Journal Home page : www.jeb.co.in ★ E-mail : editor@jeb.co.in

JEB
Journal of Environmental Biology

ISSN: 0254-8704
CODEN: JEBIDP

Studies on seed production of mungbean (*Vigna radiata*) sown at different dates

Anil Kumar Singh[1,2]*, Pravesh Kumar[1] and Naresh Chandra[2]

[1]*GB Pant University of Agriculture and Technology, Pantnagar-263 145, India*
[2]*ICAR Research Complex for Eastern Region, Patna-800 014, India*
**Corresponding Author email : anil.icarpat@gmail.com*

Publication Info

Paper received:
26 August 2011

Revised received:
26 December 2011

Accepted:
26 March 2012

Abstract

To get maximum yield of kharif mungbean, a field experiment was conducted in a split plot design and replicated four times. Five varieties of mungbean viz., Pusa 105, Ganga 1, ML 682, PMB 14 and Pant Mung 4 were sown normal and late. Data on growth, development and yield components were recorded from ten randomly selected plants from each plots. Grain and straw yield were taken from the net harvested plot and computed to get kg ha^{-1}. Among the varieties, PMB 14 ranked first in terms of grain yield (549 kg ha^{-1}) followed by Ganga 1 (521kg ha^{-1}), ML 682(495 kg ha^{-1}), Pant Mung 4 (475 kg ha^{-1}) and Pusa 105 (438 kg ha^{-1}). Highest grain yield (516 kg ha^{-1}) was obtained in case of normal sowing whereas comparably lower yield (476 kg ha^{-1}) was recorded under late sown condition. Significant interaction was noticed only in case of pods per plant.To obtain higher grain yield, mungbean should be sown at normal time (1st week of August) with genotype PMB 14.Most consistent performer under normal and delayed sowing wasML682. Pant Mung 4 was found to be most sensitive in delay planting than other tested varieties.

Key words

Growth and development, Mungbean, Planting dates, Seed yield

Introduction

India is the world largest homeland of vegetarian population and world leader in pulse production and import to provide protein supplements (Singh *et al*., 2012). Rapid population growth and low production especially of pulses have enhanced the problem of food security. Indian pulse production has been stuck in between 14 and 15 Mt since mid-nineties, resulting in poor consumption (33 g/capita/day) during 2010 (Ali *and Gupta,* 2012).Cultivated land area has become stagnated and there is lesser possibility to increase in the future (Singh *et al*., 2012).

In India especially rice-wheat is the prevalent cropping system and the area and resultantly the production of pulses have become marginalized (Singh *et al*., 2013). In the wake of these circumstances, it can be said that given due importance, mungbean can play a major role in the national economy of India due to their wider adaptability, easy digestibility, better palatability and higher market price(Patil *et al.*, 2003, Ramakrishna *et al.*, 2000 and Reddy, 2009). Potential yield of mungbean can be achieved through optimum use of inputs and agronomic practices. Besides other inputs like date of sowing and improved varieties are of primary importance (Ali *and Gupta,* 2012). Samanta *et al.* (1999) and Singh *et al*. (2010) suggested that date of sowing is the most important non-monetary input to obtain optimum yield from mungbeanas.

Too early sowing may result in poor germination and poor plant stands, while yield from very late sown crop may be low due to unfavorable agro-climatic conditions for the growth and development of mungbean (Sadeghipour, 2008 and Miah *et al*., 2009).Optimum date of sowing of mungbean vary from variety to variety and season to season due to variation in agro-ecological conditions. Therefore, there must be a specific date of sowing for different varieties to obtain the maximum yield (Ramakrishna *et al.,* 2000; Reddy, 2009). Mungbean productivity can be achieved efficiently with the selection of superior genotypes which is the pre-requisite, possessing better heritability and genetic advance for various traits. The yield can be increased to a greater extent provided high yielding varieties are identified and planted at suitable date of sowing (Ali and Gupta, 2012; Singh *et al*., 2010). Keeping these factors in view, the present study was designed to screen out the high yielding varieties and proper date of sowing for the high gain yield of mungbean.

Materials and Methods

The experiment was conducted at the Crop Research Centre of GovindBallabh Pant University of Agriculture and Technology, Pantnagar (29º N latitude, 79º E longitudes), during kharif season with five mung bean varieties (Pusa 105, Ganga 1, ML 682, PMB 14 and Pant Mung 4) sown at two dates viz., 8 August (normal sowing) and 28 August (late sowing). The experiment was laid out in a split plot design and replicated four times. The experimental site falls under tarai belt of Himalaya. The maximum and minimum temperature during crop season ranged from 26.1–33.3ºC and 8.7-26ºC respectively.In general, temperature decreased with the advancement of crop age. The average relative humidityvaried from 64.2 to 90.5 %. During the crop season the site experienced 1063.2 mm rainfall, most of which was received in the month of August.The experimental soil was loam in texture,rich in organic carbon (1.2%) and medium in available phosphorus (13ppm) exchangeable potassium (K) (173ppm) with pH value of 7.1 (Deshpande *et al.,* 1972). The plot size was 4.0m x 2.7m. The experimental plots were fertilized with uniform application of di-ammonium phosphate (18 % N and 46 % P_2O_5) @ 50 kg ha^{-1} was made after final land preparation. Relatively higher seed rate (20 kg ha^{-1}) was used for proper maintenance of plant population. Two weedings were done in both normal and late sowing about 15 and 30 days after sowing. Data on yield components were taken from five randomly selected plants of each plot and grain and straw yield were taken from the net harvested plot. Regular analysis of variance was performed for each trait for all seasons and the combined (Pooled) analysis over seasons after testing error variance homogeneity was carried out according to the procedure outlined by Gomez and Gomez (1984), using the MSTATC version 2.1 (Michigan State University, USA) statistical package design. Significant differences between the treatments were compared with the critical difference at (± 5%) probability by LSD.

Results and Discussion

The data regarding plant height at maturity and grain yield under both planting dates of mung bean variety are presented in Table 1. Plant height decreased with delay in sowing. The maximum mean plant height at maturity was found under normal sowing (55.6cm) and minimum plant height was recorded under late sowing (46.7cm). Farz *et al.* (2006) and Sadeghipour (2008) also reported similar results on mungbean.Mungbean varieties differed significantly among themselves in respect of plant height. Pant Mung 4 produced tallest plant (53.7cm), varieties, Pusa 1º5and ML 682 was statistically taller as Pant Mung 4, however, it had significantly taller height than Ganga 1 and PMB 14 at maturity (Table 1). Corresponding smallest plant height was recorded with PMB 14 (Soomro, 2003; Singh *et al*., 2010 and Sarkar *et al.,* 2004). Planting date had significant effect on dry matter production. Significantly higher dry matter (15.33 g plant^{-1}) was accumulated in case of normal planting than in case of late planting (10.10 g plant^{-1}). Algan, (2011) and Patil *et al.* (2003) also notice similar results. Response of mungbean varieties varied significantly in respect of dry

Table 1 : Effect of sowing data on the growth, development and yield attributes of different varieties of mungbean.

Treatments	Plant height (cm)	Dry matter (g plant^{-1})	Pods per plant	Grains per pod	Grain yield (g plant^{-1})
Planting date					
Normal	55.6	15.33	16.8	10.90	2.90
Late	46.7	13.10	12.9	9.10	2.61
SEM (±)	2.0	0.47	1.20	0.10	0.07
CD (±5%)	6.3	1.51	3.70	0.40	0.22
Genotype					
Pusa 105	53.3	14.66	13.1	10.5	2.55
Ganga 1	50.7	14.54	16.4	10.9	2.80
ML 682	51.3	13.88	14.3	10.6	2.68
PMB 14	49.2	13.80	16.9	10.8	2.93
Pant Mung 4	53.7	14.72	15.1	10.4	2.62
SEM (±)	1.0	0.28	1.20	0.20	0.08
CD (±5%)	3.0	0.82	3.50	NS	0.25

matter also. It was recorded that Pant Mung 4 being on par with Pusa 105 and Ganga 1 had significantly higher total dry matter than ML 682 and PMB 14. PMB 14 recorded lowest dry matter (Reddy, 2009 and Singh *et al*., 2010). Late sown crop could not accumulate sufficient dry matter because of lesser vegetative and reproductive period. Normal sown crop remained in the field for relatively longer period and accumulated more photosynthates. Similar results were also noticed by Farz *et al*. (2006), Samant *et al*. (1999) and Miah *et al*. (2009). The total dry matter production in a genotype indicates the potential for yield, but its mobilization towards the grain yield is an important factor for economic yield. It is the function of crop growth rate in total growth period and is related with grain yield (Patil *et al.,*2003; Soomro, 2003; Reddy, 2009). The capacity of a plant to produce dry matter depends upon the size and duration of the photosynthetic apparatus leaf, but it also depends upon the genetic potential of the varieties where some varieties have more potential to translocate assimilates towards economic yield due to differential response of different varieties. Similar results were reported by Patil *et al.* (2003), Reddy (2009) and Ramakrishna *et al.* (2000). Better plant growth measured in terms of higher plant height and dry matter accumulation in whole plant might have led plants to produce higher yield under normal sowing. These results showed similarity with the findings of Algan (2011) Samant *et al*. (1999) and Singh *et al*. (2010).

Both planting dates and varieties of mungbean significantly influenced number of pods plant^{-1}. Highest pods plant^{-1} was recorded under normal sown mungbean plots. Similarly in case of genotypes/varieties PMB 14 produced maximum (16.9 pods plant^{-1}). Interaction effects among genotypes and planting dates and between planting dates and varieties were noticed. Significant interaction among the all variables/treatments was noticed in case of number of pods per plant. Perusal of data presented in Table 3 revealed that in respect of pods plant^{-1} variety ML 682 was least influenced under normal and delay sowing condition and produced 15.5 and14.0 pods plant^{-1} respectively. Whereas Pant Mung 4 was reported to be most sensitive to delay planting and produced 20.7 and 12.0 pods plant^{-1} under normal and delay sowing, than other tested varieties. Farz *et al.* (2006), Patil *et al.* (2003), Samant *et al.* (1997) and Singh *et al*. (2010) also reported similar result.

Planting date did influence grains pod^{-1}significantly. Normal sown mung bean produced (10.9 grains pod^{-1}) than late sown crop. Delay in planting hampered number of seed per pod. However, mung bean varieties did not differed significantly in case of grain pod^{-1} and it were ranged between 10.4 to 10.9.Grain yield (g plant^{-1}) data presented in Table 1 showed that grain yield decreased with delay in planting. Normal sowing (8 August) had relatively more grain (2.90g plant^{-1}) than late sowing (28 August) in *kharif* mungbean (Miah *et al*. 2009 and Sadeghipour, 2008). In case of varieties, PMB 14 which was at par with Ganga 1 produced significantly higher grain yield plant^{-1} than remaining varieties. Lowest yield was recorded from Pusa 105 which was at par with ML 682 and Pant Mung 4. Results showed that genotype PMB 14 which was on par with Ganga 1 and ML 682 produced significantly higher grain yield than Pant Mung 4 and Pusa 105 (Sarkar *et al*., 2004; Singh *et al*., 2010). Relatively higher grain yield from normal sowing was probably due to higher grain yield plant^{-1} and its attributes with number of pods plant^{-1}, grains pod^{-1}and test weight. Significant interaction between dates of sowing and varieties indicated that Pusa105 and Pant Mung 4 produced significantly higher number of pods plant^{-1}in normal sowing than late sowing whereas number of pod in remaining varieties were at par under two sowing dates (Samant *et al*. 1999 ; Singh *et al*., 2010).

Grain yield data presented in Table 2 showed that grain yield decreased with delay in planting. Normal planting had significantly more grain yield (516 kg ha^{-1}) than late planted mungbean. Results revealed that normal sowing produced higher grain yield which resulted from the highest number of pods plant^{-1}, grains pod^{-1}, test weight and grain yield (g plant^{-1}). Late sowing of mung bean produced lower yield. The reduction in grain yield from late sowing than in normal sowing was 7.75 %. These findings are in close conformity with the reports of Miah *et al*. (2009) and Singh *et al*. (2010). Mungbean varieties differed significantly in case of grain yield (kg ha^{-1}). Genotype PMB 14 was highest yielder (549 kg ha^{-1}) followed by Ganga 1, ML 682 and Pant Mung 4 that ranked second, third and fourth respectively. Pusa 105 was the lowest yielder (Patil *et al.,* 2003; Soomro, 2003). High seed yield in PMB 14 might be due to its inherited genetic makeup as evidenced by higher number of pods plant^{-1}and grain yield. Higher plant population at maturity in PMB 14 and Ganga 1 might have resulted in increased yield. Differential response of different varieties was also observed by Singh et *al*. (2010) and Sadeghipour (2008). For obtaining higher mungbean grain yield, not only vegetative growth and development but efficient utilization of photosynthates towards economic sink enlargement is also important (Reddy, 2009; Singh et *al*., 2010). Response to normal sowing date also revealed significantly higher accumulation of total dry matter (g plant^{-1}) in normal sowing than late sowing and this might have resulted in production of higher biological yield in normal sowing date (Reddy, 2009; Ramakrishna *et al.*, 2000).

Mungbean varieties differed significantly among themselves in respect of straw yield (kg ha^{-1}) and harvest

Table 2 : Effects of sowing date on the yield attribute and yield of different varieties of mungbean

Treatments	Biological yield (kg ha^{-1})	Grain yield (kg ha^{-1})	Strawyield (kg ha^{-1})	Harvest index	Test weight (g)
Planting date					
Normal	2283	516	1767	0.22	29.1
Late	1785	476	1309	0.26	28.8
S.Em(±)	127	18	121	0.01	0.10
CD (±5%)	408	NS	387	NS	NS
Genotype					
Pusa 105	2047	438	1609	0.21	28.2
Ganga 1	1869	521	1348	0.27	28.3
ML 682	2198	495	1703	0.22	28.1
PMB 14	1906	549	1357	0.28	28.4
Pant Mung 4	2147	475	1672	0.22	28.0
S.Em. (±)	124	22	124	0.01	0.3
CD (±5%)	NS	64	352	0.03	NS

Table 3 : Interaction effects between sowing date and varieties for number of pods per plant

Planting date	**Varieties**				
	Pusa 105	**Ganga 1**	**ML 682**	**PMB 14**	**Pant Mung 4**
Normal	18.3	14.6	15.5	14.7	20.7
Late	11.2	12.2	14.0	15.1	12.0
			SEM (±)	**CD (±5%)**	
For comparing sowing date at same or different varieties			1.9	5.7	
For comparing varieties under same sowing date			1.7	4.7	

index while non-significant differences were recorded for grains pod^{-1}, test weight and biological yield. The higher biological (above ground biomass) and grain yield was recorded under normal sowing conditions clearly indicated the role vegetative growth and development and their positive association with grain yield of mungbean. Similar trends were also reported by Patil *et al.* (2003), Singh *et al.* (2010) and Sadeghipour (2008). In case of late sown mungbean crop life cycle (vegetative and reproductive phase) gets reduced to 67 days as against 78 days in case of normal sowing conditions (data not presented in this paper). This might have adversely affected the production of photosynthates and its translocation towards the grain. Normal sowing produced significantly higher straw yield as compared to late sow condition (Sadeghipour, 2008; Singh et *al.*, 2010).

The maximum test weight (1000 seed weight), (28.4g) was recorded in PMB 14 however , corresponding minimum (28.0g) was noticed in case of Pant Mung 4, though the differences among varieties were non-significant. These results showed that test weight has not as much impact on grain yield as other yield contributing characters (Patil *et al.,* 2003; Sarkar et *al*., 2004; Reddy, 2009). Harvest index (Table 2) showed opposite trend as found in grain, straw and biological yield producing lower value at normal sowing and higher in late sowing due to lower vegetative growth and resultantly less dry matter accumulation reflected lower straw yield in comparison to grain yield. The lower harvest index under normal sowing might be due to higher temperature and higher cumulative rainfall that enhanced vegetative growth of the crop resulting in larger canopy but comparatively lower grain yield as reported by Reddy (2009) and Singh *et al.* (2010). Varieties under the study showed significant differences in their harvest index. PMB 14 showed maximum harvest index (0.28) followed by Ganga 1 (0.27). Rest varieties did not show significant differences. The lowest harvest index (0.21) was observed in Pusa 105 might be due to the genetic potential of the varieties. Similar findings were also reported by Soomro (2003) and Sarkar et *al*. (2004). Based on results obtained from two years experimentation, it is recommended from this endeavor that significant differences were observed between both sowing dates for all the traits under study except grain yield/hectare, test weight and harvest index. Increase in plant height might be due to more growing period in normal sowing. Higher grain yield (516 kg ha^{-1}) was found under normal sowing due to more height of the crop. Mungbean genotype PMB 14 produced the highest grain yield (549 kg ha^{-1}) followed by Ganga 1 (521 kg ha^{-1}).

From the present study it is concluded that to improve mungbean production and its productivity under Pantnagar condition especially during rainy / *Kharif* season, timely planting in the I[st] week of August would be beneficial. Selection of suitable genotypes also play a crucial role in mungbean production. Among the present day genotypes /varieties available, PMB 14, Ganga 1 and ML 682 should be cultivated as their performance under normal and late conditions are comparably better than others.

References

Algan, N. and A.E. Çelen: Evaluation of mung bean (*Vigna radiata* L.) as green manure in Aegean conditions in terms of soil nutrition under different sowing dates. *Afri. J. Agril. Res.,* **6**, 1744-1749 (2011).

Ali, M. and S. Gupta: Carrying capacity of Indian agriculture: Pulse crops. *Cur. Sci.*, **102**, 874-881 (2012).

Deshpande, S.B., J.B. Fehrenbacher and S.H. Beaver: Genesis and classification, Mollisols of tarai region of U.P., India. *Geoderma,* **6**, 195-201(1971).

Farz, R.A., J. Iqbal and M.A.A.H.A. Bakhsh: Effect of sowing dates and planting pattern on growth and yield of mungbean (*Vigna radiata* L.) Cv. M-6. *Int. J. Agril. Biol*., **8**, 63-65 (2006).

Gomez, K.W. and A.A. Gomez: Statistical Procedures for Agricultural Research. 2[nd] Edn., John Willey and Sons, Inc. New York, p. 574 (1984).

Miah, M.A.K., M.P. Anwar, M. Begum, A.S. Juraimi and M.A. Islam: Influence of sowing date on growth and yield of summer mungbean varieties. *J. Agric. Soc. Sci.*, **5**, 73–76 (2009).

Patil, B.L., V.S. Hegde and P.M. Saliath: Studies on genetic divergence over stress and non stress environment in mungbean. *Indian J. Gent. Plant Breed.*, **63**, 77-76 (2003).

Ramakrishna, A., C.L.L. Gowda and C. Johansen: Management factors affecting legumes production in the Indo-Gangetic Plain. In: Legumes in rice and wheat cropping systems of the Indo-Gangetic Plain-constraints and opportunities (Eds.: C. Johansen, J.M. Duxbury, S.M. Virmani and C.L.L. Gowda). ICRISAT, Patancheru, Andhra Pradesh, pp. 156-165 (2000).

Reddy, A.A.: Pulses production technology: Status and way forward. *Eco. Polt. Weekly,* **44**, 73-80 (2009).

Sadeghipour, O.: Response of mungbean varieties to different sowing dates. *Pak. J. Biol. Sci.,* **11**, 2048-50 (2008).

Samant, S.C., M.H. Rashid, P. Biswas and M.A. Hasan: Performance of five cultivars of mungbean under different dates of sowing. *Bangladesh J. Agric. Res*., **24**, 521-527(1999).

Sarkar, M.A.R., M.H. Kabir, M. Begum and M.A. Salam: Yield performance of mungbean as affected by planting date, variety and plant density. *J. Agronomy,* **3**, 18-24. (2004).

Singh, A.K., B.P. Bhatt, P.K. Sundaram, A.K. Gupta and D. Singh: Planting geometry to optimize growth and productivity faba bean (*Vicia faba* L.) and soil fertility. *J. Environ. Biol.*, **34**, 117-122 (2013).

Singh, A.K., Manibhushan, B.P. Bhatt, K.M. Singh and A. Upadhyaya: An analysis of oilseeds and pulses scenario in Eastern India during 2050-51. *J. Agril. Sci.,* **5**, 241-249 (2013).

Singh, A. K., N. Chandra, R.C. Bharati and S. K. Dimree:Effect of seed size and seeding depth on Faba bean (*Vicia faba* L.) productivity. *Envi. Ecol.,* **28**, 1722-1727(2010).

Singh, Guriqbal, H.S. Sekhan, Hari Ram, K.K. Gill and P. Sharma: Effect of date of sowing on nodulation, growth, thermal requirement and grain yield of *kharif* mungbean genotypes. *J. Food Legumes,* **23**, 132-134 (2010).

Soomro, N.A.: Response of mungbean genotypes to different dates of sowing in kharif season under rainfed condition. *Asian J. Plant Sci*., **2**, 377-79 (2003).