J. Environ. Sci. & Natural Resources, 7(1): 87–92, 2014 ISSN 1999-7361

Effect of Biofertilizer and Weeding on the Growth Characters and Seed Yield of Summer Mungbean

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Abstract: An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from February to June 2010 to study the effect of bio fertilizer and weeding on the growth characters and yield of summer mungbean (cv. Binamoog-7). Experimental treatments comprised of (a) five levels of biofertilizer: 0, 1, 2, 3, 4 kg ha^{-1} and (b) four levels of weeding: no weeding, one weeding, two weeding, and three weeding. The experiment was laid out in a randomized complete block design with three replications. The results indicate that the highest plant height (58.83cm) was obtained at 60DAS from 4 kg biofertilizer ha^{-1} and the highest dry weight $plant^{-1}$ (17.78g) at 60DAS was produced from 2 kg biofertilizer ha^{-1}.Three times weeding produced highest plant height (41.69cm) and dry weight $plant^{-1}$ (18.09g) at 60DAS and seed yield (1.96 t ha^{-1}) was attained significantly at maximum level from the application of 2 kg ha^{-1}biofertilizer. Application of 2 kg biofertilizer ha^{-1} with three times weeding was proved to be the best possible combination.

Key Words: Biofertilizer, Growth, Seed yield, Weeding

Introduction

Mungbean (*Vignaradiata*L. Wilezek) is one of the most popular leguminous crops in Bangladesh. It is an important pulse crop of global economic importance principally for its seeds with high protein content which are used as human food. In the Indian sub-continent especially in Bangladesh mungbean is mainly used as 'Dal' or vegetable soup. It serves as vital source of vegetable protein, minerals, and vitamins particularly in developing countries Mungbean contains 51% carbohydrate, 26% protein, 10% moisture, 4% minerals and 3% vitamins (Kaul, 1982; Afzal *et al.,* 2008). In Bangladesh, mungbean grows well all over the country. Among the pulses, it ranks third in area and production and first in market price. The total production of mungbean in Bangladesh in 2006-07 was 19,000 metric tons from an area of 24291 hectares and the average yield was about 0.78 t ha^{-1} (BBS, 2007). In Bangladesh, the main form of protein readily available to the bulk of the population is plant protein. The daily per capita consumption of pulses in Bangladesh is only 10.96 grams (BBS, 2007), while the World Health Organization (FAO, 1999) suggested 45 grams per capita per day for a balanced diet. Increase in pulse production is urgently needed to meet up the demand and to minimize the shortage of feed. Cultivation of mungbean can improve the physical, chemical and biological properties of soil as well as increase soil fertility status through biological nitrogen fixation with symbiont *Bradyrhizobium* from the atmosphere (Peoples *et al*., 1995).

Seed inoculation with effective *Bradyrhizobium* can play a vital role in the formation of nodules to fix atmospheric nitrogen by symbiotic process in the root system of legume crops making the nutrient available to the plants (Basu and Bandyopadhyaay, 1990; Bhuiya *et al.,* 1984, Chatterjee and Bhattacharjee 2002 Chouwdhury *et el*., 200). Franco (1978) revealed that Rhizobium strains in association with the host plant were able to fix approximately 20 percent atmospheric nitrogen throughout the world annually. *Bradyrhizobium* inoculation increased mungbean seed yield from 4.3% to 16.2% (Vaishya*et. al.* 1983).In Bangladesh, inoculation with increased 57% effective nodules, 77% dry matter production, 64% grain yield and 40% hay yield over uninoculated control in mungbean cultivation (Chanda*et al.,* 1991).The application of fertilizer with inoculated seed significantly increased the seed yield of mungbean (Nadeem *et al*., 2004).

Weed is an important factor responsible for low yield of crops (Islam *et al.,* 2006). Weed is very much eco-friendly with the growth and development of Mungbean and, therefore, weed control is essential for mungbean cultivation (Mody, 1978). Yield losses due to uncontrolled weed growth in mungbean ranges from 27 to 100% (Madrid and Vega, 1971; BARI, 1985; Ahmed *et al.*, 1987). In Bangladesh, there is a general believe that mungbean does not require any weeding. Hence the farmers of this country do not follow any weed control measure. Possibly, it may be one of the causes for low yield of mungbean in the country. The time of weeding has an important effect on the growth and yield of mungbean. Weeding at wrong time and also at wrong stage of the crop during growing season may not be beneficial. Not much research work so far was made on the effect of bio fertilizer and weeding on mungbean growth and yield. Keeping all these in

view, the present study was undertaken to estimate the effect of biofertilizer and weeding on the growth characters and seed yield of mungbean.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory. Bangladesh Agricultural University, Mymensingh from February to June 2010. The experimental field was located at 24.75° North latitude and 90.50° East longitude at an altitude of 18 m from the sea level. The experiment was laid out in a randomized complete block design. There were three replications. The unit plot size was 5 m^2 (2 m × 2.5 m).The block and unit plots were separated by 1m and 0.75m spacing, respectively. The total number of unit plots was 60. Different levels of biofertilizer were placed in the main plots and weeding levels in the sub plots. All the treatments were randomly allocated to the experimental plots. There were five levels of biofertilizer as follows: I_0 = Control (no biofertilizer), I_1 = 1.0 kg ha^{-1}biofertilizer, I_2 = 2.0 kg ha^{-1}bioiertilizer, I_3 = 3.0 kg ha^{-1}biofertilizer, I_4 = 4.0 kg ha^{-1}biofertilizer and four levels of weeding W_0 = No weeding, W_1 = One weeding (15 DAS), W_2 = Two weeding (15 DAS and 30 DAS) and W_3 = Three weeding (15 DAS,30 DAS and 45 DAS) were used in the experiment: Summer mungbean variety Binamoog-7 was used as the experimental crop. Liquid broth of BINA-MB mix culture, a mixture of three s*Bradyrhizobium* strains viz. BINA-MB-441, BINA-MB-169 and BINA-MB-301, were used in this experiment. The *Bradyrhizobium* strains used in the present study were collected from the Soil Microbiology Laboratory of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh. The experimental plot was opened with a power tiller on 15 February 2010 and subsequently ploughed twice with country plough followed by laddering to achieve a medium tilth required for the crop. The land was finally prepared on 2 March 2010 by country plough followed by laddering.The unit plots were uniformly fertilized with, triple super phosphate and muriate of potash at the rate of 75 and 40 kg ha^{-1}, respectively, during final land preparation. The quantity of seed required for each plot was weighed on the basis of experimental specification and kept in polythene bags. The seeds were mixed with molasses for adhering to the biofertilizer. Then the biofertilizer was mixed thoroughly with the seed as per treatments and the seeds were placed in a cool dry place to avoid sticking together. The seeds were sown continuously in 30cm apart row spacing about 3cm depth in the afternoon of 3March, 2010. After sowing, the seeds were covered with soil to preserve moisture.

Thinning was done after 15 days of sowing to maintain a uniform plant population. Weeding were done as per treatment i.e. 15 plots remained unwedded, one weeding was done in 15 plots at 15 DAS, two weeding were done in 30 plots at 15 DAS and 30 DAS and three weeding were done in 45 plots at 15 DAS,30 DAS and 45 DAS. Irrigation was not given at the early stages of crop growth, as there was no symptom of moisture stress. However, there was heavy rainfall on middle April to middle May 2010.The excess water was removed from the field at that time. The insecticide Malathion 57EC was sprayed @1.51 ha^{-1} at the time of 50% pod formation stage to control pod borer. Crops were frequently monitored to note any change in plant, character, crops looked good since the initial stage and they maintained a satisfactory growth till harvest. At the time when 80% of the pods turned brown in color, the crop was assessed to attain maturity.

The crops were harvested from central 2 m^2 area of each plot for yield data on different dates as they attained maturity. The crop bundles were sun dried for two days by placing them on threshing floor. Seeds were separated from the plants by beating the bundles with wooden sticks. The collected seeds were dried in the sun for reducing the moisture to about nearly 14% level. The dried seeds were cleaned and weighed $plot^{-1}$.

The collected data were compiled and analyzed statistically using the analysis of variance technique (ANOVA) for each of the characters under study was done by F (variance) ratio. The differences among treatment means were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984) with the help of a computer based package programmed MSTAT-C.

Results and discussions

Effect of biofertizer

Plant height was significantly influenced by biofertilizer at all sampling dates except 30 DAS (Table 1). The highest plant heights of 25.88, 40.96 and 58.83 cm were produced at 40, 50 and 60 DAS, respectively from 4 kg biofertilizer ha^{-1} and the shortest plant heights of 24.47, 38.58, 53.24 cm were found from no biofertilizer treatment. Table 1 show that plant height was increased with increasing level of biofertilizer up to 60 days after sowing (DAS). Dry weight $plant^{-1}$ differed significantly due to biofertilizer at all sampling dates (Table 1). The highest dry weights $plant^{-1}$ of 1.03, 6.96, 12.38 and 17.78 g were obtained at 30, 40, 50 and 60 DAS, respectively from seed inoculation with biofertilizer 2 kg ha^{-1} and the lowest amount of dry weights $plant^{-1}$ of 0.37, 5.95, 11.67 and 16.05g at 30, 40, 50 and 60 DAS, respectively were produced from the control

treatment (Table 1). It was observed that biofertilizer increased dry weight plant^{-1}upto 2 kg ha^{-1} and further application of biofertilizer decreased the dry weight plant^{-1}. This might be due to the corrosive action of excess uptake of biofertilizer. Effect of biofertilizer on seed yield was highly significant (Table 1). Significantly the highest seed yield (1.96 t ha^{-1}) was produced from 2 kg biofertilizer ha^{-1} treatment and the lowest seed yield (1.54 t ha^{-1}) was produced from control treatment. The result revealed that application of biofertilizer increased the seed yield than that of no biofertilizer application up to a certain level. The highest seed yield of 1.96 t ha^{-1} was obtained due to the positive contribution of growth characters under the study. Chatterjee and Bhattacharjee (2002) carried out an experiment to study the effect of inoculation with *Rhizobium* sp. and phosphate solubilizing bacteria (PSB) on the nodulation and seed yield of mungbean cv. B-l at West Bengal, India and reported that plants inoculated with *Rhizobium* strains and PSB showed increased rate of nodulation, N content and seed yield over control. Bhattacharyya and Pal (2001) conducted a field experiment in West Bengal, India during the *pre-kharif*season of 1998 to study the effect *of Rhizobium* inoculation on mungbean and reported that inoculation significantly influenced the number of nodules plant^{-1}, dry matter accumulation in the shoot, crop growth rate and plant height. Similarly, Pahuja*et al.* (1975) reported that weeding had a significant influence on plant height, number of pods plant^{-1} seed yield.

Effect of weeding

Weeding had a significant effect on plant height at 50 DAS and 60 DAS. The tallest plant heights of 41.69cm and 57.65cm (Table 2) were obtained at 50 DAS and 60 DAS respectively where crops received three times weeding. The shortest plant heights of 37.12cm and 50.48 cm were obtained from no weeding treatment. At the initial stage weed infestation was not much invisible but about 6 weeks after weeds growth was noticed to be vigorous because of heavy rainfall occurred. The influence of weeding on dry weight plant^{-1} was found significant at all sampling dates (Table 2). The highest dry weights plant^{-1} of 7.9, 7.02, 12.65 and 18.09 g were obtained at three time weeding and the lowest amount of dry weights plant^{-1} of 0.42, 5.56, 10.71 and 15.60 g were obtained from the control treatment at different dates (Table 2). It was observed that increase of level of weeding increased plant dry weight and decreased the level of weeding must be decrease the plant dry weight. There was a significant effect of different levels of weeding on the seed yield (Table 2). The highest seed yield (2.00 t ha^{-1}) was produced from three times weeding and the lowest seed yield (1.48 t ha^{-1}) was obtained from the control treatment. It was observed that seed yield increased when the weed free duration extend up to 45days and after this increase in the duration of weed free had no beneficial effect on seed yield. This result obtained in this study at 3 times weeding (45 days weed free) is in agreement with the findings of Singh et al.1996, who was conducted an experiment in Indian soil. Singh *et al.* (1996) carried out a field experiment on green gram cultivar k851 to determine the crop weed competition in summer green gram and they found that seed yield was decreased by 35% when the crop was infested for the first 30 DAS. Yield increased with increase in weed free duration to the first 45 DAS (0.81 t ha^{-1} compared with 0.88 t ha^{-1}) in free plots. Bayan and Saharia (1996) carried out an experiment to study the weed management and phosphorus on green gram during the *kharif*seasons of 1994-95. They indicated that effective weed manager could be achieved with one hand weeding at 20 DAS. Weed free and weeding at 20 DAS resulted in a significant increase in plant dry matter compared with no weeding. They also showed that branches plant^{-1} and seed yields were significantly influenced by weed management.

Interaction of biofertilizer and weeding

The interaction between biofertilizer and weeding had a significant effect on plant height at all sampling dates. The tallest plant heights of 14.23, 27.28, 42.46 and 60.28cm were found from 2 kg ha^{-1}biofertilizer and three time weeding treatment and the shortest plants of 14.21, 23.79, 33.74 and 45.69cm were obtained from the control treatment (Table 3).The interaction between biofertilizer and weeding level has significant effect on dry weight plant^{-1} at 30 and 40 DAS (Table 3). The highest dry weight paint^{-1} of 1.57 and 7.97g were from the plant treated with 2 kg ha^{-1}biofertilizer with three times weeding. The lowest amount of dry weight plant^{-1} at 30 DAS, 0.26g was found from control treatment and at 40 DAS 5.17g was found from the treatment of 3 kg ha^{-1}bio fertilizer with no weeding. The interaction effect of biofertilizer and weeding level had a significant influence on seed yield (Table 3).The highest seed yield (3.73 t ha^{-1}) was obtained from the treatment of 2 kg biofertilizer ha^{-1} combined with three weeding and the lowest seed yield (1.18 t ha^{-1}) was obtained from the control treatment.

Table 1. Effect of biofertilizer on the growth parameters and seed yield of mungbean

Level of biofertilizer (kg ha^{-1})	Plant height (cm)				Dry weight plant^{-1} (g)				Seed yield (t ha^{-1})
	30 DAS	40 DAS	50 DAS	60 DAS	30 DAS	40 DAS	50 DAS	60 DAS	
0	13.06	24.47b	38.58c	53.24bc	0.37d	5.95c	11.67c	16.05c	1.54d
1	13.09	25.29ab	39.32bc	52.16c	0.61b	6.38b	12.02b	16.93b	1.74b
2	13.14	25.88a	39.64bc	53.4bc	1.03a	6.96a	12.38a	17.78a	1.96a
3	13.16	25.17ab	40.1ab	55.06b	0.52c	5.56d	11.12d	16.84b	1.70b
4	13.25	25.55a	40.96a	58.83a	0.46c	6.28b	11.32d	16.85b	1.63c
S($\overline{X}$)	0.2	0.31	0.43	0.85	0.03	0.07	0.08	0.18	0.03
Level of Significance	NS	**	**	**	**	**	**	**	**

** = Significant at 1% level of probability
NS = Not significant.

Table 2. Effect of weeding on the growth parameters and seed yield of mungbean

Level of weeding	Plant height (cm)				Dry weight plant^{-1} (g)				Seed yield (t ha^{-1})
	30 DAS	40 DAS	50 DAS	60 DAS	30 DAS	40 DAS	50 DAS	60 DAS	
No Weeding	12.98	25	37.12c	50.48c	0.42d	5.56d	10.71d	15.60c	1.48d
One Weeding	12.93	25.25	40.09b	54.59b	0.49c	5.98c	11.45c	16.92b	1.63c
Two Weeding	13.32	25.04	39.98b	55.43b	0.69b	6.35b	12.01b	16.94b	1.91b
Three Weeding	13.32	25.8	41.69a	57.65a	0.79a	7.02a	12.65a	18.09a	2.00a
S($\overline{X}$)	0.18	0.27	0.38	0.76	0.02	0.06	0.07	0.16	0.02
Level of Significance	NS	NS	**	**	**	**	**	**	**

** = Significant at 1% level of probability
NS = Not significant.

Table 3. Interaction effect of biofertilizer and weeding on the growth parameters and seed yield of mungbean

Interaction (Biofertilizer × Weeding)	Plant height (cm)				Dry weight plant^{-1} (g)				Seed yield (t ha^{-1})
	30 DAS	40 DAS	50 DAS	60 DAS	30 DAS	40 DAS	50 DAS	60 DAS	
I_0W_0	11.98d	23.79e	33.74d	45.69g	0.26j	5.27ij	10.69	14.82	1.18n
I_0W_1	12.62bcd	24.95b-e	40.14abc	52.22cde	0.32hij	5.56g-j	11.46	15.96	1.39lm
I_0W_2	13.04a-d	25.18 b-e	38.91c	55.67a-d	0.39g-j	6.33cde	12.12	16.22	1.83e-h
I_0W_3	12.67bcd	23.94de	41.53abc	59.36ab	0.5efg	6.64bcd	12.43	17.19	1.78f-j
I_1W_0	12.41cd	24.17de	34.12d	46.67fg	0.45f-i	5.38hij	10.95	15.12	1.31mn
I_1W_1	13.48abc	24.89 b-e	39.44bc	53.22cde	0.56d-g	5.87fg	11.52	16.5	1.63jk
I_1W_2	12.9a-d	25.19 b-e	41.49abc	55.45a-d	0.73c	6.67bc	12.54	17.51	1.98cde
I_1W_3	13.57abc	26.93ab	42.24ab	53.29cde	0.69cd	7.60a	13.08	18.58	2.02bcd
I_2W_0	13.21a-d	25.47 a-e	41.77abc	48.71efg	0.58c-f	6.20def	11.33	16.3	1.65ijk
I_2W_1	12.69bcd	24.97 b-e	41.35abc	56.63a-d	0.67cde	6.67bc	12.11	17.64	1.69h-k
I_2W_2	13.31a-d	25.8 a-e	39.38bc	52.55cde	1.3b	7.00b	12.47	17.94	2.14b
I_2W_3	14.23a	26.39abc	41.34abc	55.72a-d	1.57a	7.97a	13.61	19.26	2.34a
I_3W_0	13.23a-d	25.61 a-e	40.75abc	51.21def	0.51efg	5.12j	10.25	15.88	1.74g-j
I_3W_1	12.97a-d	25.82 a-e	39.58abc	53.88b-e	0.46f-i	5.45g-j	10.98	17.22	1.88d-g
I_3W_2	13.5abc	24.78cde	39.17c	55.57a-d	0.53d-g	5.58ghi	11.39	16.56	1.94c-f
I_3W_3	12.93a-d	24.47cde	40.89abc	59.59ab	0.59c-f	6.10ef	11.86	17.71	2.05bc
I_4W_0	13.07a-d	25.94a-d	35.21d	60.13a	0.31ij	5.82fgh	10.32	15.9	1.53kl
I_4W_1	12.87a-d	25.64 a-e	39.96abc	57abc	0.44f-i	6.35cde	11.16	17.3	1.53kl
I_4W_2	13.86ab	24.24de	40.93abc	57.9abc	0.49fgh	6.17ef	11.52	16.48	1.67h-k
I_4W_3	14.21a	27.28a	42.46a	60.28a	0.61c-f	6.78bc	12.27	17.74	1.81f-i
S($\overline{X}$)	0.41	0.61	0.85	1.7	0.05	0.14	0.16	0.36	0.05
Level of Significance	**	**	**	**	**	**	NS	NS	**

** = Significant at 1% level of probability
NS = Not significant.

Conclusion

From the above result it is revealed that growth characters and seed yield were significantly influenced by different levels of bio fertilizer and weeding. The highest dry weight per plant and seed yield (2.34 t ha^{-1}) was produced from seed inoculated with bio fertilizer @ 2 kg ha^{-1} with three weeding. The results obtained in this experiment also indicated that there is scope to increase the yield of mungbean by applying more weeding and using proper dose of bio-fertilizer in Binamoog-7.

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