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Performance evaluation of Mung bean [*Vigna radiata* (L.) Wilczek] varieties in pastoral areas of South Omo Zone, Southern Ethiopia

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A B S T R A C T

Field experiments were conducted on pastoral and agro-pastoral areas of South Omo Zone at Dasenech, Hammer and Gynagatom woredas of Southern Ethiopia on mung bean [*Vigna radiata* (L.) Wilczek] varieties in 2019 under irrigated condition. The objective of the study was to select the best performing mung bean varieties in the target areas. The treatments involved in the study were three improved and one local mung bean variety (NVL-01, Shewarobit, N-26, and local). The experiment was carried out using a randomized complete block design (RCBD) with three replications. The combined analysis of variance result for mean squares depicted that there were significant differences observed among the varieties for all the studied parameters except the number of seeds per pod. The overall mean values for plant height ranged from 41.33 cm for Shewarobit to 62.00 cm for the local check. The mean values for the number of pods per plant ranged from 19.33 for the local check to 24.44 for NVL-01. The mean value for a thousand seeds weight was maximum 59.56 g for N-26, while it was a minimum 48.22 g for Shewarobit. The highest overall mean grain yield of 2483.8 kg ha^{-1} was recorded for N-26 while the minimum 1462.6 kg ha^{-1} was noted for the local check. The grain yield advantages of 41.11, 34.52, and 25.26% were obtained from the improved varieties N-26, NVL-01, and Shewarobit, respectively over the local check. The effect of varieties on grain yield was significant and the best performing mung bean varieties namely N-26 2483.8 kg ha^{-1} and NVL-01 2233.6 kg ha^{-1} would be recommended for the specific community and its vicinity even though further study should be carried out including some recently released varieties for improved mung bean production and also to put the recommendation on a strong basis.

Keywords: Mung bean, varieties, Yield components, Grain Yield

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Introduction

Mung bean [*Vigna radiata* (L.) Wilczek], is an important annual legume crop (Rahim *et al.*, 2010). It is an important pulse crop not only in the Indian sub-continent where it has been cultivated for centuries but also globally, where it serves both as a food crop and source of income (Mogotsi, 2006). The crop is rich in nutrients, especially proteins (23-25%) and micronutrients (iron and zinc) and is associated with low anti-nutritional factors such as those, which cause flatulence, making it a suitable food for weaning babies (Paul *et al.*, 2011; Puranik *et al.*, 2011). Mung bean is considered a wonder crop due to its ability to tolerate or escape drought conditions, yet has short maturity periods and improves soil fertility through biological nitrogen fixation (Swaminathan *et al.*, 2012). Ethiopia produced 514,227.41 quintals of mung bean on 41,633.20 hectare of land (CSA, 2018). Ethiopian national average yield was 12.35 qt ha^{-1} (CSA, 2018). Farmers in some moisture stress areas of South Omo Zone, like Dasenech, Gyngatom, low altitude areas of Semen Ari woreda, and Bena Tsemay areas are producing mung bean to supplement their protein needs so that there is a need to expand its production to the intended potential areas where moisture stress is a challenge for producing long maturing crops. Even though mung bean production is common in some parts of the South Omo Zone, but the production is mainly focused on local cultivars that are low yielders, late maturing and susceptible to disease. Thus, there is a need to introduce the improved mung bean varieties to moisture stress areas of the South Omo Zone.

Materials and Methods

Description of the study area

The adaptive research was implemented during the 2019 cropping season in Dasenech, Hammer, and Nyangatom woredas under irrigated conditions. Geographically, these three administrative districts were founded in the southwestern part of Ethiopia, located at about 981, 801 and 971 Kilometers, respectively from the country's capital (Addis Ababa). Astronomically, Dasenech woreda (administrative district) found lying between 4°37′–4°48′ N latitude and 35°56′–36°20′ E longitude, Hammer between 4°25′–5°30′ N latitude and 36°5′–36°59′ E longitude, and Nyangatom between 5°05′–5°21′ North latitude and 35°55′–36°14′ East longitude, respectively. The altitude of the areas varies between 353 m.a.s.l and 606 m.a.s.l for Dasenech, 371 m.a.s.l. and 2084 m.a.s.l for Hammer and 380 m.a.s.l and 497 m.a.s.l for Nyangatom district, respectively.

Treatments and experimental design

The experiment consisted of three improved mung bean varieties and one local check with a total of 12 plots. The field experiment was laid out in a randomized complete block design (RCBD) with three replications. Mung bean was sown in ten rows per plot with a spacing of 40 cm between rows and 5 cm between plants within a row with a gross plot area of (4 m x 5 m = 20 m^2).

Data collection

Six central rows (5.0 m x 2.4 m = 12 m^2) were harvested for the determination of grain yield. Grain yield was adjusted to 12.5% moisture content. Ten plants were randomly selected from the six central rows to determine yield and yield components, which consisted of plant height, number of pods per plant and number of seeds per pod.

Data analysis

All the agronomic data were recorded and being subjected to analysis using the R statistical software version 3.4.1. Effects were considered significant in all statistical calculations if the P-values were $\leq$ 0.05. Means were separated using Fisher's least significant difference (LSD) test.

Results and Discussion

The combined analysis of variance results for mean squares showed that there were significant differences observed among the mung bean genotypes for all the studied parameters except the number of seeds per pod (Table 1). These results are supported by the previous results of (Ahmad *et al.*, 2003; Adhiena *et al.*, 2015; Wedajo, 2015; Teame *et al.*, 2017; Yehuala *et al.*, 2018; Tadesse and Shashemene, 2021) who reported that there were significant variations observed among the mung genotypes for yield and yield-related traits. The combined analysis of variance results for mean squares showed that there were significant differences observed among the mung bean genotypes for seed yield (Table 1). This finding is supported by the results of several authors (Rasul *et al.*, 2012; Adhiena *et al.*, 2015; Wedajo, 2015; Teame *et al.*, 2017; Habte, 2018; Yehuala *et al.*, 2018; Fantaye *et al.*, 2019) who reported that significant differences were observed among the mung bean varieties for grain yield.

Plant height ranged from 33 cm for the improved variety N-26 at Hammer to 69 cm for the local check at Gyngatom (Table 2). In this study, the overall mean values for plant height ranged from 41.333 cm for variety Shewarobit to 62 cm for the local check (Table 2). It showed that different plant height values observed among the tested mung bean varieties across the test environments. This finding is in agreement with the previous results of Tadesse and Shashemene (2021) who reported that plant height ranged from 40.53 cm for the variety NVL-01 to 56.90 cm for the variety Arkebe at Adamitulu Jido Kombolcha district. In addition, Tadesse and Shashemene (2021) reported that plant height ranged from 32.80 cm for the variety NVL-01 to 35.30 cm for the variety Arkebe Sankura district Jejebicho.

The number of pods per plant ranged from 19 for the local check and NVL-01, respectively at Dasenech and Shewarobit at Hammer to 25 for the improved variety NVL-01 at Gyngatom and Hammer (Table 3). The combined analysis of variance results across locations revealed that the mean values for the number of pods per plant ranged from 19.33 for the local check to 24.444 for the improved variety NVL-01 (Table 2). Thousand seeds weight ranged from 45 g in Dasenech and Hammer to 64 g for the improved variety N-26 at Gyngatom (Table 3). The overall mean values for the thousand seeds weight ranged from 48.22 g for the variety Shewarobit to 59.56 g for the variety N-26 (Table 2). Grain yield ranged from 2626 kg ha^{-1} for the improved variety N-26 at Dasenech to 1341 kg ha^{-1} for the local check at Gyngatom (Table 3). It indicated that the tested mung bean genotypes performed differently at different environments. Similarly, Tadesse and Shashemene (2021) observed similar trends for the studied Mungbean varieties at different location and who reported that the highest grain yield 18.01 qt ha^{-1} was recorded from (N-26) variety at Adamitulu Jido Kombolcha followed by the Arkebe variety 17.52 qt ha^{-1}, while the lowest grain yield 13.01 qt ha^{-1} was obtained from the variety of Shewarobit at Adami tulu Jido Kombolcha district. The highest 24.00 qt ha^{-1} and lowest 12.48 qt ha^{-1} grain yield was obtained from variety Arkebe and NVL-01, respectively.

The highest overall mean grain yield of 2483.8 kg ha^{-1} was recorded for the variety N-26 while the minimum 1462.6 kg ha^{-1} was noted for the local check. The grain yield advantages of 41.11, 34.52, and 25.26% were obtained from the improved varieties N-26, NVL-01, and Shewarobit, respectively over the local check.

Table 1. Mean square values for growth parameters, yield components and grain yield of mung bean at south omo zone in 2019.

Source of Variations	DF	PH	PPP	SPP	TSW	GY
Rep	2	51.08*	3.58*	2.58*	8.36*	28744*
Variety	3	798.77***	42.25***	2.74ns	263.66***	1723903***
Location	2	117.25ns	1.75ns	1.08ns	3.44ns	57755ns
Location*Variety	6	58.32	2.86ns	0.94ns	7.74ns	24657ns
Error	22	32.45	3.97	1.40	18.18	53910

*Note: *, ** and *** indicate significance at P≤ 0.05, P≤ 0.01 and P≤ 0.001, respectively and 'ns' indicate non-significant, DF= degree of freedom, PH= plant height (cm), PPP= the number of pods per plant, SPP= the number of seeds per pod, TSW= thousand seeds weight (g), GY= Grain Yield (kg ha^{-1}).*

Table 2. Combined results of mean values of growth parameters, yield components and grain yield of mung bean varieties at south omo zone in 2019.

Varieties	PH	PPP	SPP	TSW	GY
NVL-01	48.89b	24.44a	12.77a	49.44b	2233.60ab
Shwarobit	41.33c	22.11a	12.00a	48.22b	1956.80b
N-26	42.78bc	23.11a	11.56a	59.56a	2483.80a
Local	62.00a	19.33b	11.67a	48.67b	1462.60c
Mean	48.75	22.25	12.00	51.47	2034.20
CV (%)	11.68	8.89	9.87	8.28	11.41
LSD (0.05)	7.46	2.59	1.55	5.58	303.98

Note: PH= plant height (cm), PPP= the number of pods per plant, SPP= the number of seeds per pod, TSW= 1000 seeds weight (g), GY= Grain Yield (kg ha^{-1}).

Table 3. Mean values for the studied yield and yield component traits of four mung bean varieties at south omo zone from in 2019.

Variety	PH (cm)				PPP				SPP				TSW (g)				GY (kg ha^{-1})			
	Location				Location				Location				Location				Location			
	Dasenech	Hammer	Gynagatom	Mean	Dasenech	Hammer	Gynagatom	Mean	Dasenech	Hammer	Gynagatom	Mean	Dasenech	Hammer	Gynagatom	Mean	Dasenech	Hammer	Gynagatom	Mean
NVL-01	47	48	38	45	19	25	25	23	13	12	11	12	45	45	54	48	2446	2000	2044	2163
Shwarobit	46	65	37	49	23	19	24	22	13	12	10	12	49	46	48	48	2272	2052	1612	1979
N-26	44	45	33	41	24	23	20	22	12	15	11	12	55	63	64	60	2626	2617	2223	2489
Local	66	49	69	62	19	23	20	21	12	12	10	11	48	52	46	49	1574	1396	1341	1437
CV (%)	11	11	9	10	11	20	11	14	8	7	3	6	5	4	4	4	11	13	13	12
LSD (0.05)	11	12	8	10	3	3	3	3	NS	NS	Ns	NS	3	4	4	4	481	519	458	486

Note: PH= plant height (cm), PPP= the number of pods per plant, SPP= the number of seeds per pod, TSW= thousand seeds weight (g), GY= grain yield (kg ha^{-1}).

Summary and Recommendation

Production of mung bean by introducing the improved and high yielding varieties is an important contribution to increase agricultural production and productivity in areas like Dasenech, Gyngatom, and Hammer woredas where there is the low practice of using improved varieties of cowpea. To this end, using the improved mung bean varieties could be one of the alternatives to improve productivity by small farmers. However, the production of mung bean using the improved varieties is not yet introduced and studied in the target area. Thus, this research work is initiated to investigate the impact of improved varieties on the performance of mung bean.

A study on variety was conducted at Dasenech, Gyngatom and Hammer under the irrigated condition in 2019. The objective of the study was to select the best performing varieties that will improve mung bean production. The experiment was carried out using the randomized complete block design (RCBD) with three replications at Dasenech, Gyngatom and Hammer under

irrigated conditions in 2019. Treatments involved in this experiment were three improved and one local mung bean variety. The result of the analysis of variance showed that all the studied were significantly affected by varieties. In this study, there were significant variations observed among the mung bean varieties for all the yield and yield components.

Based on the mean grain yield results over the three locations and yield advantages over the local check, the improved varieties performed better than the local check across locations. The effect of varieties on grain yield was significant and the best performing mung bean varieties namely N-26 2483.8 kg ha^{-1} and NVL-01 2233.6 kg ha^{-1} would be recommended for the specific community and its vicinity even though further study should be carried out including some recently released varieties for improved mung bean production and also to put the recommendation on a strong basis.

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