

Comparative Performance of Mung Bean (*Vigna radiata* L.) Varieties under Rainfed Condition in Indian Thar Desert

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Abstract: Six genotypes of mung bean namely IC 39535, IC 39429, IC 39358, IC 39447, IC 39283 and IC 39313 (check) were tested in random block design. The genotypes showed significant variation in plant height, branches per plant, pods per plant, seeds per pod, 100 seed weight, seed yield, biological yield and harvest index. IC 39358 followed by IC 39535 produced significantly higher seed yield than national check and rest of the genotypes. Significantly higher number of pods and branches per plant mainly attributed towards increased seed yield in IC 39358 and IC 39535. In general, short duration genotypes IC 39535, IC 39429 and IC 39283 in comparison to normal duration genotypes showed efficient biological frame and yield attributes which resulted into higher overall biological yield, better harvest index and thus higher seed yield.

Key words: Mung bean • genotypes • early maturing • late maturing • hyper arid • rainfed

INTRODUCTION

Mung bean is a protein rich pulse crop grown primarily in arid and semi arid region of Rajasthan and Gujarat states and is characteristically known for their poor productivity. It is grown preferentially by marginal and poor farmers for grain and fodder purpose due to their dismally low investment capacity. In mung bean, the selection pressure had been mostly for adaptation to stress environments. All genotypes of mung bean were brought from Central Arid Research Institute (CAZRI). All these genotypes do not perform equally in rainfed hyper arid conditions with erratic and low rainfall, high temperature and high wind speed. Only short duration genotypes are capable to tolerate/survive intermittent droughts without making significant yield losses and can provide assured high production in long run. Keeping this hypothesis in mind an experiment was conducted at experimental field at Boranada, Jodhpur during *Kharif* 2005 to identify suitable mung bean genotypes for rainfed conditions of Indian Thar Desert.

MATERIALS AND METHODS

The climate of the experimental field: In the year 2005 about 44.2 mm rainfall in 5 pre monsoon rain events were also recorded during April to June. July was the rainiest

month (180.9 mm, 8 rainy days). Two months of July and August accounted for almost 72 per cent of the total rainfall during year 2005. In total 242.3 mm rainfall was received in 14 rainy days from April to August. The monsoon withdrew in the second fortnight of August. The crop thereafter survived on conserved moisture for about next 34 days. In general, no significant moisture stress period was recorded for continuous 70 days of crop growth, which is sufficient for the short and normal duration varieties of mung bean. The mean temperature throughout the growing period remained around 28°C. Mean wind speed was more than 10 km/h till mid September and reduced afterwards.

The soil of the experimental field: The experiment was laid out in soil of the sites, classified as deep, mixed, hyperthermic and calcareous (Table 1). The soils were low in organic carbon (0.13%) and available N content (209 kg KMnO₄-N/ha), medium in P (16 kg P/ha) and K content (140 kg K/ha).

These almost level, well drained, very deep sandy loam soils with 4.2 to 6.5% free CaCO₃ content provide sufficient soil volume and condition for *in situ* rain water conservation and penetration of mung bean roots deeper into sub surface soils. However, alkaline condition of the soils (pH > 8.0) imposed slight limitation for successful rainfed cultivation of mung bean in this region.

Table 1: Physio-chemical properties of the soils of the experimental site

Horizon	Depth (cm)	Particle size distribution			CaCO ₃ (%)	pHe	ECe dSm ⁻¹	Organic carbon (%)	CEC (Cmol (+p)/kg)
		Sand (%)	Clay (%)	Texture					
Mixed, hyperthermic, calcareous and deep soils at Boranada, Jodhpur									
Ap	0-30	75.4	6.2	ls	5.4	8.7	0.8	0.13	3.5
C1	30-60	82.2	6.9	ls	4.2	8.5	0.6	0.09	2.8
C2	60-90	85.2	6.4	ls	5.2	8.6	0.4	0.07	2.4
C2	90-120	86.7	6.6	1s	6.5	8.7	0.5	0.08	2.4

Table 2: Growth, yield attributes, biological and seed yield of Mung bean genotypes under arid and semi arid conditions of Jodhpur

Variety	Plant height (cm)	No. of branches/plant	No. of pods/plant	No. of seeds/pod.	100 seed weight (g)	Seed yield (kg/ha)	Biological yield (kg/ha)	HI
IC 39535	19.8	6.4	32.8	3.8	3.33	330	1390	23.3
IC 39429	40.2	11.6	17.4	3.9	3.5	175	1370	12.6
IC 39358	19.1	17.5	42.2	4.2	3.22	385	1715	23.8
IC 39313	23.4	9.3	29.9	4.4	3.46	295	1785	16.5
IC 39283	22.5	16.2	32.6	3.7	3.36	275	1465	18.7
IC 39447	19.7	8.2	24.4	3.5	3.89	240	1790	13.4
SEM±	1.55	0.78	3.13	0.06	0.029	24	75	1.09
CD at 5%	4.70	2.40	9.40	0.20	0.090	74	246	3.60

The experimental details: Six improved genotypes of short and normal maturity duration were sown on July 2 in complete randomized block design and replicated thrice. Genotypes sown include IC 39535, IC 39429, IC 39358, IC 39447, IC 39283 and IC 39313 (check). The genotypes were sown in lines at 30 cm spacing. Thinning/gap filling of the experimental plots was done 10 days after sowing to maintain the optimum plant population. At maturity 5 plants per plot were randomly harvested from second and third rows from the western side of the each plot to estimate mean plant height (cm), number of branches per plant, number of pods per plant, number of seeds per pods and 100 seed weight (g). The net plot was demarcated and harvested to estimate seed and biological yield (kg/ha). Analysis of variance (ANOVA) technique was used to compare the means of different growth and yield attributes to draw logical conclusions.

RESULTS AND DISCUSSION

Growth and yield attributes: Sufficient moisture availability period of more than 80 days allowed all mung bean genotypes to express their full genetic potential under prevailing soil-site conditions. Thus, the varieties showed significant variation in plant height (19.1-40.2 cm), branches per plant (6.4-17.5), pods per plant (17.4- 42.2), seeds per pod (3.5-4.4) and 100 seed weight (3.22-3.89 g) (Table 2). The genotypes also showed variation in average maturity duration. Genotype IC 39535, IC 39358 and IC 39283 matured in 62-68 days, while IC 39429, IC 39447 and IC 39313 took 72-80 days. IC 39429 produced significantly maximum plant height (40.2 cm) while

non-significant difference in plant height was recorded between other genotypes. In general, early maturing genotypes attained average height of only 20.6 cm in comparison to 27.6 cm of medium duration genotypes. It may be due to the sufficient soil moisture availability period during vegetative growth stages of all the genotypes to express their genetic variations. The number of branches per plant was significantly different between IC 39358 and rest of the genotypes except IC 39283. The difference was non-significant between these two. Over all, early maturing genotypes recorded 31.4 per cent more branches per plant than medium duration genotypes. Similarly, on an average, short duration genotypes produced 35.9 pods per plant in comparison to 23.9 pods per plant by medium duration genotypes. IC 39429 produced significantly lowest number of pods per plant (17.0) than rest of the genotypes. The difference in pods per plant was also found significant between IC 39358 and IC 39313; IC 39358 and IC 39447, respectively. However, it was non-significant between other pairs. More number of branches per plant of short duration genotypes increased the biological frame for pod cluster emergence, which ultimately resulted into higher pods per plant. Several workers has reported similar trends [2-4].

The number of seeds per pod was significantly lowest in IC 39447 than rest of the genotypes. The difference in seeds per pod was also found significant between IC 39447 and IC 39429; IC 39447 and IC 39535; IC 39447 and IC 39283 and was non-significant between other pairs. The overall variation in seeds per pod between early and normal maturing genotypes was marginal. It may be due to the sufficient moisture

availability period during pod filling stage of the crop. The 100 seed weight was significantly highest in IC 39447 (3.89 g). It was followed by IC 39429 (3.50 g). Genotypes IC 39358 had significantly lowest seed weight (3.22 g) than rest of the genotypes except IC 39535. It was mainly due to distribution of photosynthates in larger number of pods and seeds in IC 39358 and IC 39535. The normal duration genotypes, in general, have higher 100 seed weight (3.62 g) than early duration genotypes (3.31 g). It may be due to the availability of longer reproductive period under normal duration genotypes.

Total biological and seed yield: At constant plant density the total biological and seed yield are the function of over all growth and yield attributes per plant [2, 4-6]. The significantly larger biological frame (plant height and number of branches per plant) to produce more number of flowers and thus, more pods per plant and 100 seed weight resulted into significant variation in biological and seed yield among the genotypes studied. Genotype IC 39313 followed by IC 39447 and IC 39358 produced significantly higher biomass than rest of the genotypes. In general, normal duration genotypes produced more biomass (1648 kg/ha) than early duration genotypes (1533 kg/ha). In contrast to this early duration genotypes produced more seed yield (336 kg/ha) than normal duration genotypes (239 kg/ha). Overall, IC 39358 produced significantly highest seed yield than rest of the genotypes except IC 39535 with which it was found at par. Significant difference in yield was also found between IC 39535 and IC 39313 /IC 39429, IC 39447/IC 39283 and IC 39429. However, seed yield was not significantly different between other pairs. Higher yield of shorter duration genotypes was also reported by several workers [1, 4, 6-9].

The data on harvest index suggest that early maturing genotypes had better harvest index (18.9- 23.9%) in comparison to normal duration genotypes (12.8-16.7%). On an average harvest index of short duration genotypes was 21.6 per cent as compared to 14.4 per cent of normal duration genotypes. Among the genotypes, IC 39358 followed by IC 39535 recorded significantly higher harvest index (23.8 and 23.3%, respectively) while IC 39429 recorded significantly lower harvest index (12.6%) than rest of the genotypes. It thus, seems that the partitioning of photosynthates towards seed was more efficient in the early maturing genotypes even under sufficient moisture availability conditions. The results are also in confirmation with the findings of Vyas *et al.*, [9].

CONCLUSIONS

The findings presented here indicate that under rainfed hyper arid situation of Boranada, Jodhpur early maturing genotypes of mung bean like IC 39358 and IC 39535 produced significantly higher seed yield compared to normal or late maturing genotypes even under above normal rainfall year when moisture stress in at its minimal. Thus, under rainfed situation early maturing genotypes are more advantageous for more efficient partitioning of photosynthates.

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