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Effects of seed rate on yield and yield attributes of mungbean in coastal belt of Bangladesh

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Abstract

A field experiment was carried out at Patuakhali Science and Technology University Farm during February to May 2006 to determine the optimum seed rate of five mungbean cultivars. Five seed rates viz. 20, 30, 40, 50 and 60 kg ha^{-1} (S_{20}, S_{30}, S_{40}, S_{50}, S_{60}, respectively) and five cultivars viz. BARI Mung-2, BARI Mung-5, BINA Mung-2, BINA Mung-5 and Patuakhali local were tested. Results indicated that BARI Mung-5 and BINA Mung-5 were higher yielding than BARI Mung-2, BINA Mung-2 and Patuakhali local. Interaction effect shows that BARI Mung-5 and BINA Mung-5 produced higher yields when seeds were sown at the rate of 50 kg ha^{-1}. BARI Mung-2 and BINA Mung-2 gave higher seed yields at the seed rate of 30 kg ha^{-1} while Patuakhali local had the highest seed yield at 20 kg ha^{-1}.

Keywords: Mungbean, Cultivar, Seed rate, Yield, Yield attributes, Coastal belt

Introduction

Mungbean (*Vigna radiata* L. wilczek) is the most important pulse crops and has great value for food, feed, fodder, fuel and green manure and as a cover crop. It is the fifth important pulse crop in Bangladesh and constitutes about 11.49% of the pulse production (BBS, 2002). About 57.5% of the total mungbean is grown during January-April in the southern districts of Bangladesh (Afzal *et al.* 1997). Like other pulse crops, the average yield of mungbean in Bangladesh is very low mainly due to lack of suitable variety and its management practices. Among the various management practices, maintaining an optimum plant population in the field is very important to obtain higher yield. Good stand establishment of the crop depends on sowing of good quality seeds at the correct rate. The varieties of mungbean cultivated in Bangladesh are generally low yielding, asynchronous and prone to disease, particularly mosaic and cercospora. To overcome these problems BARI (Bangladesh Agricultural Research Institute) and BINA (Bangladesh Institute of Nuclear Agriculture) have developed some high yielding varieties of mungbean. The yield of mungbean may be increased by cultivating these varieties with suitable seed rates. But little information is available in this respect for coastal belt of Bangladesh. Therefore, the present investigation was undertaken to assess the performance of some cultivars of mungbean under different seed rates in southern part of Bangladesh.

Materials and Methods

The experiment was conducted at Patuakhali Science and Technology University Farm on medium high land during the period from February to May 2006. The soil of the experimental field was clay loam belonging to the Agro-ecological Zone (AEZ) of Ganges Tidal Floodplain. Three constrasting groups of cultivars were selected. BARI Mung-5, a variety released by BARI and BINA Mung-5, a variety of BINA belong to bold seeded group. BARI Mung-2 (Kanti), a variety of BARI and BINA Mung-2, a variety of BINA belong to medium seeded group. Patuakhali local belongs to small seeded group. They also differ in respect of flowering behaviour. BARI Mung-5 and BINA Mung-2 are more or less synchronous and others are asynchronous. The experiment was laid out in a split-plot design with 3 replications keeping cultivars in the main plot and seed rates namely 20, 30, 40, 50 and 60 kg

ha^{-1} (S_{20}, S_{30}, S_{40}, S_{50}, S_{60}, respectively) in the sub-plots. The size of each unit plot was 4.0 m X 2.5 m. The land was uniformly fertilized with 20 kg N, 40 kg P_2O_5 and 20 kg K_2O ha^{-1} in the form of urea, triple super phosphate and muriate of potash, respectively at the time of final land preparation. Seeds were sown on 5 February, 2006 at a row spacing of 30 cm as per treatments. One weeding was done at 30 days after sowing. One irrigation was given at 4 days after weeding. Data on yield components were recorded from 10 randomly selected plants $plot^{-1}$. Days to flowering, days to maturity and seed yield were taken on whole plot basis. Days to flowering represents days required for flowering of 50% plants in a plot from the date of sowing. Days to maturity represents days required for maturity of 95% pods in a plot from the date of sowing. The threshed grain were sundried and weighed. The grain weight was adjusted at 12% moisture content. The relevant data obtained were analysed and the treatment means were compared by Duncan's New Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Results indicates that mungbean cultivars differed significantly in respect of yield and other crop characters (Table 1 & 2). BINA Mung-5 and BARI Mung-5 produced statistically similar seed yields (1060 and 1039 kg ha^{-1}, respectively) which were significantly higher than others (Table 2). The higher yield potential of BINA Mung-5 and BARI Mung-5 was mainly due to increase number of seeds pod^{-1} (9.08 and 8.48 seeds pod^{-1}, respectively) and 100-seed weight (3.85 and 3.70 g, respectively). Patuakhali local gave significantly the lowest seed yield (636 kg ha^{-1}) mainly due to decreased number of pods $plant^{-1}$ (8.24), number of seeds pod^{-1} (7.74) and 100-seed weight (2.22 g). BARI Mung-2 and BINA Mung-2 produced medium and similar seed yields of 788 and 749 kg ha^{-1}, respectively. Although BINA Mung-2 produced the maximum number of pods $plant^{-1}$ (10.43) but it failed to produce the maximum seed yield because of its less number of seeds pod^{-1} (7.38) and medium seed size (2.98 $g100^{-1}$ seed). Samanta *et al.* (1999) also reported variation in the yield of mungbean cultivars. Bold seeded mungbean produced higher dry matter than small seeded mungbean. BINA Mung-5 produced significantly the highest dry matter $plant^{-1}$ (Table 1). BARI Mung-5 and BINA Mung-2 had similar dry matter of 9.63 and 9.56 g $plant^{-1}$, respectively followed by BARI Mung-2 (8.07 g $plant^{-1}$). Patuakhali local produced significantly the lowest dry matter $plant^{-1}$ (6.11 g). The higher and lower dry matter yields were due to the variation in plant height, branches $plant^{-1}$, seeds pod^{-1} and seed size. Khan *et al.* (2004) also reported higher dry matter in bold seeded mungbean than small seeded mungbean. Cultivars showed significant variation in germination, flowering and maturity. In general, small seeded cultivars took less number of days for germination than bold seeded cultivars. Thus Patuakhali local having small seed required 5 days for germination while bold seeded group (BARI Mung-5 and BINA Mung-5) required 7-8 days for germination. The medium seeded group (BARI Mung-2 and BINA Mung-2) required 6 days for germination. Patuakhali local and BINA Mung-5 required same and higher number of days to flowering (73 and 71, respectively) than other cultivars. BINA Mung-5 required the highest number of days to maturity (95 days) followed by Patuakhali local (90 days), BARI Mung-2 (85 days) and BINA Mung-2 (84 days). BARI Mung-5 required significantly the least number of days to flowering (60 days) and maturity (80 days).

Table 1. Effect of cultivar and seed rate on plant height, dry matter production, germination, flowering and maturity of mungbean

Treatment	Plant height (cm)	Dry matter yield (g/plant)	Days to germination	Days to flowering	Days to maturity
Cultivar					
BARI Mung-2	28.59 a	8.07 c	6 bc	68 bc	85 c
BARI Mung-5	27.24 b	9.63 b	7 ab	60 d	80 d
BINA Mung-2	28.95 a	9.56 b	6 bc	65 c	84 c
BINA Mung-5	28.62 a	10.06 a	8 a	71 ab	95 a
Patuakhali local	26.74 b	6.11 d	5 c	73 a	90 b
Seed rate (kg/ha)					
S_{20}	25.32 e	10.96 a	6	70 a	90 a
S_{30}	27.17 d	8.98 b	6	68 ab	88 ab
S_{40}	28.11 c	7.72 d	6	67 ab	87 ab
S_{50}	29.01 b	7.86 cd	6	66 b	86 bc
S_{60}	30.56 a	7.91 c	6	66 b	85 c

Means followed by a common letter are not significantly different at the 5% level by DMRT.

Table 2. Effect of cultivar and seed rate on yield and yield components of mungbean

Treatment	No. of branches/plant	No. of pods/plant	Pod length	No. of seeds/pod	100-seed weight	Seed yield (kg/ha)
Cultivar						
BARI Mung-2	3.31 bc	9.73 b	5.15 c	8.31 c	2.99 b	788 b
BARI Mung-5	3.25 c	9.19 c	5.72 b	8.48 b	3.70 a	1039 a
BINA Mung-2	4.11 a	10.43 a	4.81 d	7.38 e	2.98 b	749 c
BINA Mung-5	2.94 d	9.03 c	6.17 a	9.08 a	3.85 a	1060 a
Patuakhali local	3.39 b	8.24 d	4.64 e	7.74 d	2.22 c	636 d
Seed rate (kg/ha)						
S_{20}	4.07 a	11.62 a	5.71 a	9.36 a	3.62 a	830 d
S_{30}	3.73 b	10.25 b	5.36 b	8.72 b	3.17 b	918 a
S_{40}	3.37 c	8.76 c	5.23 c	8.07 c	3.08 c	851 c
S_{50}	3.09 d	8.44 d	5.13 d	7.78 d	3.04 c	879 b
S_{60}	2.73 e	7.55 e	5.05 e	7.07 e	2.84 d	794 e

Means followed by a common letter are not significantly different at the 5% level by DMRT.

Effect of seed rate was significant for all the crop characters studied (Table 1 & 2). Plant height increased with increase in seed rate. The competition for the natural resources under higher seed rate might be so pronounced that plants had to adjust through remarkable elongation of plant height. The decreasing trend was observed in case of dry matter yield plant^{-1}, branches plant^{-1}, pods plant^{-1}, pod length, seeds pod^{-1} and 100-seed weight. The decreased crop characters under higher seed rates might be attributed to more competition

among plants. Singh *et al.* (1988) and Rahman and Mia (1995) also reported decreased plant characters in mungbean due to increased planting density. Table 2 shows that seed yield increased from 830 kg ha^{-1} to 918 kg ha^{-1} with the increase in seed rate from 20 kg ha^{-1} to 30 kg ha^{-1} and then declined with further increase in seed rate. The increase in seed yield might be attributed to the higher number of plants $unit^{-1}$ area. The increase in seed yield with increase in planting density up to a certain limit was also reported by Al-Ousmani (2004) in mungbean. Tomor *et al.* (1993) and Rahman and Miah (1995) also reported similar results in mungbean. The decrease in seed yield over 30 kg seed ha^{-1} might be due to higher plant competition for resources required for growth and development of the crop. This result indicates that 30 kg seed ha^{-1} may be the optimum seed rate of mungbean under the agro-ecological conditions of the present study.

Table 3. Interaction effect of cultivar and seed rate on yield and yield components of mungbean

Treatment	Plant height (cm)	No. of branches /plant	No. of pods/ plant	Pod length (cm)	Seeds/ pod	100-seed weight (g)	Seed yield (kg/ha)	Dry matter /plant (g)
BARI Mung-2 X S_{20}	25.70 i	4.60 a	11.27 c	5.37 fgh	9.12 d	3.57 bc	780 hij	9.26 fg
BARI Mung-2 X S_{30}	28.82 cdef	3.53 gh	10.80 cde	5.22 ghi	8.48 ef	2.93 de	950 defg	8.02 ij
BARI Mung-2 X S_{40}	29.00 bcde	3.00 kl	9.27 hi	5.09 ij	8.48 ef	2.89 de	821 h	8.82 gh
BARI Mung-2 X S_{50}	29.30 bcd	2.87 klm	9.00 ij	5.04 jk	7.90 hi	2.81 def	725 jkl	9.53 ef
BARI Mung-2 X S_{60}	30.17 b	2.53 n	8.33 jk	5.03 jk	7.56 j	2.73 ef	663 l	4.72 m
BARI Mung-5 X S_{20}	25.00 i	4.00 de	13.00 a	6.05 cd	10.20 b	4.04 ab	900 g	11.86 b
BARI Mung-5 X S_{30}	25.63 i	3.73 fg	10.00 fgh	5.95 d	9.63 c	3.86 abc	995 de	8.07 ij
BARI Mung-5 X S_{40}	27.13 h	3.27 ij	8.33 jk	5.75 e	8.37 f	3.72 abc	1000 de	6.70 kl
BARI Mung-5 X S_{50}	28.20 defgh	2.73 m	8.07 k	5.47 f	8.14 g	3.63 abc	1200 ab	10.22 d
BARI Mung-5 X S_{60}	30.22 b	2.53 n	6.53 no	5.38 fg	6.08 m	3.26 cde	1100 c	11.58 bc
BINA Mung-2 X S_{20}	25.79 i	4.33 b	11.40 bc	5.21 hi	8.09 g	3.66 abc	730 jk	15.08 a
BINA Mung-2 X S_{30}	28.33 defgh	4.27 bc	11.00 cd	4.89 kl	7.84 i	2.93 de	925 fg	10.08 de
BINA Mung-2 X S_{40}	28.70 cdef	4.20 bcd	10.21 efg	4.75 lm	7.12 k	2.79 ef	825 h	8.37 hi
BINA Mung-2 X S_{50}	29.70 bc	4.07 cd	10.05 efg	4.70 m	7.11 k	2.79 ef	708 kl	7.15 k
BINA Mung-2 X S_{60}	32.27 a	3.67 fg	9.50 ghi	4.53 n	6.74 l	2.78 ef	558 mn	7.10 k
BINA Mung-5 X S_{20}	25.27 i	3.33 hi	12.10 b	6.48 a	10.97 a	4.21 a	940 efg	11.10 c
BINA Mung-5 X S_{30}	27.13 h	3.33 hi	10.20 efg	6.23 b	9.58 c	3.89 ab	970 def	10.99 c
BINA Mung-5 X S_{40}	28.40 defg	2.80 lm	8.00 kl	6.12 bc	8.61 e	3.88 ab	1010 d	8.22 hij
BINA Mung-5 X S_{50}	30.13 b	2.73 m	7.81 kl	6.06 cd	8.36 f	3.87 abc	1231 a	8.21 hij
BINA Mung-5 X S_{60}	32.21 a	2.53 n	7.02 mn	5.96 cd	7.92 hi	3.42 bcd	1149 bc	11.80 b
Patuakhali Local X S_{20}	24.83 i	4.07 cd	10.321 def	5.46 f	8.44 f	2.66 efg	800 hi	7.74 j
Patuakhali Local X S_{30}	25.92 i	3.80 ef	9.25 i	4.52 no	8.06 gh	2.26 fgh	750 ijk	7.75 j
Patuakhali Local X S_{40}	27.30 gh	3.60 fg	8.01 k	4.44 nop	7.78 i	2.11 gh	600 m	6.51 l
Patuakhali Local X S_{50}	27.70 fgh	3.07 jk	7.28 lm	4.41 nop	7.38 k	2.08 h	531 no	4.21 m
Patuakhali Local X S_{60}	27.93 efgh	2.40 n	6.35 o	4.36 p	7.05 k	2.00 h	500 o	4.36 m

Means followed by a common letter are not significantly different at the 5% level by DMRT.

Days to flowering and maturity were significantly affected by different seed rates although the magnitude of difference was not wide. Days to flowering and maturity decreased gradually with the increase in seed rate, being 70 and 90 days at 20 kg seed ha^{-1} and 66 and 85 days at 60 kg seed ha^{-1}, respectively. Early flowering under higher seed rate might be due to the creation of a microclimate by crowded community of mungbean which needs further critical study. The earliness in flowering confirmed early maturity under higher seed rate. Saxena (1984) and Pramanik *et al.* (1990) also noted similar findings in chickpea. Seed rates had no influence on days to germination.

The interaction effect of cultivar and seed rate was significant for plant height, branches $plant^{-1}$, pods $plant^{-1}$, pod length, seeds pod^{-1}, 100-seed weight, seed and dry matter yield. In general, bold seeded crop performed better than the small seeded crop. In all cultivars, seed yield increased with the increase in seed rate upto a certain level and declined with further increase. BINA Mung-5 produced the highest seed yield (1231 kg ha^{-1}) at the seed rate of 50 kg ha^{-1} and was at par with BARI Mung-5 (1200 kg ha^{-1}) at the same seed rate. Patuakhali local had the lowest seed yield (500 kg ha^{-1}) with 60 kg seed rate which was identical to 50 kg seed rate with same cultivar. Patuakhali local registered the maximum yield (800 kg ha^{-1}) with 20 kg seed. BARI Mung-2 and BINA Mung-2 gave identical but significantly higher seed yields (950 and 925 kg ha^{-1}, respectively) with 30 kg seed rate. BINA (1998) and BARI (2000) also reported similar seed rates in small and bold seeded mungbean.

From the above discussion, it appears that bold seeded mungbean namely BINA Mung-5 and BARI Mung-5 are better performing cultivars with the seed rate of 50 kg ha^{-1} under the agro-ecological conditions of the study area.

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