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Seed yield of mungbean as affected by variety and plant spacing in *Kharif*-I season

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Abstract

An experiment was carried out to study the effect of variety and planting density on the yield of mungbean in *Kharif*-I season (February to June) of 2003. The experiment comprised five varieties viz. BARIMung-2, BARIMung-3, BARIMung-4, BARIMung-5 and BINAMung-2 and three spacing of planting viz. 30 cm × 10 cm, 20 cm × 20 cm and 40 cm × 30 cm. The experiment was laid out in a randomized complete block design with three replications. It was observed that BARIMung-2 produced the highest seed yield and BINAMung-2 did the lowest. Plant spacing of 30 cm × 10 cm produced the highest seed yield of mungbean while 40 cm × 30 cm spacing produced the lowest seed yield. BARIMung-2 planted at a spacing of 30 cm × 10 cm gave the maximum seed yield.

Keywords: Mungbean, Variety, Plant spacing, Yield

Introduction

Mungbean (*Vigna radiata* L.) is an important pulse crop of Bangladesh which contains high graded vegetable proteins and satisfactory level of minerals and vitamins. Mungbean may be the first choice of farmers due to its good taste, easy digestibility, better palatability and acceptable market price. Among the pulses area, only 8.10% lands are used for the cultivation of mungbean (Kabir, 2001). According to World Health Organization (WHO), per capita per day requirement of pulse is 45g. But in Bangladesh, only 12g pulse is available per capita per day. About 6.01 million tons of pulse is required to meet the present per capita requirement of our country (BARI, 1998). The modern varieties of mungbean usually produce higher seed yield. Mungbean variety MB-55 produced higher seed yield than MB-63 at all three locations of Bangladesh (Ahmed *et al.,* 1987). The yield of recently developed mungbean varieties Kanti, Mubarik and BINAMung-1 ranges from 1.0 to 1.2, 0.8 to 1.0 and 0.8 to 1.0 t ha^{-1}, respectively (ICRISAT, 1991). Seed yield and yield components of mungbean are markedly influenced by planting density. The farmers usually grow mungbean without maintaining proper planting density. They hesitate to grow mungbean in rows, although row planting facilitates easy intercultural operations resulting in higher yield (BARI, 1997). Row planting with appropriate planting density can help ensure optimum plant population $unit^{-1}$ area of mungbean thereby increasing the yield (BARI, 1998). Mungbean grown at a density of 33 plant m^{-2} produced higher yield (Thakuria and Saharia, 1990). Optimum plant density for higher yield of mungbean were 50 to 60 plants m^{-2} (Mimber, 1993) and 30 to 40 plants m^{-2} (BARI, 1998). The highest yield of mungbean was observed from a density of 33 plants m^{-2} (Haque, 1995). The present study was, therefore, undertaken to find out the relative yielding ability of five varieties of mungbean in *Kharif*-I season under variable spacing of planting.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from February to June (*Kharif*-I season), 2002. The soil of experimental plot was sitly loam with pH 6.7, organic matter 1.55%, total nitrogen (N) 0.055%, available phosphorus (P) 12 ppm, available sulphur (S) 16 ppm and exchangeable potassium (K) 0.38 me 100^{-1} g soil. The experiment comprised five varieties of

mungbean viz. (i) BARIMung-2, (ii) BARIMung-3, (iii) BARIMung-4, (iv) BARIMung-5, (v) BINAMung-2; and three spacings of planting viz. (i) 30 cm × 10 cm, (ii) 20 cm × 20 cm and (iii) 40 cm × 30 cm. The experiment was laid out in a randomized complete block design with three replications. Size of each unit plot was 3 m × 2m. Experimental land was prepared with ploughing and laddering and was uniformly fertilized with 20 kg N, 40 kg P_2O_5 and 20 kg K_2O ha^{-1} through urea, triple super phosphate (TSP) and muriate of potash (MP), respectively at final land preparation (BARI, 1999). Crop management practices such as weeding, thinning and plant protection measures were done as per requirement. Data on yield attributes were taken from 5 randomly selected plants $plot^{-1}$. The crops of 3 m^2 (3m × 1 m) in each plot were harvested by hand picking of pods at different dates as per maturity of different varieties. Seed yield was recorded at 10% moisture content. The collected data were compiled and tabulated properly for statistical analysis. Analysis of variance was done with the help of computer package M-STAT program and differences among treatment means were tested with Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Yield contributing characters and yield

Effect of variety

Five varieties of mungbean differed significantly for plant height (Table 1). Variety BARIMung-2 and BARIMung-4 produced statistically identical and the highest plant height followed in order by BINAMung-2 and BARIMung-3. The lowest plant height (32.67 cm) was observed in BARIMung-5. Variation in plant height of varieties might have occurred due to their differences in genetic make-up.

Variety BARIMung-2 produced the highest dry matter $plant^{-1}$ followed in order by BARIMung-3, BINAMung-2, BARIMung-4 and BARIMung-5. The variety BARIMung-5 produced the lowest dry matter $plant^{-1}$ (Table1). Less number of branches $plant^{-1}$ and less plant height were mainly responsible for the lowest dry matter production.

Variety BARIMung-2 and BARIMung-3 produced the highest and statistically identical number of branches $plant^{-1}$ while BINAMung-2 and BARIMung-4 occupied the second position. The lowest number of branches $plant^{-1}$ was observed in BARIMung-5. Variety BARIMung-2 and BARIMung-5 produced the highest and statistically identical number of pods $branch^{-1}$. The lowest number of pods $branch^{-1}$ was produced in BARIMung-3, which was statistically identical to BARIMung-4 and BINAMung-2. The highest number of pods $plant^{-1}$ was produced in the variety BARIMung-2 and the lowest in BARI-Mung-3. Varieties BARIMung-4, BARIMung-5 and BINAMung-2 were statistically identical to BARIMung-3 in this respect. The highest length of pod was found in the variety BARIMung-5. The lowest pod length was found in BARIMung-2, which was statistically identical to the rest three varieties (Table 1). Variety BARIMung-5 produced the highest number of seeds $pods^{-1}$, which was similar to BARIMung-2. The lowest number of seeds pod^{-1} was produced in BARIMung-4. Varity BARIMung-3 and BINAMung-2 were statistically identical to BARIMung-4 in this regard. BARIMung-5 produced the highest 1000-seed weight followed in order by BINAMung-2, BARIMung-2, BARIMung-3 and BARIMung-4. Variation in 1000-seed weight among the varieties of mungbean might be due to their different genetic characteristics. Similar trend of performance in 1000-seed weight was observed in Mungbean by Samanta *et al*. (1999).

Significant variation in seed yield was observed among five varieties of mungbean (Table1). Variety BARIMung-2 gave the highest seed yield (843.7 kg ha^{-1}). The high yield potential of BARIMung-2 was realized mainly through increased number of branches plant^{-1}, number of pods branch^{-1}, number of pods plant^{-1} and seeds pod^{-1} (Table 1). The second highest seed yield was observed in BARIMung-3, which was statistically identical to those observed in BARIMung-4 and BARIMung-5. The lowest seed yield was obtained in BINAMung-2.

Table 1. Effects of variety and plant spacing on yield contributing characters and yield of mungbean

Treatment	Plant height (cm)	Total dry matter at harvest (g plant^{-1})	Number of branches plant^{-1}	Number of pods branch^{-1}	Number of pods plant^{-1}	Pod length (cm)	Number of seeds pod^{-1}	Weight of 1000 seeds (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest Index (%)
Variety											
BARIMung-2	38.12^{ab}	10.57^{a}	2.22^{a}	3.67^{a}	14.56^{a}	6.79^{b}	10.33^{ab}	30.89^{c}	843.70^{a}	1850^{b}	31.38^{a}
BARIMung-3	36.18^{c}	9.94^{b}	2.11^{ab}	3.14^{b}	11.56^{b}	6.84^{b}	9.78^{bc}	30.73^{d}	783.80^{b}	1800^{b}	29.19^{b}
BARIMung-4	39.24^{a}	8.54^{d}	1.89^{bc}	3.33^{b}	11.67^{b}	6.87^{b}	9.44^{c}	30.23^{e}	779.50^{b}	2160^{a}	26.69^{c}
BARIMung-5	32.67^{d}	8.49^{d}	1.81^{c}	3.75^{a}	12.00^{b}	7.16^{a}	10.53^{a}	35.97^{a}	770.30^{b}	1840^{b}	29.69^{b}
BINAMung-2	36.94^{bc}	8.91^{c}	1.92^{bc}	3.28^{b}	11.56^{b}	6.87^{b}	9.53^{c}	31.13^{b}	701.20^{c}	1990^{ab}	26.16^{c}
S $\bar{x}$	0.403	0.08	0.06	0.06	0.265	0.028	0.146	0.036	3.695	54.0	0.195
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Spacing of planting											
20 cm X 20 cm	34.69^{c}	8.79^{b}	1.57^{c}	3.62^{a}	12.00^{b}	6.86^{b}	9.77	31.38^{c}	750.50^{b}	1840^{b}	29.28^{a}
30 cm X 10 cm	36.88^{b}	9.64^{a}	2.33^{a}	3.42^{b}	13.13^{a}	6.97^{a}	10.00	31.93^{b}	1046.00^{a}	2580^{a}	28.43^{b}
40 cm X 30 cm	38.31^{a}	9.44^{a}	2.07^{b}	3.27^{b}	11.67^{b}	6.87^{b}	10.00	32.06^{a}	530.90^{c}	1370^{c}	28.16^{b}
S $\bar{x}$	0.312	0.062	0.05	0.05	0.21	0.02	--	0.028	2.86	42.0	0.151
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	NS	0.01	0.01	0.01	0.01
CV (%)	3.30	2.62	9.49	5.48	6.49	1.18	4.40	0.34	1.43	8.31	2.04

Means having same letter(s) in a column do not differ significantly (as per DMRT). NS= Not significant

Stover yield was significantly affected by varieties (Table1). The highest stover yield was obtained in BARIMung-4 mainly due to the highest plant height (Table 1). BINAMung-2 was statistically identical to BARIMung-4 regarding stover yield. The lowest stover yield was obtained in BARIMung-3, which was statistically identical to BARIMung-2 and BARIMung-5. Harvest index was significantly affected by varieties (Table1). The highest harvest index was obtained in variety BARIMung-2 mainly due to the highest seed yield (Table1) followed in order by BARIMung-3 and BARIMung-5. The lowest harvest index was observed in BINAMung-2, which was statistically identical to that of BARIMung-4.

Effect of plant spacing

All yield contributing characters were significantly influenced by planting density except number of seeds pod^{-1} (Table 1). The tallest plant was observed at a planting density of 40 cm $\times$ 30 cm mainly due to more space for growing up the individual plant. The shortest plant was observed at a planting density of 20 cm $\times$ 20 cm. The highest dry matter plant^{-1} was produced at spacing of 30 cm $\times$ 10 cm, which was identical to that of 40 cm $\times$ 30 cm. The lowest dry matter plant^{-1} was produced in 20 cm $\times$ 20 cm spacing. The highest number of branches plant^{-1} was observed at 30 cm $\times$ 10 cm spacing followed in order by 40 cm $\times$ 30 cm and 20 cm $\times$ 20 cm. The highest number of pods branch^{-1} was produced at 20 cm $\times$ 20 cm spacing and the lowest number of pods branch^{-1} was produced at 40 cm $\times$ 30 cm spacing, which was similar to 30 cm × 10 cm spacing. The highest number of pods plant^{-1} was found at 30 cm × 10 cm spacing and the lowest one was found at 40 cm × 30 cm. However, 20 cm × 20 cm spacing produced similar pods plant^{-1} as that of 40 cm × 30 cm spacing. The highest pod length was observed at 30 cm $\times$ 10 cm spacing. The lowest pod length was observed at

20 cm × 20 cm spacing, which was statistically identical to 40 cm × 30 cm spacing. The highest 1000-seed weight was observed at 40 cm × 30 cm spacing followed in order by 30 cm × 10 cm and 20 cm × 20 cm spacing.

The highest seed yield (1046.0 kg ha^{-1}) was obtained at 30 cm × 10 cm spacing followed in order by 20 cm × 20 cm and 40 cm × 30 cm spacing. This highest seed yield resulted mainly due to higher number of branches $plant^{-1}$ and number of pods $plant^{-1}$ (Table 1).

The highest stover yield was observed at 30 cm × 10 cm spacing mainly due to higher number of branches $plant^{-1}$ and the lowest one was observed at 40 cm × 30 cm spacing. The highest harvest index was found at 20 cm × 20 cm spacing and the lowest harvest index was found at 40 cm × 30 cm spacing. The harvest index at 30 cm × 10 cm was statistically identical to that of 40 cm × 30 cm spacing.

Interaction effects of variety and spacing of planting

Interaction effects between variety and spacing of planting were significant in all yield contributing characters except number of seeds pod^{-1} (Table 2). The highest plant height was observed in BARIMung-4 planted at a spacing of 40 cm × 30 cm and the lowest plant height was observed in BARIMung-5 planted at a spacing of 20 cm × 20 cm. The variety BARIMung-2 planted at a spacing of 30 cm × 10 cm produced the highest dry matter $plant^{-1}$, which was identical to that of BARIMung-3. The lowest dry matter $plant^{-1}$ was produced in BARIMung-4 planted at a spacing of 20 cm × 20 cm, which was statistically identical to BARIMung-5 and BINAMung-2 at the same spacing (Table 2). The highest number of branches $plant^{-1}$ was observed in BARIMung-2 planted at a spacing of 30 cm × 10 cm, which was statistically identical to BARIMung-3 at the same spacing. The lowest number of branches $plant^{-1}$ was observed in variety BARIMung-5 planted at 20 cm × 20 cm spacing. The highest number of pods $branch^{-1}$ was observed in variety BARIMung-2 at 30 cm × 10 cm spacing, which was statistically identical to BARIMung-5, BARIMung-2 and BARIMung-4 at 20 cm × 20 cm spacing, BARIMung-5 at 30 cm × 10 cm and BINAMung-2 at 40 cm × 30 cm spacing. The lowest number of pods $branch^{-1}$ was found in BINAMung-2 at spacing of 30 cm × 10 cm. The highest number of pods $plant^{-1}$ was observed in variety BARIMung-2 planted at a spacing of 30 cm × 10 cm (Table 2) and the lowest number of pods $plant^{-1}$ was observed in variety BARIMung-2 and variety BINAMung-2 planted at a spacing of 40 cm × 30 cm and BARIMung-3 planted at a spacing of 20 cm × 20 cm. The highest pod length was observed in BARIMung-5 planted at spacings of 20cm × 20cm and 30 cm × 10 cm and the lowest pod length was observed in BARIMung-2 planted at 40 cm × 30 cm spacing. The highest 1000-seed weight was observed in BARIMung-5 at 40 cm × 30 cm spacing due to longer and heavier seed size (Table 2) and the lowest 1000-seed weight was observed in BARIMung-2 planted at 40 cm × 30 cm spacing and in BARIMung-4 planted at 20 cm × 20 cm spacing, which were statistically identical (Table 2).

The variety BARIMung-2 planted at a spacing of 30 cm × 10 cm gave the highest seed yield (1217.0 kg ha^{-1}) due to the highest number of pods produced $plant^{-1}$. The second highest seed yield was obtained in variety BARIMung-3 planted at a spacing of 30 cm × 10 cm. The lowest seed yield was obtained in BARIMung-3 at 40 cm × 30 cm spacing, which was statistically identical to that of BARIMung-2 at the same spacing (Table 2).

All the varieties planted at a density of 30 cm × 10 cm produced the highest and statistically identical stover yield. Higher stover yields were obtained mainly due to higher number of branches $plant^{-1}$ and pods $plant^{-1}$ (Table 2). The lowest stover yield was observed in variety BARIMung-2 planted at a spacing of 40 cm × 30 cm.

Table 2. Interaction effects of variety and plant spacing on yield contributing characters and yield of mungbean

Interaction (Variety × Spacing of planting)	Plant height (cm)	Total dry matter at harvest (g plant^{-1})	Number of branches plant^{-1}	Number of pods branch^{-1}	Number of pods plant^{-1}	Pod length (cm)	Number of seeds pod^{-1}	Weight of 1000 seeds (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest Index (%)
BARI-2 × (20 x 20cm)	35.25^{c-e}	10.21^{b}	1.83^{b-d}	3.92^{a}	15.33^{b}	6.86^{bc}	10.33	30.85^{f}	808.10^{g}	1860^{c}	30.26^{bc}
BARI-2 × (30 x10cm)	41.55^{b}	11.23^{a}	2.92^{a}	4.17^{a}	18.33^{a}	6.88^{bc}	10.67	31.87^{d}	1217.0^{a}	2590^{ab}	32.31 ^{a}
BARI-2 × (40 x30cm)	37.55^{c}	10.26^{b}	1.92^{b-d}	2.92^{d}	10.00^{g}	6.64^{d}	10.00	29.96^{i}	505.70^{l}	1100 ^{f}	31.58 ^{ab}
BARI-3 × (20 x20cm)	33.48^{d-f}	9.47^{c}	1.58^{de}	3.00^{cd}	10.00^{g}	6.74^{cd}	9.67	31.12^{e}	704.50^{j}	1620^{c-e}	30.60^{bc}
BARI-3 × (30 x10cm)	37.90^{c}	10.87^{a}	2.83^{a}	3.00^{cd}	13.33^{cd}	6.98^{b}	10.00	30.75^{fg}	1159.0^{b}	2530^{ab}	28.80^{d-f}
BARI-3 × (40 x30cm)	37.17^{c}	9.50^{c}	1.92^{b-d}	3.42^{bc}	11.33^{d-g}	6.80^{b-d}	9.67	30.32^{h}	488.30^{l}	1250^{ef}	28.15^{ef}
BARI-4 × (20 x20cm)	35.80^{cd}	8.07^{e}	1.58^{de}	4.00^{a}	12.67^{c-e}	6.64^{d}	9.17	29.85^{j}	847.60^{f}	2260^{b}	27.61^{fg}
BARI-4 × (30 x10cm)	36.57^{c}	9.02^{cd}	1.92^{b-d}	3.00^{cd}	11.67^{d-g}	6.99^{b}	9.50	30.32^{h}	949.10^{d}	2700^{a}	26.32^{gh}
BARI-4 × (40 x30cm)	45.35^{a}	8.53^{de}	2.17^{b}	3.00^{cd}	10.67^{e-g}	6.98^{b}	9.67	30.52^{gh}	541.90^{k}	1530^{c-e}	26.16^{h}
BARI-5 × (20 x20cm)	32.10^{f}	8.12^{e}	1.17^{e}	4.08^{a}	11.67^{d-g}	7.22^{a}	10.50	34.39^{c}	734.70^{h}	1740^{cd}	29.99^{cd}
BARI-5 × (30 x10cm)	32.53^{ef}	8.59^{de}	2.08^{bc}	4.00^{a}	12.33^{d-f}	7.27^{a}	10.42	35.86^{b}	1018.0^{c}	2420^{ab}	29.62^{cd}
BARI-5 × (40 x30cm)	33.37^{d-f}	8.76^{d}	2.17^{b}	3.17^{cd}	12.00^{d-g}	6.99^{b}	10.67	37.67^{a}	557.70^{k}	1360^{d-f}	29.48^{c-e}
BINA-2 × (20 x20cm)	36.82^{c}	8.12^{e}	1.67^{cd}	3.08^{cd}	10.33^{fg}	6.84^{b-d}	9.17	30.71^{fg}	657.40^{j}	1690^{cd}	27.94^{f}
BINA-2 × (30 x10cm)	35.87^{cd}	8.49^{de}	1.92^{b-d}	2.92^{d}	10.00^{g}	6.75^{cd}	9.42	30.85^{f}	885.50^{e}	2640^{b}	25.12^{h}
BINA-2 × (40 x30cm)	38.13^{c}	10.13^{b}	2.17^{b}	3.83^{ab}	14.33^{bc}	7.02^{b}	10.00	31.84 ^{d}	560.80^{k}	1650^{cd}	25.41 ^{h}
$S\bar{x}$	0.698	0.14	0.109	0.108	0.459	0.048	--	0.063	6.4	93.0	0.337
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	NS	0.01	0.01	0.01	0.01
C V (%)	3.30	2.62	9.49	5.48	6.49	1.18	4.40	0.34	1.43	8.31	2.04

Means having same letter(s) in a column do not differ significantly as per DMRT. NS= Not significant.

The highest harvest index was obtained in the variety BARIMung-2 planted at a spacing of 30 cm × 10 cm mainly due to the highest seed yield (Table 2). Similar harvest index was obtained from the variety BARIMung-2 planted at a spacing of 40 cm × 30 cm. The lowest harvest indices were obtained from the varieties BARIMung-4 and BINAMung-2 planted at a spacing of 40 cm × 30 cm and the variety BINAMung-2 planted at a spacing of 30 cm × 10 cm (Table 2).

From the present study it is concluded that 30 cm × 10 cm plant spacing was more suitable for the cultivation of mungbean variety BARIMung-2 in *Kharif*-I season. Variety BARIMung-5 produced the highest weight of 1000 seeds and the longest pods, but not the seed yield.

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