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Research Article

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Performance evaluation of improved mung bean (*Vigna radiata* (L.) Wilczek) varieties at low moisture areas East Shewa, Oromia, Ethiopia

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ABSTRACT

Mung bean is a useful crop in drier areas and has a good potential for crop rotation and relay cropping with cereals using residual moisture. The experiment was conducted at Adami Tulu Agricultural Research Center (ATARC), Lume and Dugda during 2018 and 2019 with the objective to identify adaptable and high yielder mung bean varieties for East Shewa Zone and similar agro ecologies. Four released mung bean varieties Shewa robit, Beroda, N-26 and Arkebe used as planting material. The experiment was laid down in Randomized Complete Block Design (RCBD) with three replications. The plot size was 1.8m × 2.5 m (4.5 m^2) having 6 rows and a spacing of 0.30 m between rows and 50 cm between replication, 1 m between blocks. Data's like plant height (cm), number of pods per plant, number of seeds per pod, days to flowering, days to maturity, grain yield (kg ha^{-1}), 100 seed weight (g) were collected and analyzed using SAS software. The combined analysis of variance showed that there was significant variation at ($P \leq 0.05$ and $P \leq 0.01$) among the studied varieties, locations, and year main effect. There were also significant interaction effect on location by year, varieties by year and location by varieties by year for grain yield and other yield components. But non-significant on varieties by location for all traits except plant height and indicated those varieties were performed similarly across the locations. Shewa Robit variety had higher grain yield (1607.4 kg ha^{-1}) followed by N-26 (1542 kg ha^{-1}) and Beroda (1466.1 kg ha^{-1}). While Arkebe Variety had lower grain yield (893.4 kg ha^{-1}) as compared with others varieties. Therefore Shewa Robit and N-26 were recommended for the study area and similar agro-ecologies.

KEYWORDS: Mungbean, grain yield, Varieties

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INTRODUCTION

Mung bean is described as the binomial name Vigna which belongs to the angiosperm dicot crops with family Fabaceae. Mung bean, *Vigna radiata* (L. Wilczek) also called Green gram an annual food legume belonging to the subgenus *Ceratotropis* in the genus *Vigna* (Jood *et al.*, 1989). Keatinge *et al.* (2011) stated that mung bean is an essential short duration, self- pollinated diploid legume crop with high nutritive significances and nitrogen fixing capacity. It is an eco-friendly food grain leguminous crop of dry land agriculture with wealthy basis of proteins, vitamins, and minerals. It is a quick crop, requiring 75–90 days to mature. It is a useful crop in drier areas and has a good potential for crop rotation and relay cropping with cereals using residual moisture (Asrate *et al.*, 2012).

It has been reported by different scholars as mung bean contains nutrition value. Mung bean can provide significant amounts of protein (240 g/kg), carbohydrate (630 g/kg) range of micronutrients in diets (EPP, 2004). Mung bean protein and carbohydrates are easily digested and create less flatulence than those derived from other legumes. Parts of mung bean like pods and sprouts are eaten as ice of vitamins and minerals is a common ingredient in Chinese and Indian cuisines Polhill and vander Maesen (1985).

Mung bean is the sixth product that Ethiopian Commodity Exchange trading next to coffee, sesame, white pea beans, maize and wheat. It mostly produced in Amhara regional state particularly in some areas of North Shewa and South Wollo as well as in some woreda's of Benishangul Gumuz regional state. Its demand in the international market is increasing from time to time and there is a need supply to address the demand.

Also, in Ethiopia's mung bean export has grown slightly from time to time Ethiopian commodity exchange (ECX, 2014). But, supply is limited in Ethiopia since the production of mungbean is very low due to different factor. Availability and distribution

of the varieties is one of factor which affects production of mungbean in Ethiopia particularly in East Shewa Zone. Therefore there is a need to adapt and popularize the released varieties in the area. Therefore, this project was initiated with the objective to identify adaptable and high yielder mung bean varieties for East Shewa Zone and similar agro ecologies.

MATERIAL AND METHODS

The experiment was conducted at Adami Tulu Agricultural Research Center (ATARC), Lume and Dugda during 2018 and 2019. ATARC is located in the mid Rift Valley of Ethiopia about 167km south from Addis Ababa. It lies at a latitude of 7° 9'N and longitude of 38° 7'E. It has an altitude of 1650 m.a.s.l. and it receives a bimodal unevenly distributed average annual rainfall of 760.9 mm per annum. The long-term mean minimum and the mean maximum temperature are 12.6 and 27 °C respectively. The pH of the soil is 7.88. The soil is fine sandy loam in texture with sand, clay and silt in proportion of 34, 48 and 18% respectively (ATARC, 1998).

Experimental Design and Management

Released varieties of mung bean varieties Shewa robit, Beroda, N-26 and Arkebe were collected from Hawasa Agricultural Research and evaluated in Randomized Complete Block Design with three replications. The plot size was 1.8m × 2.5 m (4.5 m^2) having 6 rows and a spacing of 0.30 m between rows and 50 cm between replication, 1 m between blocks. 100 kg/ha of NPS and 50kg/ha urea was set aside homogeneous for all treatments. All agronomic recommendations of the were followed for managing the production of the crop.

Data Collection and Statistical Analysis

During the experiment data on individual plant basis plant height (cm), number of pods per plant, number of seeds per pod, and on plot basis days to flowering, days to maturity, grain yield (kg ha-1), 100 seed weight (g) and yield components were collected and analyzed. The significant difference among the treatment means the least significant difference (LSD) test.

RESULTS AND DISCUSSION

The combined analysis of variance for all varieties at different environmental conditions for grain yield and yield related traits are presented in Table1 and Table 2. The result revealed that locations showed highly significant (P≤0.01) for grain yield, number of pod per plant, plant height and number of branch. But non-significant for days to flowering, days to maturity, number of pod per cluster, number of seed per pod and hundred seed weight.

Varieties had showed highly significant (P≤0.01) for studied trait other than number of seed per pod and significant at (P≤0.05) for number of pod per plant, number of pod per cluster and number of seed per pod Wedajo (2015); Ahmad *et al.* (2015) and Rasul *et al.* (2008) stated that mung bean cultivars had significant effect on number of pods plant. Similarly Mequannit and Terefa (2020) reported that mung bean varieties showed significant effect on grain yield and hundred seed weight. Year had significant influence on the agronomic parameters except days to flowering, number of cluster per plant and plant height.

Varieties across location showed non-significant variation among studied parameters except plant height. This indicated that varieties were not affected across the environment and revealed that varieties respond similar manner across the location. Varieties by year interaction effect were significant only for grain yield and hundred seed weight and indicate that season was affecting the response of varieties on grain yield and hundred seed weight. But varieties by year interaction effect were non -significant for other traits. Location by year by varieties was only significant on grain yield but non-significant on other studied parameters. The significance of location over year on variety indicates that grain yield is affected by location by year by varieties interaction effect.

Arkebe variety was early to flowering as well as early to mature while shewarobit showed late to flower and to mature as compared with other varieties. Beroda variety had higher number of cluster per plant (6.73) and number of pod per plant (26.97) followed by Shewarobit (6.11) and (22.79) respectively while Arkebe variety had lower number of cluster per plant (5.17) and number of pod per plant (19.3). Higher plant height (48.77) was recorded from Shewarobit variety followed by N-26 (47.32cm) and Beroda (46.6). Conversely shorter plant height was recoded from Arkebe (41.10cm) variety. N-26 had higher hundred seed weight (5.05) followed by Arkebe variety and lower hundred seed weight was recorded from Shewarobit (3.88) variety.

Grain yield is the result of dry matter production and its transformation in to economic value that takes place in the plant system. There was significant difference on grain yield with the varietal effect on tested mung bean varieties. Shewa Robit variety had higher grain yield (1607.4 kg/ha) followed by N-26 (1542 kg/ha) and Beroda (1466.1 kg/ha). While Arkebe Variety had lower grain yield (893.4 kg/ha) as compared with others varieties. The variety has lower agronomic performance this might cause of lower yield than other varieties.

Mequannit and Terefa (2020) reported higher grain yield for NUL-1 (2326.8 kg/ha), Shewa robit (2302.6kg/ha) and N-26 (1946.3kg/ha) of mung bean varieties at tepi, south western Ethiopia. In opposite Wadajo (2015) reported lower yield performance for Baroda (2.57), N-26 (2.10qt/ha) and Shewarobit (2.07qt/ha) below national average (8.6 qt/ha) for mung bean varities at Jinka, Ethiopia. Significant effect of mung bean genotypes on grain yield had been also has been reported by Wedajo (2015); Rasul *et al.* (2012) and Omid (2008).

Table 1: Combined analysis of Mung-bean varieties at ATARC, Dugda and Lume districts tested for two year

Source of variation	Df	Mean Squares									
		GY (kg/ha)	DF	DM	NCP	NPC	NPP	NSP	PH (cm)	NB	100SW
Rep	2	472196	6.97ns	38ns	4.305ns	1.43ns	105.7ns	27.05ns	7.73ns	3.122ns	0.03ns
L.	2	6704865**	4.76ns	11.51ns	16.13*	2.43ns	374.94**	4.56ns	1381.46**	8.985**	0.05ns
Vr.	3	1901761**	18.4**	90.31**	7.5*	9.17*	140.2*	2.09ns	207.78**	0.321ns	7.145**
Yr	1	5688614**	1.12ns	50.0*	58.68**	0.2ns	1071.07**	73.21*	39.43ns	35.14**	6.956**
L*V	6	50915^{ns}	2.28ns	1.38ns	5.9ns	2.4ns	53.4ns	11.53ns	594.46**	1.658ns	0.115ns
L*yr	2	10791786**	0.54ns	12.27ns	3.4ns	3.7ns	57.89ns	53.67*	152.61**	15.12**	0.461*
V*Yr	3	1131331*	1.94ns	1.67ns	3.2ns	2.18ns	31.8ns	22.3ns	37.83ns	1.51ns	0.811*
L*V*Yr	6	1217082*	2.5ns	1.71ns	1.55ns	1.98ns	41.06ns	21.51ns	20.4ns	1.788ns	0.063ns

ns=non-significant, *= significant, **= highly significant, V=Varieties, L=Location, Yr=Year, L*V=Location by Varieties, V*Yr=Varieties by year, L* Yr=Location by year, L*V*Yr=Location by Varieties by year, GY=Grain Yield, DF=Days to flowering, DM=Days to maturity, NCP=Number of cluster per plant, NPC=Number of pod per cluster, NPP=Number of pod per plant, NSP=Number of seed per pod, PH=Plant height

Table 2: Combined mean yield and agronomic traits of Mung bean varieties tested at ATARC, Dugda and Lume districts for two year

Varities	Combined Means									
	GY (kg/ha)	DF	DM	NCP	NPC	NPP	NSP	PH (cm)	NB	100SW
Sh/Robit	1607.4a	52.78a	91.67a	6.11ab	4.97a	22.79ab	10.94	48.77a	3.53	3.88c
N-26	1542a	50.61b	86.89b	5.81ab	4.2a	20.64b	11.2	47.32a	3.32	5.05a
Beroda	1466.1a	52.67a	91.67a	6.73a	4.92a	26.97a	10.46	46.6a	3.30	3.59d
Arkebe	893.4b	51.67ab	88.61b	5.178b	3.06b	19.3c	10.63	41.10b	3.55	4.16b
LSD	125.38	1.38	2.13	1.21	0.95	4.52	2.589	3.7	0.67ns	0.26
CV	13.4	4	3.6	13.3	12.5	18.2	15.7	12.1	12.8	9.1
S.E	335.91	2.06	3.17	1.8	1.41	6.74	3.858	5.55	1.02	0.37

GY=Grain Yield, DF=Days to flowering, DM=Days to maturity, NCP=Number of cluster per plant, NPC=Number of pod per cluster, NPP=Number of pod per plant, NSP=Number of seed per pod, PH=Plant height, NB=Number of branch per plant, 100SW=Hundred seed weight

SUMMARY AND CONCLUSION

Mung bean is the sixth product that Ethiopian Commodity Exchange trading next to coffee, sesame, white pea beans, maize and wheat. Mung bean is a useful crop in drier areas and has a good potential for crop rotation and relay cropping with cereals using residual moisture. The combined analysis of variance showed that there was significant variation at ($P \leq 0.05$ and $P \leq 0.01$) among the studied varieties, locations, and year main effect.

There were also significant interaction effect location by year, varieties by year and location by varieties by year for grain yield and other yield components. The analysis of variance revealed that there is significant variation among observed agronomic traits except for number of seed per pod of tested Mung bean varieties. Shewa Robit variety had higher grain yield (1607.4 kg/ha) followed by N-26 (1542 kg/ha) and Beroda (1466.1 kg/ha). While Arkebe Variety had lower grain yield (893.4 kg/ha) as compared with others varieties. Therefore Shewa Robit, N-26 and Beroda were recommended for the study area and similar agro-ecologies.

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