American-Eurasian Journal of Agronomy, 4 (1): 01-05, 2011
ISSN 1995-896X

Yield Components and Yield of Different Mungbean Varieties as Affected by Row Spacing

[1]K.U. Ahamed, [1]Kamrun Nahar, [2]N.M. Rahmatullah, [3]Golam Faruq and [4]M.D. Ali Alamgir

[1]Department of Agricultural Botany,
Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
[2]Department of Agricultural Statistics,
Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
[3]Institute of Biological Science, Faculty of Science,
University of Malaya, Kualalumpur, Malaysia
[4]Genetic Resources and Seed Division,
Bangladesh Jute Research Institute, Dhaka, Bangladesh

Abstract: An experiment was conducted at the experimental field of Agricultural Botany Department, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh from the period of August, 2009 to April, 2010 (kharif -2 season). Five Mungbean varieties namely BARI Mung-2 (M_2), BARI Mung-3 (M_3), BARI Mung-4 (M_4), BARI Mung-5 (M_5) and BARI Mung-6 (M_6) were used in the experiment to observe their yield attributes in different plant spacings viz. 20×10 cm (D_1), 30×10 cm (D_2) and 40×10 cm (D_3). Yield and yield contributing characters varied significantly due to variation in varieties and plant spacings. BARI Mung-2 and BARI Mung-6 produced the highest and the lowest yield of 938.20 and 592.88 kg ha^{-1} respectively. The plant spacing 20×10 cm produced the highest (1044.03 kg ha^{-1}) and 40×10 cm produced the lowest yield (621.97 kg ha^{-1}). In case of interaction of variety and spacing BARI Mung-2 with 20×10 cm produced the highest yield of 1284.9 kg ha^{-1}.

Key words: Vigna radiata · Plant spacing · Yield

INTRODUCTION

Mungbean (*Vigna radiata* Lin.) is one of the most important and popular pulse crop and it ranks the third position regarding area and production among pulses in Bangladesh [1]. Total production of pulses in Bangladesh is only 0.65 million ton against 2.7 million ton requirement. The shortage of pulse crop is almost 80% of the total requirement [2]. The reason for this is low yield mainly [3]. There are various reasons for low yield. Among the cultural practices seed rate is one of the important components. There are large differences in yield among the mungbean varieties [4] and the maximum potentiality can be achieved from the optimum spacing. Row planting with appropriate planting density can help to ensure optimum plant population unit^{-1} area of mungbean thereby increasing the yield [5]. Experiments and works on spacing of mungbean have been carried out in Bangladesh, as well as in other countries to find out the suitable plant population to get maximum yield [6]. Improper spacing reduced the yield of mungbean up to 20-40% [7] due to competition for light, space, water and nutrition. On the other hand, wider space allows individual plants to produce more branches and pods, but it provides smaller number of pods per unit area due to fewer plants per unit area [8]. So, optimum plant spacing and seed rate should be ensured for the plant to grow properly in order to give higher yield [9]. In this context, the present study was undertaken to observe the effect of different plant spacing on the yield attributes and yield of some widely cultivated mungbean varieties of Bangladesh.

Corresponding Author: Kamrun Nahar, Department of Agricultural Botany, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

MATERIALS AND METHODS

The experiment was conducted at the experimental field of Agricultural Botany Department, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh from the period of August, 2009 to April, 2010 (kharif -2 season). Five Mungbean varieties namely BARI Mung-2 (M_2), BARI Mung-3 (M_3), BARI Mung-4 (M_4), BARI Mung-5 (M_5) and BARI Mung-6 (M_6) were used in the experiment to observe their yield attributes in different plant spacings viz. 20×10 cm (D_1), 30×10 cm (D_2) and 40×10 cm (D_3). The experiment was laid out with randomized complete block design and with three replications. The unit plot size was 2.5×1.5 m. The land was prepared properly with ploughing and laddering. The fertilizers were given during the final land preparation at the dose of 20 kg N ha^{-1}, 40 kg P_2O_5 ha^{-1} and 20 kg K_2O ha^{-1} in the form of urea, tripple supperphosphate (TSP) and muriate of potash (MP) [10]. Other intercultural operations were performed as per requirement and recommendation [11]. Data on different parameters were taken according to the maturity time of different varieties. The yielded seeds were adjusted at 12% moisture level before taking weight. The data were analyzed by MSTAT program and mean differences were tested by Duncan's Multiple Range Test (DMRT) [12].

RESULTS AND DISCUSSION

Yield components are not independent. They are also not passive participants in the determination of seed yield, but, on the contrary, exert an active influence on yield through the source-sink transport relationship. In general, an increase in one component at a certain level, often leads to a decrease in another. Often the number of pods per plant declines as the number of plants per unit area increases. Similarly, the weight per seed decreases as the number of seeds per pod increases. This means that, for maximum yield, all these yield components should in an appropriate balance [13]. Here in the experiment different values against different parameters were found due to varietial differences and differences in plant spacing and because of their interaction also. Here all the parameters were found significant at 0.01 level except the No. of seeds pod^{-1}.

Varietial Effect on Yield Components and Yield: There are large differences in yield among the mungbean varieties [4]. In the present study five varieties of mungbean showed different performances in respect of different yield components. Here changes in different parameters have been discussed. The pod length (7.91 cm) was found the highest in the variety BARI Mung-6 and it is statistically superior to all other varieties (Table 1). The second highest long pod (7.18 cm) was found in the variety BARI Mung-5 and the shortest pod (6.34 cm) was found in BARI Mung-3 and this value is 9.22% lower than the highest value of BARI Mung-6. This variation in pod length is may be due to the differences in genotypes [14]. Number of pod per plant is an important yield contributing character. Generally it is said that there is a positive correlation between the number of pod per plant and yield [15]. In the study BARI Mung-3 produced the highest No. of pod $plant^{-1}$ (12.77) which is identical with the production of BARI Mung-2 and produced 12.26 number

Table 1: Effect of variety and spacing of plant on yield attributes and yield of mungbean

Treatments	Pod length $plant^{-1}$ (cm)	No. of pod $plant^{-1}$	No. of seed pod^{-1}	Seed weight $plant^{-1}$ (g)	1000 seed weight (g)	Seed yield (kg ha^{-1})
Variety						
M_2 (BARI Mung-2)	6.71bc	12.26a	11.25ab	5.17ab	29.77bc	938.20a
M_3 (BARI Mung-3)	6.34c	12.77a	10.74c	4.91abc	30.73b	911.17a
M_4 (BARI Mung-4)	6.53bc	11.22b	11.38a	4.41c	27.46c	836.56b
M_5 (BARI Mung-5)	7.18ab	9.93c	11.14b	5.48a	37.36a	733.94c
M_6 (BARI Mung-6)	7.91a	11.66b	11.27a	4.55bc	32.34b	592.88d
lsd	0.74	0.52	0.21	0.62	2.6	36.7
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01
Spacing						
D_1 (20×10 cm)	7.23a	13.12a	11.09a	6.03a	32.39b	1044.03a
D_2(30×10 cm)	7.19a	11.25ab	11.20a	5.21b	34.76a	741.66b
D_3(40×10 cm)	6.39b	10.34b	11.18a	4.51b	34.02ab	621.97c
lsd	0.68	2.11	1.2	0.75	1.88	68.4
Level of significance	0.01	0.1	NS	0.01	0.01	0.01
CV (%)	9.4	21.80	4.78	22.01	19.63	24.01

The values in a column having common letters do not differ significantly; NS=non-significant

Table 2: Interaction effect of variety and plant spacing

Treatments	Pod length plant^{-1} (cm)	No. of pod plant^{-1}	No. of seed pod^{-1}	Seed weight plant^{-1} (g)	1000 seed weight (g)	Seed yield (kg ha^{-1})
M_2D_1	6.89cd	14.07a	11.23ab	5.68bc	31.39bc	1284.9a
M_3 D_1	6.21de	13.47ab	10.5b	5.35cd	29.59cde	1113.83b
M_4D_1	7.3bc	14.2a	11.3ab	5.41bcd	31.26bcd	1001.23c
M_5D_1	7.86ab	10.73d	11.23ab	6.50a	36.73a	1057.63bc
M_6D_1	7.95ab	14.53a	11.2ab	4.34efgh	28.23e	762.57fg
M_2D_2	6.60cde	13.07ab	11.63a	4.76defg	30.23bcde	869.8d
M_3D_2	6.63cde	10.53d	10.87ab	4.54efgh	32.54b	817.3de
M_4D_2	6.6cde	9.73d	11.37ab	3.8h	29.59cde	717.47gh
M_5D_2	7.68b	11cd	10.87ab	6.13ab	36.3a	669.7hi
M_6D_2	8.47a	12.27bc	11.3ab	4.25fgh	29.01cde	634.07i
M_2D_3	6.63cde	9.67de	10.9ab	5.07cde	29.77bcde	659.9hi
M_3D_3	6.21de	14.33a	10.87ab	4.83def	30.06bcde	802.4ef
M_4D_3	5.90e	9.73d	11.5ab	4.04gh	28.47de	791.0ef
M_5D_3	5.93e	8.07f	11.33ab	3.83h	27.5e	474.5j
M_6D_3	7.22bc	8.2ef	11.33ab	4.81def	28.88cde	382.03k
lsd	0.78	1.5	1.01	0.75	2.9	58.3
Level of significance	0.01	0.01	NS	0.01	0.01	0.01
CV (%)	9.4	21.80	4.78	22.01	19.63	24.01

The values in a column having common letters do not differ significantly; NS=non-significant

of pods. There was no statistically significant was found among the performance of BARI Mung-4 and BARI Mung-6 those produced 11.22 and 11.66 pods plant^{-1} respectively and the lowest number of pods (9.93) were produced by BARI Mung-5 (Table 1).

The no. of seed pod^{-1} was not found as significant. However, the highest number of seeds was produced by BARI Mung-4 followed by BARI Mung-6, BARI Mung-2, BARI Mung-3 respectively. Among them the first two were statistically identical and superior and BARI Mung-3 was inferior to all (Table 1). Like many other characters the seed weight of varieties differ due to genetic make up of the varieties and their expression [14]. Seed weight is a very important character that determines the yield to a great extent. For seed weight plant^{-1} the highest (5.48 g) and lowest value (4.41 g) was found for BARI Mung-5 and BARI Mung-4 respectively and the highest value was 19.52% higher than the lowest one. Thousand seed weight which is one of the most important yield contributing characters was found the highest in BARI Mung-5 and it is 37.36 gm and the lowest was in BARI Mung-4 which is 27.46 gm (Table 1) and first value is 26.49% higher than the later one. According to another findings the highest 1000 grain weight was produced by the variety BARI Mung-5 where all the experimental varieties were as like as the present study except the variety BARI Mung-6 [14].

As affected by many contributing characters like pod length, no. of pod plant^{-1}, no. of seed pod^{-1}, seed weight plant^{-1}, 1000 seed weight finally the yield of the variety BARI Mung-2 was found the highest (938.20 kg ha^{-1}), BARI Mung-3 produced the second highest yield (911.17 kg ha^{-1}) and these are followed by the variety BARI Mung-4 (836.56 kg ha^{-1}), BARI Mung-5 (733.94 kg ha^{-1}) and BARI Mung-6 (592.88 kg ha^{-1}). Among these values the values of BARI Mung-2 and BARI Mung-3 were identical statistically and in the rest cases the all the values were statistically dissimilar (Table 1). Kabir and Sarker [14] also reported that BARI Mung-2 produced the highest yield of 843.70 kg ha^{-1}.

Effect of Plant Spacing on the Yield Components and Yield: Densely planted plants compete among them for all the inputs like water, nutrient, light etc. where wider plant spacing facilitate to grow plant properly [16]. Since the land space and the fixed costs associated with it are usually much more valuable than the costs of individual plants, the most important consideration is the effect that varying the plant population has on the yield per unit area rather than on the yield per plant [13]. The optimum population, therefore, is the one which produces the greatest net return to the grower. So, we studied the effect of different spacings (Table 1) and also the interaction of variety and spacings (Table 2).

Table 3: Correlation among Yield, No. of pod plant^{-1}, No. of seeds pod^{-1}, seed weight plant^{-1} and 1000 seed weight of mungbean

	Yield	No. of pod plant^{-1}	No. of seed pod^{-1}	Seed weight plant^{-1}	1000 seed weight
Yield	1	0.577**	0.453**	0.398**	0.452**
No. of pod plant^{-1}		1	0.246*	0.573**	0.243^{NS}
No. of seeds pod^{-1}			1	0.492**	0.363*
Seed weight plant^{-1}				1	0.692**
1000 seed weight					1

**Significant at 0.01 level *Significant at 0.05 level ^{NS}Non-significant

All the yield attributes showed superior value at 20×10 cm plant spacing except the 1000 seed weight. Pod length plant^{-1} was found the highest at 20×10 cm spacing followed in order by 30×10 and 20×10 cm and the first two are similar statistically. Wider space allows individual plants to produce more branches and pods, but it provides smaller number of pods per unit area due to fewer plants per unit area [8]. The no. of pod plant^{-1} was the highest 13.12 in the spacing 20×10 cm and it was the lowest in 40×10 cm spacing. The plants of the treatment 30×10 cm spacing produced the highest no. of seed pod^{-1} but values of all other treatments were not different than it. Seed weight plant^{-1} was 6.03 gm in 20×30 cm and its statistical value is higher; 5.21 cm in 30×10 cm and 4.51 in 30×10 cm and these are indifferent statistically. 1000 seed weight was the highest in 30×10 cm and it was 34.02 gm and the lowest in 20×10 cm which is 6.82% higher. The plants of 20×10 cm spacing produced the highest seed yield of 1044.03 kg ha^{-1}. All the values are different significantly from each other. Plants of 30×10 cm and those of 40×10 cm produced 7.41 and 621.97 kg ha^{-1} of seed. So, the plants of 20×10 cm spacing yielded 28.96% and 40.42% higher than the plants of 30×10 cm and 40×10 cm respectively. Among these findings the values of pod length plant^{-1}, no of pod plant^{-1}, no of seed plant^{-1} and 1000 seed weight have got similarities with the findings of Kabir and Sarkar [14].

Interaction Effect of Variety and Plant Spacing: The results of interaction of variety and spacing showed a wide range of variation. Different types of interaction respond differently in different parameters. Pod length/plant was the highest (8.47 cm) in the BARI Mung-6 at a spacing of 30×10 cm and it was lowest (5.90 cm) in case of BARI Mung-4 at a spacing of 40×10 cm which is similar with BARI Mung-5 (produced 5.93 cm long pod) at 40×10 cm spacing (Table 2). The difference between the highest and the lowest value is 30.34%. The similar trend was found by other researchers [8, 14]. Number pod plant^{-1} was found the highest (14.53) in the combination of BARI Mung-6 and 20×10 cm spacing but it was similar with other three (BARI Mung-2 and 20×10 cm; BARI Mung-4 and 20×10 cm; BARI Mung-3 and 40×10 cm statistically. This value was the lowest (8.07) in the BARI Mung-5 and 40×10.

The highest value was 11.63 and the lowest was 10.5 in BARI Mung-2 at spacing 30×10 cm and in BARI Mung-3 at 30×10 cm spacing respectively for the parameter no. of seed pod^{-1} and the first one is 9.71% higher than the later one. Without the highest and the lowest value all other values are indifferent statistically. The highest 1000 seed weight was 36.73 gm produced by BARI Mung-5 at 20×10 cm spacing which was at per with 36.3 produced by BARI Mung-5 and 30×10 cm and the highest value was 25.12% higher than the lowest value 27.5 gm produced by BARI Mung-5 at 40×10 cm planting. Kabir and Sarkar [14] also found the highest 1000 seed weight in BARI Mung-5 but at 40×30 cm planting. In case of interaction effect BARI Mung-2 performed the best at 20×10 cm spacing. The lowest was found in case of BARI Mung-5 at 40×10 cm planting. The highest and the lowest yield was 1284.9 and 474.5 kg ha^{-1} and their difference was 63.07%. The finding of Kabir and Sarkar [14] is similar in that sense that BARI Mung-2 performed as best but they found it at a spacing of 30×10 cm.

Correlation among the Yield Components: Correlation study expresses that all the yield components have significant positive relationship among themselves except between no. of pod plant^{-1} and 1000 seed weight (Table 3).

All were significant at 1% level except the correlation between No. of pod plant^{-1} and seed weight plant^{-1}, no. of seeds pod^{-1} and 1000 seed weight which were significant at 5% level.

CONCLUSION

From the study, it can be concluded that variety and spacing significantly influence the yield components and yield of mungbean. For, Kharif-2 season 20×10 cm spacing is good. Among the varieties BARI Mung-2 produced the highest yield, BARI Mung-5 produced the heaviest 1000 seed weight, BARI Mung-6 produced the highest no. of seeds plant^{-1} and the longest pod, BARI Mung-3 produced the highest no. of pod plant^{-1}.

REFERENCES

1. MoA, (Ministry of Agriculture), 2006. Handbook of Agricultural Statistics 2005, http://www.moa.gov.bd/statistics/statistics.htm. Accessed on November 26, 2006.
2. Rahman, M.A. and M.O. Ali, 2007. The Causes of Decrease in Pulse Production and its Remedy, Krishi Biplop (A fortnightly magazine in Bengali), Published on 15 November, 2007. 279 East Hazipara, Rampura, Dhaka-1219, Bangladesh. pp: 5.
3. Ministry of Agriculture (MoA), 2005. *Hand Book of Agricultural Statistics, December, 2005*, Ministry of Agriculture, Government of People's Repub., Bangladesh, Dhaka. pp: 14.
4. Ahmad, F., O. Hirota, Y. Yamada and M. Rahman, 2003. Growth Characteristics and Yield of mungbean varieties cultivated under different shading conditions. Japanese J. Trop. Agric., 47: 1-8.
5. BARI, (Bangladesh Agricultural Research Institute), 1998. *Bangladesh-e Moog Daler Chash* (in Bangla)-Mungbean Cultivation in Bangladesh. Pulse Res. Sta., Bangladesh Agril. Res. Inst., Joydebpur, Gazipur-1701, Bangladesh. pp: 45.
6. Mondal, M.M.A., 2007. A study of source-sink relation in mungbean. Ph.D. Dissertation, Department of Crop Bot., Bangladesh Agriculture University, Mymensingh. pp: 82-84.
7. Asian Vegetables Research and Development Centre (AVRDC), 1974. Mungbean Report for., 1973. Shanhua, Taiwan. pp: 23.
8. Begum, M.S.T.N., M. Begum, M.P. Anwar and A.S. Juraimi, 2009. Otimizing Seed Rate for Summer Mungbean Varieties. J. Agric. Social. Sci., 5(4): 114-118.
9. Miah, M.H.N., M.A. Karin, M.S. Rahman and M.S. Islam, 1990. Performance of Nizershail under different row spacing. J. Train. Dev., 3: 31-34.
10. BARI, (Bangladesh Agricultural Research Institute). 1999. *Krishi Projukti Hat Boi* (in Bangla)-Handbook on Agro-technology. Rashid *et al.* (Eds.). Bangladesh Agril. Res. Inst., Joydebpur, Gazipur-1701, Bangladesh. pp: 100.
11. Afjal, M.A., A.N.M.M. Murshed, M.A. Bakar, A. Hamid and A.B.M. Salahuddin, 1998. Cultivation of Pulse Crop in Bangladesh (In Bengali). Published by Pulse Research Station, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur-1701 In Collaboration with AVRDC-USAID Bangladesh Project., pp: 23-26.
12. Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedure for Agricultural Research. 2nd Edn., John Wiley and Sons., New York, pp: 207-215.
13. Kuo, C.G., 2001. Proceedings of the forum on the ASEAN-AVRDC Regional Network on Vegetable Research and Development (AARNET) 24-26 September 2001. Asian Vegetable Research and Development Center, Shanhua, Taiwan. pp: 1-7.
14. Kabir, M.H. and M.A.R. Sarkar, 2008. Seed yield of mungbean as affected by variety and plant spacing in *Kharif*-I season. J. Bangladesh. Agril. Univ., 6(2): 239-244.
15. Hashem, A. and A. Hamid, 1996. Canopy structure, light interception and productivity of three mungbean varieties. In A.N. Asthana, D.H. Kim (eds.), Recent advances in mungbean research, IIPR, Kanpur, India, pp: 83-91.
16. Reddy, T.Y. and G.H.S. Reddi, 2006. Plant Population. Principals of Agronomy. Third revised eddition. Kalyani Publishers. New Delhi, 110002. pp: 193-203.