

Registration of *Morka* Maize (*Zea mays* L.) Variety

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Abstract: *Morka* is a common name given to the maize (*Zea mays* L.) variety with the pedigree *UCB S₁ C₂* after its official release. It is an open pollinated variety developed by the Jimma Agricultural Research Center from *UCB* after two cycles of *S₁* recurrent selection. *Morka* means “competent” in *Afan Oromo* language given to express its yield potential which is comparable to that of the popular hybrid variety, BH660, in the areas. Its performance was evaluated in field experiments carried out over two years in three locations environments where it gave mean grain yield of 8.7 t ha⁻¹ and significantly ($P < 0.01$) out yielded the standard check (*UCB*) with a grain yield benefit of 30% (2.0 t ha⁻¹). Better grain yield potential, significantly ($P < 0.01$) shorter plant height and lower ear placement, and superior tolerance to diseases and resistance to lodging than the original *UCB* are the desirable traits of this variety. *Morka* was recommended for commercial production in the mid altitude (1600-1800 m above sea level) agro-ecologies of Jimma and Illu Ababora Zones.

Keywords: Maize; *Morka*; Open Pollinated Variety; Recurrent Selection; *Ukuruguru Composite B*

1. Introduction

Maize is the most important staple food in many parts of Ethiopia. It is the leading cereal in productivity and second to Tef in area of production in the country (CSA, 2006). The western parts of Ethiopia have very great potential for both its production and utilization. *Ukuruguru Composite B (UCB)* was the most adapted and well preferred open pollinated variety of maize in the southwestern part of Ethiopia; especially, in Jimma and Illu Ababora Zones since its release in 1975. This variety possesses adequate levels of resistance to major leaf diseases (Assefa, 1995; Dagne *et al.*, 2001) and storage pests (Demissew *et al.*, 2004). However, it grows tall, reaches a height of 350 centimeters (cm) and bears heavy cobs placed at 250 cm height that makes it susceptible to lodging. Contamination through cross pollination with pollen from nearby maize fields was the major factor for the accumulation of undesirable traits in *UCB*. Furthermore, no efforts were made to keep up its genetic purity throughout its long usage since it was commercialized in 1975. These conditions have resulted in the genetic deterioration and reduced yield potential of *UCB*. Thus, farmers were forced to withdraw from growing *UCB* since 1995. To alleviate this problem, the maize breeding team based at the Jimma Agricultural Research Center had been doing intensive improvement on *UCB* since 1998. The objective was to develop the improved version of *UCB* that can be released for commercial production as an option to the hybrid varieties.

The *S₁* recurrent selection also called endogamic selection, involves repeated regeneration of the first selfed (*S₁*) progenies and subsequent evaluation of the progenies to select the superior ones that can be recommended to reconstitute improved version of the parent variety. In maize, this selection scheme is considered to be more efficient than other selection schemes in improving a broad based population as it exposes deleterious homozygous genes to be eliminated through selection. Burton *et al.* (1971) realized gains of

4.2% cycle⁻¹ over four cycles of selection for grain yield. Besides its effectiveness in improving performance in terms of productivity, it has been useful in improving resistance to biotic stresses such as European corn borer (Penny *et al.*, 1967), stalk rot (Jinahyon and Russell, 1969) and downy mildew (De Leon *et al.*, 1993). Through two cycles of this selection program we have successfully improved grain yield, plant height and ear placement, tolerance to diseases and resistance to lodging in the tall and lodging susceptible *UCB* maize variety. Thus, the improved version, *UCB S₁ C₂ (Morka)* which has higher grain yield and reduced plant height and ear placement, was officially released in 2008 after ten years of continuous work. The released variety was given a new name *Morka* meaning “competent” in *Afan Oromo* language to express its yield potential which is comparable to that of the popular hybrid variety, BH660, in Jimma and similar areas. *Morka* fits best to areas receiving annual rainfall ranging from 1000-2000 mm and was recommended for commercial production in the mid altitude (1600-1800 masl) agro-ecologies of Jimma and Illu Ababora Zones in the western part of Ethiopia. Currently, there is a tremendously growing demand for *Morka* seed from farmers in west Wellega Zone of Oromia and the Kaffa and Dawaro Zones of the Southern Nations, Nationalities and Peoples’ Region.

2. Varietal Evaluation and/or Testing

Morka was developed from the Tanzanian open pollinated variety, *UCB*, which was introduced to Ethiopia in the 1970s and released for commercial production in the southwestern part of the country in 1975. Two cycles of *S₁* recurrent selection have been carried out to improve grain yield, plant height, ear placement, resistance to lodging and other desirable agronomic traits. Yield performance was evaluated in field experiments carried out at three locations (Jimma, Hurumu and Bako) for two years (2006 and 2007). *Kuleni*, Gibe composite, *UCB*, BH660 and BH670 were included as checks. Its verification trial was also conducted at two

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on-station and four on-farm locations. Planting was done from mid April to mid May depending on the onset of rain. A seed rate of 25 kg ha⁻¹ and fertilizer of 46 kg N and 66 kg P₂O₅ ha⁻¹ were used. All the other field management practices were applied following research recommendations specific to each location. Full procedures followed to develop the variety and evaluate yield performance in on-station and on-farm experiments are indicated in research paper submitted to East African Journal of Agricultural Science for parallel publication (Leta and Habte, in press).

3. Agronomic and Morphological Characteristics

Morka has shorter plant height, lower ear placement, higher grain yield and better resistance to diseases and tolerance to lodging than the original *UCB*. Its other distinguishing features are purple and white tassels, silks and stems (more than 60% white colored), white seed color, semi flint grain texture, medium grain size and thousand grain weight of 40 grams. It tends to be more prolific with wider spacing and good soil fertility though it bears about 1.5 ears per plant on average with the recommended row and plant spacing of 75 and 30 cm, respectively. It attains 50% tasseling and 50% silking within 90 and 94 days, respectively, after emergence. Its ear and plant heights are 160 and 285 cm, in that order (Table 1) with ear position of 0.55 which is almost at the middle of the plant.

4. Yield Performance

Morka gave the highest mean grain yield of 8.7 t ha⁻¹ across five environments and significantly ($P < 0.01$) out yielded *UCB* with yield advantage of 30% (2.0 t ha⁻¹) and out yielded BH660 with statistically non significant grain yield of 0.8 t ha⁻¹ (Table 2). Across two on-stations (Jimma and Hurumu) and four on-farm verification sites, *Morka* produced mean grain yield of 6.1 t ha⁻¹ with yield advantage of 2.0 t ha⁻¹ over the standard check, *UCB* (Table 3).

5. Stability of Performance

Yield stability was studied using data obtained from five environments as per Eberhart and Russell (1996). The result of the study showed that *Morka* had high yield across environments and less than unity regression coefficient indicating that it had above average stability and is better adapted to marginal conditions (Leta and Habte, unpublished data).

6. Disease Reaction and Lodging Resistance

Morka was superior in tolerance to diseases and resistance to lodging as compared to the standard check, *UCB*. Significantly ($P < 0.01$) lower mean severity of 1.83 and 2.00 were recorded for gray leaf spot and turcicum leaf blight (Table 2), respectively, in *Morka* in a 1-5 scale, where 1 indicates clean or no infection and 5 indicates severe disease.

7. Quality Analysis

Morka was found to have good *injera* baking quality. Its *injera* is soft, has good and attractive physical appearance or texture and longer shelf-life even without mixing it with *teff*. It has also proved to have more flour to grain ratio. The fresh green cobs of this variety are very sweet. Its white colored and semi flint textured kernels in straight and longer rows on the cobs are of unique importance in adding beauty to the boiled fresh maize and increases consumers preference. Its grains have better resistance to storage pests (Demissew *et al.*, 2004) which allows farmers to store the grains for a longer time. These were found to be desirable qualities of *Morka* that attract consumers.

8. Conclusions

Morka was found to be a higher and more stable yielder than *UCB* with lower ear placement and shorter plant height. As a result of its short stature and low ear placement, it is more resistant to lodging. It was recommended for the mid altitude (1600-1800 masl) agro-ecologies of Jimma and Illu Ababora Zones and similar areas in the southwestern part of Ethiopia. After it was officially approved for full release by the National Variety Releasing Committee in February 2008, the variety was named "*Morka*" meaning "competent" in *Afan Oromo* language to express its yield potential which is comparable with the yield potential of the popular hybrid variety in the region.

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Table 1. Agronomical and morphological characteristics of *Morka*.

Characters	Values/description
Adaptation	Jimma and Illu Ababora Zones
Altitude (masl)	1600-1800
Rainfall (mm)	1000-2000
Fertilizer rate (kg ha ⁻¹)	
-Phosphorous as P ₂ O ₅	46
-Nitrogen as N	46
Planting date	Mid April to mid May depending on the on set of rain
Seed rate (kg ha ⁻¹):	25
Days to anthesis (pollen shading)	90
Days to silking	94
1000 seed weight (g)	40
Ear height (cm)	160
Plant height (cm)	285
Stem color	White and purple
Tassel color	White and purple
Seed color	White
Pollen color	Yellow
Grain texture	Semi flint
Grain size	Medium
Crop pest reaction	Tolerant to major leaf diseases (GLS, Blight and Rust)
Yield (t ha ⁻¹)	
-Research field	8-11
-Farmer field	5-6
Year of release	2008
Breeder/Maintainer	JARC/EIAR

Table 2. Mean grain yield and major agronomic traits of *Morka* and the standard checks combined across five environments.

Entry	Grain yield (t ha ⁻¹)	Plant height (cm)	Ear height (cm)	Ear position	Days to 50% Silking	Diseases (1-5 scale) ^a			Lodging (%)
						GLS	TLB	CR	
<i>Morka</i>	8.7a	289.8b	162.1c	0.55b	94b	1.83c	2.00c	1.15c	14.99
UCB	6.7b	320.6a	201.7a	0.63a	97a	2.15a	2.38a	1.23b	17.36
BH660	7.9ab	302.2b	179.7b	0.60a	95b	2.08b	2.10b	1.25a	22.47
LSD (0.01)	1.40	17.70	14.10	0.045	1.43	0.069	0.010	0.058	ns ^b

Values followed by the same letter(s) are not significantly different from each other; ^a1 = Clean or no infection and 5 = Severely diseased; ^bns = No statistically significant difference; GLS = Gray leaf spot; TLB = Turicum leaf blight; CR = Common rust

Table 3. Mean data combined across two on-station and four on-farm sites in variety verification trial.

Entry	Days to 50% silking	Plant height (cm)	Ear height (cm)	Diseases (1-5) ^a			Lodging (%)	Plant aspect (1-5) ^b	Ear aspect (1-5) ^b	Diseased ears (No)	Bare tips (No)	Grain yield (t ha ⁻¹)
				GLS	TLB	CR						
<i>Morka</i>	79	263	194	1.5	1.5	1.0	2.6	1.4	1.4	3	0	6.2
UCB	91	350	226	2.0	2.0	1.0	34.3	3.0	2.2	6	0	4.2

^a1 = Indicates clean or no infection and 5 = Severely diseased; ^b1 = Good and 5 = Poor; GLS = Gray leaf spot; TLB = Turicum leaf blight; CR = Common rust