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Interaction Effect of Variety and Different Fertilizers on the Growth and Yield of Summer Mungbean

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Abstract: An experiment was carried out in experimental field of the department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh to investigate the interaction effect of variety and fertilizers on the growth and yield of summer Mungbean during the summer season of 2007. Five levels of fertilizer viz. control, N + P +K, Biofertilizer, Biofertilizer + N + P + K and Bio-fertilizer + P + K. and three varieties BARI mung 5, BARI mung 6 and BINA mung 5 were also used as experimental variables. The experiment was laid out in Randomized Block Design with fifteen treatments where each treatment was replicated three times. Results showed that most of the growth and yield component of mungbean viz. plant height, branch plant^{-1}, number of nodules plant^{-1}, total dry matter plant^{-1}, pods plant^{-1}, seed plant^{-1}, seed pod^{-1}, weight of 1000-seeds, seed yield and straw yield were significantly influence by the bio-fertilizer (*Bradyrhyzobium* inoculums) treatment except number of leaves and dry weight of nodule. These are influenced by chemical fertilizer and biofertilizer also. All the parameters performed better in case of *Bradyrhyzobium* inoculums. BARI mung 6 obtained highest number of nodule plant^{-1} and higher dry weight of nodule. It also obtained highest number of pod plant^{-1}, seed plant^{-1}, 1000 seed weight and seed yield. Interaction effect of variety and bio-fertilizer (*Bradyrhyzobium)* inoculation was significant of all the parameters. BARI mung 6 with *Bradyrhyzobium* inoculums produced the highest number of nodule and pod plant^{-1}. It also showed the highest seed yield, Stover yield and 1000-seed weight.

Key words: Variety · Biofertilizer · Growth · Yield

INTRODUCTION

Mung bean (*Vigna radiata L.*) is an important pulse crop of Bangladesh. It is generally used as 'Dhal' or vegetable soup and often feed to babies. On an average Bangladesh as diet, only 8-10 percent of protein intake originates from animal sources, the rest can be met from plant sources by increasing the consumption of pulses. Hence from the point of nutritional value, mung bean is perhaps the best of all other pulses [1]. In mung bean seed, there is 51% carbohydrate, 26% protein, 3% minerals and 3% vitamins [2]. In Bangladesh, the main form of protein readily available to the bulk of the population is plant protein. As the population has increased and the cost of production of animal protein have soared, it is preferred, is economically out of reach for the bulk of population in the both rural and urban areas, pulse has no alternative.

Pulse as well as mungbean production has been steadily decreasing due to reduced acreage because of expansion of rice especially boro rice cultivation area. Therefore, to meet the situation, it is necessary to boost up the production through varietal development and proper management practices as well as cultivation of summer mungbean. Fitting them in our usual cropping system and use of seed inoculation with effective *Bradyrhizobium* strains should get priority to produce better nodulation, nitrogen fixation, growth and higher yield. Besides, being a source of protein for man and animal, like other legumes, mungbean has the ability to increase the nitrogen fertility of soils through biological nitrogen fixation with symbiont *Bradyrhizobium*. Franco [3] revealed that *Rhizobium* strains in association with the host plant were able to fix approximately 20% to the atmospheric nitrogen throughout the world annually. Hence, selection of suitable mungbean *Bradyrhizobium* is one of the most important means of obtaining higher yield. Vincent [4] reported that inoculation is necessary for soils where the *rhizobia* are ineffective or where they were sparse. The most economical way to provide additional nitrogen is through inoculation of seeds and soils with effective strains that can produce maximum

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nodulation, nitrogen uptake and grain yield. Therefore, seed inoculation of summer mungbean cultivar with effective *Bradyrhizobium* can play an important role in nodule and nitrogen fixation. Available literature shows that *Bradyrhizobium* inoculation increased mungbean seed yield from 4.3% to 16.2% [5]. In Bangladesh inoculation with *Bradyrhizobium* increased 57% effective nodule, 77% dry matter production, 64% grain yield and 40% hay yield over un inoculated controlled in mungbean cultivation [6].

In Bangladesh, few studies have been conducted on the effects of bio-fertilizer and chemical fertilizer compared to control on mungbean. Considering the above facts, the study was undertaken for observe the effect of *Bradyrhizobium* inoculants on the growth, nodulation and yield of mung bean and to study the interaction between the variety and bio and chemical fertilizers of the yield of mung bean.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy field laboratory of Sher-e-Bangla Agricultural University, Dhaka, during the period from March to June, 2007 in the summer season. The soil of the experimental site belongs to the agro ecological zone of 'Madhupur Tract' (AEZ No. 28). It is deep Red Brown Terrace Soil and belongs to 'Nodda' cultivated series. The soil is silty clay loam in texture. P^H varied from 5.47 to 5.63. The climate is characterized by high temperature and heavy rainfall during kharif season (March-September) and scanty rainfall during rabi season (October-March) associated with moderately low temperature. Three summer Mungbean varieties viz.V_1= BARI Mung 5, V_2=BARI mung 6 and V_3=BINA mung 5 were used as the experimental crops and five fertilizer levels such as F0=control (No Fertilizer), F_1=Nitrogen + Phosphorus + Potassium, F_2= Bio fertilizer only, F3= Bio fertilizer + Nitrogen + Phosphorus + Potassium and F_4= Biofertilizer + Phosphorus + Potassium were used for the investigation of interaction effects where all the chemical fertilizers were applied at their recommended dose. and fifteen combined treatments were V_1F_0, V_1F_1, V_1F_2, V_1F_3, V_1F_4, V_2F_0, V_2F_1, V_2F_2, V_2F_3, V_2F_4, V_3F_0, V_3F_1, V_3F_2, V_3F_3 and V_3F_4.The experiment was laid out in a randomize block design having three replications. The unit plot size was $10m^2$ (4.0m X 2.5m). The *Bradyrhizobium* inoculums used in this study were collected from the Soil Microbiology Laboratory of BINA, Mymensingh. Liquid BINA-MB culture (viz., BINA-MB 441) is used in the experiment. The plots were fertilized as per the designed treatments. Nitrogen, Phosphorus and Potassium were applied in the form of urea, triple super phosphate and muriate of potash. All the fertilizers were incorporated into the soil before sowing of seeds. In case of bio fertilizer, seeds of mungbean varieties were inoculated with *Rhizobium* inoculums just before sowing. The seeds were kept in polyethylene bags and were soaked with required amount of molasses and water for putting a sticky layer on the seed surface. Thereafter, powdered inocula were mixed thoroughly with the seeds as per treatment with a view to putting a blackish layer on the seed surface. The seeds were dried in the shade before sowing. Seeds were sown on the furrows on 20 March, 2007 and the furrows were covered by soils soon after seeding. During the sowing day the sky was clear, so both inoculated and uninoculated seeds were sown on that day starting from morning to afternoon. The line to line (furrow to furrow) distance was maintained at 25 cm with continuous distribution of seeds in the line. Weeding and thinning were done at 18 days after sowing (DAS) when the plant attained at height of about 8-10 cm. Plant to plant distance was maintained at 6-7 cm. Second weeding was done at 35 DAS when the plants attained about 25-30 cm height. A light irrigation was given 15 days after sowing. During experimental period, there was heavy rainfall for several times. So it was essential to remove the excess water from the field. The crop was attacked by pod borer and was successfully controlled by the application of Malathion 57 EC @ 1.5 L ha^{-1}at the time of 50% pod formation stage (55 DAS). The crop was harvested on 5 June, 2007from prefixed 1.0 m^2 areas for recording yield data. Before harvesting ten plants were selected randomly from each plot and were uprooted for recording yield contributing characters data. The rest of the plants prefixed $1m^2$ areas were harvested plot wise and were bundled separately, tagged and brought to the threshing floor of Agronomy field laboratory. The collected data were compiled and analyzed statistically using the analysis of variance (ANOVA) technique with the help of a computer package program MSTAT-C and the mean differences were adjusted by Duncan's New Multiple Range Test (DMRT) (Gomez and Gomez, 1986).

RESULTS AND DISCUSSION

Interaction effect of variety and fertilizers on growth parameters of mungbean: In early growth stage such as up to 20 days after sowing (DAS) there was no significant difference among the treatments due to the interaction of

variety and biofertilizer but at later stage the highest pant height was observed in the biofertilizer inoculated plots of BINA mung 5(45.93 cm, 60.63 cm and 69.73 cm) at 35 DAS, 50 DAS and 65 DAS respectively (Table 1) while lowest was observed in BARI mung 5(52.27 cm) with control, similar trend also found Thakuni and Saharia [7]. Higher number of leaves plant^{-1} (30.60) were observed in BINA mung 5 when it was treated with biofertilizer at 50 DAS and BINA mung 5 showed the maximum (21.20) leaf with biofertilizer inoculated plot at 35 DAS but total number of nodules production was highest in BARI mung 6 at 20 DAS and 50 DAS and BINA mung 5.Incase of nodule dry weight plant^{-1} at 20 DAS BARI mung 6 showed highest (0.45 mg) dry weight when it was inoculated with *Bradyrhizobium* along with other all chemical fertilizers (N, P and K) and lowest (0.28 mg) found in BARI Mung 5 in controlled condition. At 35 DAS BINA Mung 5 showed highest (12.33 mg) dry weight when it was treated with *Bradyrhizobium* and chemical fertilizers but at 50 DAS BARI Mung 6 showed highest dry weight (8.41 mg) when it was treated with *Bradyrhizobium* with chemical fertilizer P and K. Among the treatments at 35 and 50 DAS the interaction of BINA mung 5and biofertilizer with chemical fertilizer N, P and K produced the highest plant dry weight 2.17 mg and 3.80 mg respectively followed by BARI mung 6 with same bio and chemical fertilizers interaction (Table 1) and the lowest (3.15 g plant^{-1}) in BARI mung 6 in control condition at 50 DAS. This indicated that biofertilizer treatment responded better that other. The above results were supported by Hoque and Hashem [8] who reported that the use of *Rhizobium* inoculants remarkably beneficial on total dry matter production of soybean and groundnut.

Interaction effect of variety and fertilizers on yield parameters and yield of mungbean: Irrespective of treatment difference BARI mung 6 produced maximum number of pods plant^{-1} (30.80) and 1000-seed weight (50.67 g) (Table 2) and the results were in conformity with the findings of Podder *et al* [9] while lowest number of

Table 1: Interaction effects of variety and fertilizers on the growth parameters of summer mungbean

	Plant height (cm)			Levees Plant^{-1}			No. ofNodules Plant^{-1}			Dry weight of Nodules(g)			Dry weight plant^{-1} (g)		
Treatment	35 DAS	50 DAS	20 DAS	35 DAS	50 DAS	20 DAS	35 DAS	50 DAS	20 DAS	35 DAS	50 DAS	50 DAS	20 DAS	35 DAS	50 DAS
V_1F_0	19.97	39.63	49.30	9.20	18.60	29.00	2.00	7.33	21.67	0.28	1.25	5.62	0.266	1.57	3.30
V_1F_1	21.37	44.57	50.83	10.40	20.20	29.40	3.00	10.00	25.33	0.35	1.75	6.77	0.313	1.63	3.50
V_1F_2	20.97	44.80	51.33	10.00	21.20	28.80	3.33	7.67	26.33	0.40	1.50	6.90	0.346	1.80	3.45
V_1F_3	21.20	43.77	54.13	10.00	20.87	28.80	2.67	8.67	24.33	0.29	1.32	6.40	0.316	1.76	3.48
V_1F_4	20.97	45.50	53.87	10.20	19.33	28.60	2.33	9.33	23.00	0.27	1.63	6.06	0.366	1.90	3.40
V_2F_0	19.90	44.07	49.60	9.6	18.67	29.20	3.00	9.33	26.67	0.32	1.61	6.89	0.290	1.60	3.15
V_2F_1	20.63	41.30	52.07	10.40	18.80	29.20	3.33	10.33	30.33	0.34	1.79	7.85	0.356	1.78	3.37
V_2F_2	20.83	44.10	53.33	9.8	19.07	29.00	3.67	10.67	29.33	0.33	1.85	7.60	0.300	1.83	3.42
V_2F_3	21.63	44.23	55.07	10.00	18.67	29.60	4.33	10.33	29.33	0.45	1.70	7.53	0.350	1.93	3.54
V_2F_4	21.40	43.83	54.80	10.60	19.20	29.60	3.00	10.00	32.33	0.37	1.78	8.41	0.313	1.8	3.46
V_3F_0	20.13	40.33	54.83	10.00	20.00	29.80	2.33	9.67	26.00	0.31	1.68	6.78	0.303	1.54	3.38
V_3F_1	21.10	43.00	57.27	10.20	21.00	30.20	3.00	9.67	27.00	0.26	1.67	7.05	0.310	1.69	3.54
V_3F_2	21.10	42.67	57.97	10.40	20.40	30.60	3.67	11.67	27.00	0.39	2.02	6.96	0.306	1.75	3.5
V_3F_3	21.47	45.93	60.63	10.60	21.00	29.20	3.00	12.33	26.67	0.34	2.13	6.88	0.376	2.17	3.8
V_3F_4	21.13	45.00	60.77	10.20	20.80	29.60	3.67	10.00	27.33	0.40	1.72	7.12	0.323	1.76	3.54
$LSD_{0.05}$	NS	2.353	1.059	0.945	1.88	1.127	1.093	0.61	3.419	0.118	0.317	0.812	0.052	0.017	0.053
CV (%)	6.55	6.26	7.16	5.60	5.69	2.29	8.15	9.77	7.62	7.86	11.15	6.95	8.12	3.60	2.89

Table 2: Interaction effects of variety and fertilizers on the yield and yield parameters of summer mungbean

Treatment	Pod Plant^{-1}	Seeds Pod^{-1}	1000-seed weight(g)	Yield (t ha^{-1})
V_1F_0	21.43 h	11.17 d	39.13 g	1.322 g
V_1F_1	22.37 gh	11.25 cd	40.20 fg	1.446 fg
V_1F_2	23.47 fg	11.87 a-c	40.57 fg	1.521 ef
V_1F_3	26.57 cd	12.48 a	41.27 f	1.633 e
V_1F_4	24.80 ef	12.07 ab	41.57 ef	1.635 e
V_2F_0	24.77 ef	11.33 cd	46.00 c	1.867 bc
V_2F_1	28.57 b	11.90 a-c	47.17 bc	1.917 a-c
V_2F_2	29.40 ab	11.97 a-c	46.43 bc	1.986 ab
V_2F_3	30.77 a	12.20 a	50.67 a	2.057 a
V_2F_4	30.80 a	11.93 a-c	50.67 a	2.049 a
V_3F_0	23.60 fg	11.00 d	40.33 de	1.558 ef
V_3F_1	26.13 de	11.48 b-d	42.83 de	1.571 ef
V_3F_2	26.20 de	12.07 ab	43.30 d	1.664 de
V_3F_3	27.97 bc	12.27 a	47.57 b	1.795 cd
V_3F_4	28.87 b	12.13 ab	46.27 bc	1.793 cd
$LSD_{0.05}$	1.588	0.63	1.324	0.129
CV (%)	6.60	6.19	4.79	5.23

Interaction effect of bio fertilizer on Stover yield and biological yield:

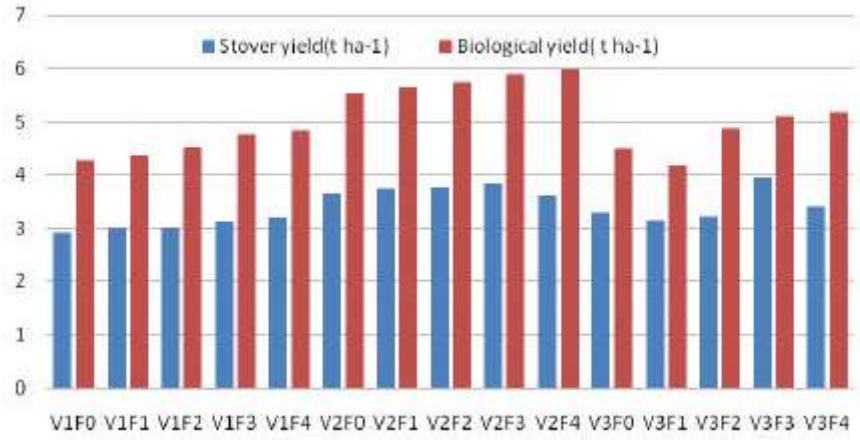

Fig. 1: Interaction effect of variety and fertilizers on the Stover and Biological yield of mungbean

pods plant^{-1} (21.43) and 1000-seed weight (39.13 g) were found in BARI mung 5 at control condition i.e. BARI mung 5 variety with no fertilization but in case of number of seeds pod^{-1}the maximum was produced by BARI Mung 5(12.48) in inoculated plants by *Bradyrhizobium* with chemical fertilizers N, P and K followed by BARI mung 6 × biofertilizer with P+K and there was no significant difference between above two treatments for production of seeds plant^{-1}. Statistically lowest was found (11.17) in BARI Mung 5with control fertilizer treatment. Significantly highest seed yield ha^{-1} was obtained from BARI mung 6 (2.057 t ha^{-1}) in inoculated plots with bio fertilizer with other chemical fertilizer such as N, P and K and statistically BARI mung 6 also produced maximum seed yield when it was treated with P, K and alone with bio fertilizer followed by interaction of BARI mung 6 with only bio fertilizer *Bradyrhizobium* treatment and it might be due to the biofertilizer increased the maximum production of crop characters and influenced the plant to have good production of dry matters and other yield contributing characters and eventually maximum production was obtained from biofertilizer inoculation plants. These results were similar with the report of Vaishya *et al*. [10], Gill *et al*. [11] and Parasad and Ram [12]. They reported that inoculation of bio fertilizer significantly increased seed yield of mungbean.

Figure 1: showed that biofertilizer together with chemical fertilizers increased the Stover yield and biological yield. Maximum Stover yield (3.93 t ha $^{-1}$) was obtained from BINA mung 5 inoculations with bio and chemical fertilizers N, P and K followed by BARI mung 6 (3.83 t ha^{-1}) treated with bio fertilizer and chemical fertilizers N, P and K and they were statistically similar. These results were consistent with the results of Mostofa *et a*l [13] who reported that inoculation significantly increased seed and Stover yield of mungbean. In case of biological yield maximum was gained from treatment V_2F_3 (BARI mung 6 × Biofertilizer together with N, P and K) and these value were 5.90 t ha^{-1} and these view also similar with Mostofa *et a*l [13].

CONCLUSION

The result of the field experiment showed that Bio-fertilizer (*Bradyrhizobium* inoculant) was beneficial in nodulation, plant height, number of branch, dry matter production and yield and yield contributing characters of three summer Mung bean varieties (BARI mung 5, BARI mung 6 and BINA mung 5). BARI mung 6 with *Bradyrhyzobium* inoculums produced the highest number of nodule and pod plant^{-1}. It also showed the highest seed yield, harvest index and 1000-seed weight. BINA mung 5 with *Bradyrhyzobium* inoculums showed the highest plant height, number of pods plant^{-1} and Stover yield. From the above discussion, we saw that BARI mung 6 with inoculums and recommended dose of nitrogen treatment were the best to produce better mungbean during summer season.

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