)
Adaptation area Adaptation area:	Bako, Gute, B/Boshe and similar agro-ecologies Altitude(mal): 1400-2300m Rainfail (mm): 1200-1300mm
Average Days to flowering	84 days
Average Days to maturity	146 days
1000 seed weight (g)	2.6
Mean Plant height (cm):	89
Seed color	Brown
Growth habit	Erect
Grain yield (ton/ha)	
On farmers field:	2.3-2.57
On station:	2.34-2.98
Blast disease reaction	Moderately resistant
Year of release	2017
Breeder/Maintainer	Bako Agricultural Research Center (BARC/OARI)

Stability and Adaptability Performance

Eberhart and Russell (1966) model revealed that *Bako-09* (Acc. 214995) showed regression coefficient (bi) relatively closer to unity (0.9879) and reasonably acceptable deviation from regression that approaches to zero (0.0321), implying the variety is stable and widely adaptable than the other genotypes (Table 3). GGE biplot analysis also showed that Bako-09 (Acc 214995) fall in the central circle away from vertical mean line and closer to the origin, indicating its high yield potential and relative stability compared to the other genotypes (Fig 1). Similarly, the AMMI analysis result revealed that Acc. 214995 and BKFM0063 recorded IPCA values relatively close to zero and hence are better stable and widely adaptable genotypes across locations.

Reaction to Major Diseases

Bako-09 (Acc.214995) showed moderately tolerant to blast *(Magnaporthe oryzea),* which is the major bottleneck for finger millet production in western Oromia.

Table 3: Regression coefficient (bi) and squared deviation from linearity of regression (s2di) by the test genotypes revealed using Eberhart and Russell model.

Genotypes	Regression coefficient (bi)	Squared deviations from regression (S^2di)	Grain yield (tons ha-1)
214995	0.9879	0.0321	2.99
BKFM0058	1.0460	0.0125	2.51
BKFM0052	0.9459	0.0607	2.53
203547	1.1639	0.1244	2.58
229727	0.4471	-0.0233	2.81
BKFM0063	1.2289	-0.0113	2.70
203356	1.4084	-0.0342	2.12
203351	1.3174	0.0292	2.59
BRCFM-8-04	0.6978	-0.0574	2.35
Anno-1	0.6600	0.0095	2.26
Gute	1.0966	-0.0407	2.45

*Standard error of beta = 0.2074; t = Tons; ha = Hectare; *, ** = Significant at P < 0.05 and P < 0.0 levels, respectively.*

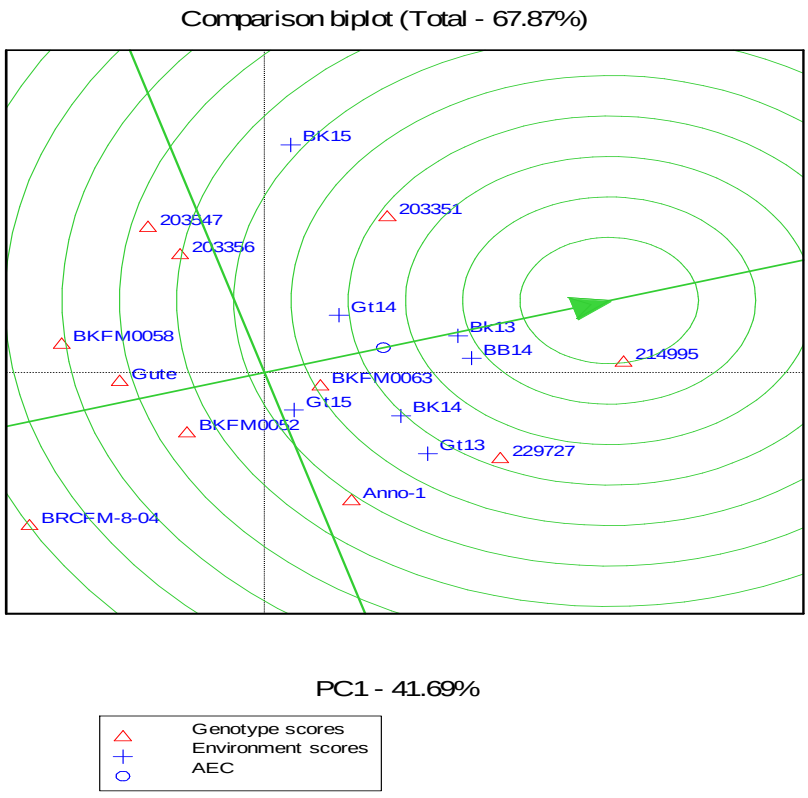

Fig 1: GGE Biplot analysis showing grain yield stability of tested genotypes and environments

Conclusion

Bako-09 gave high grain yield, showed wider adaptability, tolerant to blast and stable performance than the standard check and other tested genotypes. Therefore, smallholder farmers and other finger millet producers inhabiting around Bako, Boneya Boshe, Gute and areas with similar agro-ecology can grow Bako-09 variety with its full agronomic and other management recommendations.

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