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EFFECT OF PLANT SPACING ON THE YIELD OF MUNGBEAN VARIETIES

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Abstract

An experiment was conducted at the research field of the Department of Agronomy and Haor Agriculture, Sylhet Agricultural University, Sylhet-3100 during Kharif 2 Season to find out the effect of plant spacing on the yield of mungbean varieties. The experiment was conducted considering two factors, mungbean varieties viz., BARI mung-6 (V_1) and Patuakhali local (V_2), plant spacing's viz., S_1= (30 cm × 15 cm), S_2= (30 cm × 10 cm), S_3= (30 cm × 5 cm). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The results showed significant variation in important yield parameters like pods plant^{-1}, seeds pod^{-1} and seed yield. The interaction effect indicated that BARI mung-6 with moderate and closer spacing had the highest number of pods plant^{-1} (9.27 and 9.00, respectively); on the other hand the highest seeds pod^{-1} (12.27) was produced in Patuakhali local variety with closer spacing. The variety BARI mung-6 produced the highest seed yield of 825.32 kg ha^{-1} with closer plant spacing which was statistically similar in Patuakhali local variety in highest and moderate spacing but the lowest seed yield (606.1 kg ha^{-1}) was produced in Patuakhali local variety with closer spacing. Therefore, BARI mung-6 with closer spacing (30 cm × 5 cm) can be recommended to cultivate mungbean during Kharif 2 season in Sylhet region.

***Keywords*:** Mungbean, Plant spacing, Patuakhali local.

Introduction

Bangladesh is an agro-based country where many crops like rice, wheat, jute, pulses, sugarcane, vegetables etc. are grown well. Among them, pulses mainly leguminous crop constitutes the main source of protein for the people, particularly for the poor people of Bangladesh. These crops are also the best source of protein for domestic animal and help to overcome the malnutrition which is a serious health problem in Bangladesh. In Bangladesh, per capita annual consumption of pulses is only 13.42 g day^{-1} capita (BBS, 2018) as against World Health Organization (WHO) of United Nations (UN) recommendation of 56 g day^{-1} capita^{-1}. Among the pulses, mungbean has a special importance in intensive cropping system.

It has good digestibility and flavor. Mungbean contains 51% carbohydrate, 26% protein, 10% moisture, 4% mineral and 3% vitamin. Hence, on the nutritional point of view, mungbean is perhaps the best all other pulses (Khan, 1981 and Kaul, 1982.) In Bangladesh, it can be grown in late winter and summer season. Summer mungbean can tolerate a high temperature exceeding 40°C and grows well in the temperature range of 30°C-35°C. Mungbean gives higher yield under summer planting than late winter season (Singh and Yadav, 1978).

Improper spacing reduces the yield of mungbean up to 20 to 40% (AVRDC, 1974) due to competition for light, space, water and nutrition. The optimum spacing favors the plants to grow in their both aerial and underground parts through efficient utilization of solar radiation and nutrients and thus increase grain yield (Miah *et al.*, 1990). Plant spacing directly affects the physiological activities through intra-specific competition. Narrowing of plant spacing by increasing seed rate generally means a more uniform distribution of plants over a given area, thus matching the plant canopy effective in intercepting radiant energy and shading weeds. Though 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. The optimum plant density is a pre-requisite for obtaining higher productivity (Rasul *et al.*, 2012). Seed yield and yield components of mungbean are markedly influenced by planting density. Some local mungbean cultivars are still being cultivated as a relay or direct seeding in some areas without maintaining proper spacing. In Bangladesh, cultivation of

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mungbean is getting popularity due its adaptability in wide range of environmental condition as well as new improved short duration varieties. The study focuses to investigate the effect of plant spacing on the yield of mungbean cultivars.

Materials and Methods

The experiment was conducted at the Research field of the Department of Agronomy and Haor Agriculture, Sylhet Agricultural University, Sylhet-3100 during the period of October to December 2017. The experimental site is located in Sylhet district which is in the North-East corner of the Bangladesh lying between 23°57' to 25°13' North latitude and 90°56' to 92°21' East longitude. The elevation of the experimental site is about 30 m above the sea level.

Planting geometry, growth and yield of Mungbean

The experimental area i.e. Sylhet is situated under sub-tropical climate, characterized by the heavy rainfall, high temperature and cloudy sky during Kharif season (April to September).The soil of experimental field was sandy loam in texture having fertility level low to medium and belongs to the under Agro-Ecological Zone of Northern Eastern Piedmont Plain (AEZ 22). The experiment was laid out in RCBD with three replications. The experiment included two mungbean varieties viz. BARI mung-6 (V_1) and Patuakhali local (V_2); and three plant spacings viz., S_1 = (30 cm × 15 cm), S_2= (30 cm × 10 cm) and S_3= (30 cm × 5 cm). Finally, six treatment combinations were V_1S_1, V_1S_2, V_1S_3, V_2S_1, V_2S_2 and V_2S_3.The combinations of treatments were allocated randomly to the plots in each replication. The unit plot size was 12 m^2 (3 m × 4 m) for the experiment. The distance between the replication was 1.0 m and the adjacent unit plot was 0.5 m. Seeds of BARI mung-6 and Patuakhali local were collected from Bangladesh Agricultural Research Institute (BARI), Gazipur and Patuakhali, respectively. The land was well prepared by before sowing and fertilized with Urea, Triple super phosphate (TSP) and Muriate of potash (MoP) were used as a source of nitrogen, phosphorous and potassium, respectively. Urea, TSP and MoP Fertilizer were used at the rate of 40, 40 and 50 kg N, P, K per hectare, respectively. All of the fertilizers were applied as basal dose during final land preparation. Seeds of mungbean varieties were sown at the rate of 40 kg ha^{-1} on the specified dates. Seeds were sown in line maintaining spacing as per treatment. Later plants in between the lines were thinned. After seed sowing the lines are covered with soil. The crop was sprayed with insecticide Admire (Imidacloprid) @ 0.2% during the flowering and pod setting stages to save the crops against pod borer (Marucavitrata) and also sprayed with Bavistin (Carbendazim) @ 0.2% to prevent Cercospora leaf spot, and foot and root rot diseases. Mungbean pods were 1st harvested on an average about 60 days after sowing (DAS) for each of the variety sowing times. Two plucking were done about 5 day's interval during harvesting. At the time when 80% of the pods were turned into brown in color, the crop was assessed to attain maturity.

Data were recorded on number of plant m^{-2}, plant height, number of leaves $plant^{-1}$, number of brunches $plant^{-1}$ and grain yield (kg ha^{-1}). Different yield attributes like plant height, leaves $plant^{-1}$, branch $plant^{-1}$, etc. were recorded. The data obtained were statistically analyzed to observe the significant difference among the treatment by using the R computer package program. The mean values of all the characters were calculated and analysis of variance was performed. The significance of the difference among the treatments means was adjusted by the Duncan Multiple Range Test (DMRT) at 1% or 5% level of probability (Gomez and Gomez, 1984).

Results and Discussion

Plant height did not differ significantly between the mungbean varieties at harvest. However, numerically higher plant height (56.42 cm) was obtained in Patuakhali local (V_2) and the lower (65.23 cm) was in BARI mung-6 (Table 1). Similarly plant height was also non-significant due to plant spacing (Table 2). The highest plant height was recorded numerically in treatment S_1 (30 cm × 15 cm) and the lowest was recorded in plant spacing S_3 (30 cm × 5 cm). Combined effect plant heights were also not significant (Table 3). Leaf number didn't differ significantly between the mungbean varieties and for spacing. Similar result showed in plant spacing and their combination reported by Miah *et al.* (1990). Numerically,the highest leaf number was recorded in treatment S_3 (30 cm × 5 cm) and the lowest plant leaf number was recorded in plant spacing S_1 (30 cm × 15 cm).

Table 1. Yield and yield attributes of Mungbean as affected by variety

Treatment	Plants m^{-2}	Plant height (cm)	Leaves $plant^{-1}$ (No.)	Branches $plant^{-1}$ (No.)	Pods $plant^{-1}$ (No.)	Seeds pod^{-1} (No.)	Seed yield (kg ha^{-1})
BARI mung-6	38.79	56.23	17.02	5.31	8.97 a	10.64 b	736.04
Local variety	37.40	56.42	17.04	5.22	8.44 b	11.80 a	731.56
F-Value	NS	NS	NS	NS	*	*	NS
CV (%)	5.52	3.02	0.64	4.27	5.32	4.20	11.38

V_1= BARI mung-6, V_2 = Local variety (Patuakhali local)

Pods plant^{-1} differed significantly between the mungbean varieties (Table 1). Higher Pods plant^{-1} was recorded in BARI mung-6 (V_1) and the lower was in Patuakhali local (V_2).

In combination insignificantly higher leaf obtained from Patukhali local with closer spacing (V_2S_3). Branches plant^{-1} had no significant variation between the mungbean varieties. Similarly, branch number does not affect in plant spacing or planting geometry as well as their combinations (Tables 2 & 3). Numerically higher branch number (5.36) was obtained in treatment S_3 (30 cm × 5 cm) and lower branch number (5.20) was recorded in plant spacing S_2 (30 cm × 10 cm). In combination the branches plant^{-1} showed insignificant variations.

Table 2. Yield and yield attributes of Mungbean as affected by plant spacing

Treatment	Plants m^{-2}	Plant height (cm)	Leaves plant^{-1} (No.)	Branches plant^{-1} (No.)	Pods plant^{-1} (No.)	Seeds pod^{-1} (No.)	Seed yield (kg ha^{-1})
30 cm × 15 cm	20.28 c	56.40	17.00	5.23	8.36 b	10.66 b	733.08
30 cm × 10 cm	31.52 b	56.35	17.03	5.20	9.03 a	11.50 a	752.56
30 cm × 5 cm	62.49 a	56.23	17.06	5.36	8.73 ab	11.50 a	715.76
F-Value	***	NS	NS	NS	*	*	NS
CV (%)	5.52	3.02	0.64	4.27	5.32	4.20	11.38

Planting geometry, growth and yield of Mungbean

The highest pods plant^{-1} was recorded in treatment S_2 (30 cm × 10 cm), which was statistically similar with plant spacing S_3 (30 cm × 5 cm) and the lowest was recorded in plant spacing S_1 (30 cm × 15 cm). The highest pods plant^{-1} was obtained from V_1S_2 which was at par with V_1S_3, V_2S_1, V_1S_1,V_2S_2 and V_2S_3. The lowest pods plant^{-1} recorded in V_2S_1. Seeds pod^{-1} differed significantly between the mungbean varieties. Higher seeds pod^{-1} was recorded in Patuakhali local (V_2) and the lower was in BARI mung-6. Similarly seeds pod^{-1}also differed significantly with plant spacing. The highest seeds pod^{-1} was recorded in treatment S_2 (30 cm × 10 cm), which was statistically similar with plant spacing S_3 (30 cm × 5 cm) and the lowest was recorded in plant spacing S_1 (30 cm × 15 cm). The highest seeds pod^{-1} was obtained from V_2S_3 which was at par with V_2S_2, V_2S_1 and V_1S_2. The lowest seeds pod^{-1} was recorded in V_1S_1. Seed yield of mungbean didn't differed significantly within the varieties.

Table 3. Yield and yield attributes of Mungbean as affected by variety and spacing

Treatment	Plants m^{-2}	Plant height (cm)	Leaves plant^{-1} (No.)	Branches plant^{-1} (No.)	Pods plant^{-1} (No.)	Seeds pod^{-1} (No.)	Seed yield (kg ha^{-1})
V_1S_1	20.00 c	56.80	17.00	5.27	8.67 ab	9.80 c	693.71 ab
V_1S_2	33.05 b	56.71	17.07	5.27	9.27 a	11.40 ab	689.11 ab
V_1S_3	63.33 a	55.20	17.00	5.40	9.00 a	10.73 b	825.32 a
V_2S_1	21.55 c	56.00	17.00	5.20	8.07 b	11.53 ab	772.46 a
V_2S_2	30.00 b	56.00	17.00	5.13	8.80 ab	11.60 ab	816.02 a
V_2S_3	62.00 a	57.27	17.13	5.33	8.47 ab	12.27 a	606.21 b
F-Value	*	NS	NS	NS	*	*	*
CV (%)	5.52	3.02	0.64	4.27	5.32	4.20	11.38

V_1= BARI mung-6, V_2 = Local variety (Patuakhali local)
S_1= 30 cm × 15 cm, S_2= 30 cm × 10 cm, S_3= 30 cm × 5 cm

Higher seed yield was recorded in BARI mung-6 (V_1) and the lower was Patuakhali local cultivar (V_2). Seed yield of mungbean was differed significantly with plant spacing (Table 2). The highest seed yield was recorded in spacing S_2 (30 cm × 10 cm) and the lowest seed yield was recorded in plant spacing S_3 (30 cm × 5 cm). In combination effect, yield was also varied significantly (Table 3). The highest yield was obtained from V_1S_3 which was statistically similar with V_1S_1, V_2S_2, V_2S_1 and V_1S_2. The lowest yield was recorded in V_2S_3.

The results showed that pods plant^{-1}, seeds pod^{-1}, plants per m^2 and the yield parameters studied in the experiment showed significant variation due to interaction effect of variety and population density. The combination V_1S_3 had the highest seed yield (825.32 kg/ha) while the combination V_2S_3 had the lowest seed yield (606.21 kg/ha). The combination V_1S_3 had the highest values in respect of branches plant^{-1}(5.40), the combination V_1S_2 had the highest values in respect of number of pods plant^{-1} (9.27), highest seeds pod^{-1} (12.27) was found in the combination V_2S_3, the highest plant height (57.27cm) in V_2S_3 combination, the highest plant population (63.33) in V_1S_3 combination and V_1S_1 had the lowest plant population (20). Due to higher plant density BARI mung-6 showed the highest yield and with the higher plant density Patuakhali local variety showed the lowest result. Because, in closer spacing more number of

plants present, found more pods plant^{-1} and seeds pod^{-1}. Similar findings were also reported by Tayyab (2000), Bhatti *et al.* (2005) and Hamid (1989).

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