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Effect of seed rate and seed source on yield and yield contributing characters of mungbean

S.M.M. Hassan, M. Ahmed, M. Zakaria[1], M.H. Kabir and A.R. Choudhury[2]
Department of Agronomy, Bangladesh Agricultural University, Mymensingh, [3]Country Coordinator, USAID/STOP AI, DAI, Bangladesh and [5]Senior Editor, Bangladesh Agricultural University, Mymensingh.

Abstract: An experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from March to May 2008 to study the effect of seed rate and seed source on seed yield and yield contributing characters of mungbean. Three seed rates viz., 20, 25 and 30 kg ha^{-1} and four seed sources viz., Jamalpur, Dinajpur, Chuadanga and BADC were included in the experiment. Results showed that the seed rate of 25 kg ha^{-1} produced the highest number of pods $plant^{-1}$ (18.20), highest number of seeds pod^{-1}(7.93), highest 1000-seed weight (31.99 g) and the highest seed yield (827.94 kg ha^{-1}). All of the yield and yield contributing characters were significantly influenced due to seed source. Seeds collected from BADC produced the maximum seed yield (978.67 kg ha^{-1}).
Key words: Seed rate, seed source, seed yield, yield contributing characters and mungbean

Introduction

Mungbean (*Vigna radiata* L. Wilczek) is considered as the top quality and costly pulse crop of Bangladesh. It constitutes a popular supplementary dietary ingredient of cereal based traditional food for all classes of people. Mungbean, in particular, is rich in easily digestible form of protein. It contains a high degree of proteins, minerals and vitamins (Sarkar *et al*., 2005). It contains more than double amount of protein than cereals which obviously improve the nutritional value of food. So, mungbean can play a vital role in solving the protein malnutrition in Bangladesh. The country is facing an acute shortage of mungbean due to low yield per unit area and less production. The yield of any crop depends on primarily the establishment of the crop i.e. the growth of the plant. In addition to yield, the quality of the crop also depends on the growth of the plant. On the other hand, good quality seed and it's rate is the first and foremost criteria for the good establishment of the crop. Seed quality depends on the source of the seed. Seed produced at a suitable agro-ecological zone by a reliable and reputed farm/farmer is supposed to produce quality seeds maintaining standard seed production techniques. There are some reasons responsible for low yield of mungbean, of them, less plant population per unit area and source of seed are important. Among the various management practices, maintaining an optimum plant population in the field is very important to obtain higher yield (Samanta et al., 2007). Seed source is another important factor responsible for low yield of grain legumes. Farmers do not think about the source of seed as they are not well aware of importance of seed source. As seed is the vital factor for a crop, its source is also of same importance. Seed collected from a good source will certainly give a good yield. On the other hand, if the seed is collected from a bad source, the seeds may be of very low germinability and be pest affected, and ultimately crop yield and quality may fall drastically. Even 100% of crop failure may occur as a result of bad seeds collected from a bad source. So, seed source should be considered during collection of seeds. Mungbean is an important pulse crop of Bangladesh but very little research works have been conducted on seed rate and seed source in the country. Therefore, the present study was undertaken to find out the optimum seed rate and the best source of seed which can contribute to better growth and quality of mungbean.

Materials and Method

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from March to May 2008. Two sets of treatments viz. Seed rate-20 kg ha^{-1} (D_1), 25 kg ha^{-1} (D_2) and 30 kg ha^{-1} (D_3) and Seed source- Jamalpur (S_1), Dinajpur (S_2), Chuadanga (S_3), BADC (S_4) in a randomized complete block design with four replications where the total number of unit plots were 48, Plot to plot and block to block distance were 0.5 m and 1.0 m, respectively. The unit plot size was 4.0 m ×2.5 m. Mungbean seeds (BARI Mungbean-2, Kanti) were procured from the farmer's field of Jamalpur, Dinajpur, Chuadanga and Bangladesh Agricultural Development Corporation (BADC), Mymensingh. The experimental land was prepared properly and fertilized with 25 kg Urea, 50 kg TSP and 30 kg MOP $hectare^{-1}$ as basal dose as per recommendation of Bangladesh Institute of Nuclear Agricultural (BINA, 2006) on March 12, 2008. Seeds were sown by broadcasting method on15 March, 2008. All other necessary intercultural operations were done in time. The crop was harvested on 31 May, 2008 when about 70% of the pods became brown in colour. Data on yield and yield components were recorded from 10 randomly selected plants from respective plots at harvesting. The collected data were compiled and analyzed statistically using the "Analysis of Variance'' technique and significance of the mean differences was adjudged by the Duncun's Multiple Range Test (Gomez and Gomez,1984).

Results and Discussion

The different seed rates used to maintain variation in plant population were found very effective and produced population from 29.17 to 43.70 plants m^{-2}. It

was observed that there was a direct relationship between seed rates and number of plants m^{-2} (Table 1). The 20 kg seeds used hectare^{-1}, maintained a very low population of 29.17 plants m^{-2}, which steadily increased up to 43.70 plants m^{-2} at the seed rate of 30 kg ha^{-1}. The results of other researchers (Singh *et al.* 1991) were also similar to the present finding. Table 2 indicates that the seed source did not influence the plant population significantly and the number of plants m^{-2} varied from 35.70 to 37.03. It was also found that number of plants m^{-2} was not significant influenced by the interaction between the seed rate and the seed sources (Table 3).

Table 1 Effect of seed rate on various plant characters, seed yield and yield components of mungbean

Seed Rate (kg ha^{-1})	Plant height (cm)	No. of branches $plant^{-1}$	Number of pods $plant^{-1}$	Pod length (cm)	No. of seeds pod^{-1}	1000-seed wt. (g)	Seed yield $plant^{-1}$ (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
20 (D_1)	31.21a	2.98	16.54b	6.95	7.65ab	30.46b	2.87b	810.88ab	2397.94b	25.22b
25(D_2)	30.90a	2.99	18.20a	6.84	7.93a	31.99a	3.16a	827.94a	2264.13c	26.78a
30 (D_3)	28.42b	2.89	16.86b	6.91	7.44b	29.69b	2.79b	806.44b	2621.69a	23.52c
Level of significance	1%	NS	1%	NS	1%	1%	1%	5%	1%	1%
CV (%)	5.72	5.55	7.39	3.95	4.61	4.52	10.30	3.37	3.21	1.64

Table 2 Effect of seed source on various plant characters, seed yield and yield components of mungbean.

Seed source	Plant height (cm)	No. of branches $plant^{-1}$	No. of pods $plant^{-1}$	Pod Length (cm)	No. of seeds pod^{-1}	1000-seed wt. (g)	Seed yield $plant^{-1}$(g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
Jamalpur(S_1)	28.95b	2.84b	16.13b	6.48c	7.12c	27.32c	2.57b	735.17c	2189.75c	25.36a
Dinajpur(S_2)	29.71b	2.83b	16.47b	6.87b	7.33bc	28.94b	2.84b	762.58bc	2268.33bc	25.18b
Chuadanga(S_3)	32.61a	2.88b	17.13b	6.99ab	7.68b	29.61b	2.91b	783.92b	2327.17b	25.26ab
BADC(S_4)	29.43b	3.24a	19.08a	7.27a	8.56a	37.00a	3.44a	978.67a	3126.42a	23.78c
Level of significance	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
CV (%)	5.72	5.55	7.39	3.95	4.61	4.52	10.30	3.37	3.21	1.64

Plant height of mungbean was significantly influenced by the seed rate (Table 1). The seed rate 20 kg ha^{-1} produced the tallest plant (31.21 cm) and it was statistically identical to 25 kg ha^{-1} seed rate. The shortest plant (28.42 cm) was recorded at 30 kg ha^{-1} used. The lower seed rate produced the higher plant height probably due to availability of more space, light, water, nutrition and other growth resources to the plant. From Table 2 it is observed that seed source had a significant influence on plant height. Among the different seed sources Chuadanga's seed produced the tallest plant (32.61cm) and the shortest (28.95 cm) was produced from the seed source of Jamalpur. The maximum plant height in Chuadanga seed might be due to its high vigour. No significant interaction of seed rate and seed source was found for plant height (Table 3). However, Chuadanga seed with the seed rate of 20 kg ha^{-1} produced the maximum plant height and BADC seed in 30 kg ha^{-1} produced the minimum plant height.

Seed rate did not show any significant effect on the production of number of branches $plant^{-1}$ (Table 1). Number of branches $plant^{-1}$ varied significantly due to seed source (Table 2). The highest number of branches $plant^{-1}$ (3.24) was found in BADC seed. Although the rest of the three seed sources produced identical number of branches $plant^{-1}$, the Dinajpur seed produced the lowest number (2.83). The interaction between seed rate and seed source was not significant in respect of producing number of branches $plant^{-1}$ (Table 3).

Seed rate showed a significant influence on the production of number of pods $plant^{-1}$ (Table 1). The highest number (18.20) of pods $plant^{-1}$ was observed from 25 kg ha^{-1} whiles the lowest (16.54) from 20 kg ha^{-1}. The reasons for highest number of pods $plant^{-1}$ in

the 25 kg ha^{-1} seed rate were perhaps higher availability of solar radiation, water, nutrient and other growth resource due to low plant population unit^{-1} area. Similar result was obtained by Islam *et al.* (1983). Seed source also significantly influenced the number of pods plant^{-1} (Table 2). Among the seed sources, BADC's seed produced the highest (19.08) number of pods plant^{-1} while Jamalpur's seed produced the lowest (16.13) number of pods plant^{-1}, the later being statistically similar with Dinajpur and Chuadanga seed. BADC's seed produced the maximum number of pods plant^{-1} probably due to their proper care and management during seed production which led the highest number of branches and better growth

Table 3 Effect of interaction between seed rate and seed source on various plant characters, seed yield and yield components of mungbean

Interaction (seed rate × seed source)	Plant height (cm)	No. of branches plant^{-1}	No. of pods plant^{-1}	Pod length (cm)	No. of seeds pod^{-1}	1000-seed weight (g)	Seed Yield plant^{-1} (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
D_1S_1	29.75	2.93	15.40	6.28c	7.04	27.75	2.55	723.00	2121.25	25.42
D_1S_2	30.17	2.85	16.42	6.80bc	7.25	28.60	2.75	757.50	2240.25	25.00
D_1S_3	34.75	2.90	16.43	7.01b	8.00	28.75	2.82	780.50	2288.50	25.44
D_1S_4	30.15	3.23	17.90	7.73a	7.30	36.75	3.36	982.50	2941.75	25.03
D_2S_1	29.85	2.83	17.23	6.47bc	7.38	28.20	2.70	761.75	2105.25	26.60
D_2S_2	30.27	2.85	17.31	6.91b	7.55	30.58	3.00	768.00	2087.50	26.89
D_2S_3	33.37	2.90	18.68	6.98b	7.85	31.20	3.09	795.00	2168.50	26.83
D_2S_4	30.10	3.38	19.60	7.02b	8.93	38.00	3.86	987.00	2695.25	26.81
D_3S_1	27.25	2.78	15.75	6.70bc	6.95	26.00	2.45	720.75	2342.75	23.52
D_3S_2	28.76	2.80	15.68	6.89b	7.19	27.65	2.78	762.25	2477.25	23.53
D_3S_3	29.70	2.85	16.27	6.99b	7.18	28.88	2.82	776.25	2524.50	23.52
D_3S_4	28.05	3.13	19.75	7.05b	8.45	36.25	3.13	966.50	3142.25	23.52
Level of significance	NS	NS	NS	1%	NS	NS	NS	NS	NS	NS
Sx^-	0.86	0.08	0.64	0.14	0.18	0.69	0.15	13.75	22.50	0.119
CV (%)	5	5.55	7.39	3.95	4.61	4.52	10.30	3.37	3.21	1.64

In a column, figures having common letter (s) did not differ significantly whereas means having dissimilar letter (s) differ significantly as per DMRT. NS= Not significantly different; D_1 = 20 kg ha^{-1}, D_2 = 25 kg ha^{-1}, D_3 = 30 kg ha^{-1} ; S_1 = Jamalpur, S_2 = Dinajpur, S_3 = Chuadanga, S_4 = BADC.

of the crop plants. Table 3 indicates that there was no significant interaction between seed rate and seed source in producing the pods plant^{-1}.

Pod length did not vary significantly due to seed rate (Table 1). Seed source exerted significant effect on pod length (Table 2). Among the different seed sources, BADC's seed produced the highest pod length (6.99 cm) which was statistically identical with that of Chuadanga's seeds and the lowest (6.48 cm) was obtained from Jamalpur's seed. There was a significant interaction effect of seed rate and seed source on pod length. BADC's seed with 20 kg seed rate ha^{-1} produced the highest (7.73 cm) pod length and the lowest (6.28 cm) pod length was found from Jamalpur's seed using 20 kg seed ha^{-1} which was statistically similar with those of Dinajpur's seed at the rate of 20 kg ha^{-1}, Jamalpur's seed at the rate of 25 kg ha^{-1} and Jamalpur's seed 30 kg ha^{-1} seed rate.

Seed rate showed a significant influence on the production of number of seeds pod^{-1} (Table 1). The seed rate of 25 kg ha^{-1} produced the highest (7.93) number of seeds pod^{-1} which was identically followed by 20 kg ha^{-1} and 30 kg ha^{-1} produced the lowest seeds pod^{-1} (7.44). Number of seeds pod^{-1} was also significantly affected by seed source (Table 2). BADC's seed produced the highest (8.56) number of seeds pod^{-1} and Jamalpur's seed produced the lowest (7.12) number of seeds pod^{-1} which was statistically identical with that of Dinajpur seed. Interaction between seed rate and seed source was found in significant on the number of seeds pod^{-1} (Table 3).

The weight of 1000 seeds varied significantly due to seed rate (Table 1). The maximum 1000-seed weight (31.99 g) was observed from 25 kg ha^{-1} seed rate and 30 kg ha^{-1} produced the minimum 1000-seed weight (29.69 g) which was statistically identical with that of 20 kg ha^{-1}. This was perhaps due to relatively less number of plants unit^{-1} area in 25 kg ha^{-1} which provided scope for increased photosynthetic activities and translocation of more metabolites to the seed sink. Seed source showed a significant influence on 1000-seed weight (Table 2). BADC's seed produced the

highest 1000-seed weight (37.00 g) while Jamalpur's seed produced the lowest (27.32 g) 1000-seed weight. Rest two seed sources were statistically identical in terms of producing 1000-seed weight. Interaction between seed rate and seed source failed to show any significant influence on this character (Table 3).

Seed rate showed significant effect on the seed yield (Table 1). The seed rate of 25 kg ha^{-1} gave the highest seed yield (827.94 kg ha^{-1}) but it was statistically followed by 20 kg ha^{-1} seed rate. The lowest seed yield (806.44 kg ha^{-1}) was obtained from 30 kg ha^{-1} but it was also statistically identical with that of 20 kg ha^{-1} seed rate. Results indicate that 25 kg ha^{-1} seed rate was the best in respect of seed yield in mungbean. This result is in partial agreement with Sarkar et al., (2005). Samanta et al. (1977) also recorded the highest seed yield with the seed rate of 24 kg ha^{-1}. The highest seed yield in 25kg ha^{-1} might have resulted due to the highest number of pods $plant^{-1}$, number of seeds pod^{-1} and 1000-seed weight (Table 1). The lower number of branches $plant^{-1}$, lower number of seeds pod^{-1} and lower 1000-seed weight produced in seed rate of 25 kg ha^{-1} might be due to higher competition between the plants for light, nutrient, water etc. Seed yield was also significantly affected by the seed source (Table 2). The maximum (978.67 kg ha^{-1}) seed yield was obtained from the BADC's seed and it was significantly different from the other treatments. Jamalpur seed produced the lowest (735.17 kg ha^{-1}) seed yield which was identical to that in Dinajpur seed. The highest seed yield produced by BADC's seed which might be due to it's authentication and proper management during seed production. The interaction effect of seed rate and seed source was found insignificant for seed yield ha^{-1} (Table 3).

Straw yield differed significantly due to seed rates (Table 1). The highest straw yield (2621.69 kg ha^{-1}) was obtained with 30 kg ha^{-1} seed rate. The second highest straw yield was found in 20 kg ha^{-1} seed rate while the lowest (2264.13 kg ha^{-1}) straw yield was recorded with 25 kg ha^{-1}. Probably the 30 kg ha^{-1} seed rate produced higher plant population which contributed to the highest straw yield but in 20 kg ha^{-1}, less intra specific competition resulted the higher straw yield than the 25 kg ha^{-1}. Seed source also influenced the straw yield significantly (Table 2). BADC seed produced significantly the highest (3126.42 kg ha^{-1}) straw yield. The lowest (2189.75 kg ha^{-1}) straw yield was recorded in Jamalpur seed which was again statistically similar with that in Dinajpur seed. No significant interaction effect between seed rate and seed source was observed with respect to the production of straw yield (Table 3).

Harvest index was found to be significantly affected by seed rate (Table 1). The seed rate of 25 kg ha^{-1} gave significantly the highest (26.78%) harvest index which was followed by 20 kg ha^{-1} and 30 kg ha^{-1} seed rates. Results indicate that higher seed yield gave the higher harvest index.

The harvest index of mungbean also varied significantly due to different seed sources (Table 2). The highest harvest index (25.36%) was produced by Jamalpur seed while the lowest (23.78%) harvest index was produced by BADC seeds. It may be also seen that higher straw yield gave the lower harvest index. The variation in harvest index was not significant due to interaction of seed rate and seed source (Table 3).

From the results stated above it may be seen that the seed rate of 25 kg ha^{-1} was superior compared to other two seed rates in terms of yield of mungbean. Again among the different seed sources, BADC's seed gave the higher seed yield. Therefore, under the condition of present research it may be concluded that farmers should use the seed of mungbean from BADC sources and it should be sown at the rate of 25 kg ha^{-1}.

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