



Effect of Different Levels of Nitrogen and Sulphur with or without Biofertilizer on Yield Contributing Characters of Binamoog-6

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Abstract

A field experiment was conducted at Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh, during the period from February to April, 2008 to evaluate the effect of N and S fertilizers with or without bio-fertilizer (*Bradyrhizobium*) on yield contributing characters of Binamoog-6. The experiment was laid out in Randomized Complete Block Design (RCBD) with nine treatments and three replications. The treatments were T₁-N₀S₀, T₂-N₀S₅, T₃-N₀S₁₀, T₄-N₁₅S₀, T₅-N₁₅S₅, T₆-N₁₅S₁₀, T₇-N₃₀S₀, T₈-N₃₀S₅ and T₉-N₃₀S₁₀ with or without bio-fertilizer (*Bradyrhizobium*). Data were recorded at 35 days after sowing (DAS), 49 DAS and at harvest. There were significant variations among the different treatments combination in terms of nodulation, growth, yield and quality. Result showed that *Bradyrhizobium* inoculation significantly increased the number of pod plant⁻¹, number of seed pod⁻¹, 1000-seed weight, stover yield, grain yield. The highest number of pod plant⁻¹ (18.78), number of seed pod⁻¹ (11.89), 1000-seed weight (43.40gm), stover yield (3.80 t ha⁻¹) and grain yield (1.92 t ha⁻¹) were recorded in I₁N₀S₁₀ treatment. The result revealed that the inoculation of bio-fertilizer (*Bradyrhizobium*) significantly increased the yield by positively influencing the yield contributing characters of Binamoog-6.

Key words: Binamoog-6, Biofertilizer, Yield

Introduction

In a developing country like Bangladesh, pulse can improve the overall nutritional value of cereal based diet. Unfortunately, there is an acute shortage of grain legumes production in the country. Total production of mungbean in Bangladesh in 2002-2003 was 30,000 m ton from an area of 109,000 acres (BBS, 2006). Mungbean has especial importance in intensive crop production system of the country for its short growing period (Ahmed *et al.*, 1978). In our country, mungbean gives the highest yield under summer planting (Satter and Ahmed, 1995). The possibilities of growing mungbean in summer are being experimented and some successes have already been made in Bangladesh. One of the biggest advantages of summer pulses is their suitability for early Kharif, particularly in the areas where low yielding Aus is produced. Experiments conducted at BARI indicate that summer pulses like mungbean are more economical than low yielding Aus rice. In a developing country like Bangladesh, pulse can improve the overall nutritional value of cereal based diet. Daily per capital consumption of pulses in Bangladesh is only 13.29gm where the World Health Organization suggested 45gm capita⁻¹ daily intake for a balanced diet. So there is a scope of increasing legumes production especially mungbean to mitigate our pulse demand.

It can grow well and produced satisfactory yield without the application of any nitrogenous fertilizer. As a legume mungbean is capable of utilizing atmospheric nitrogen through symbiotic association with *Bradyrhizobium* sp. (*Vigna*). Further it

contributes in improving nitrogen fertility of the soil when proper nodulation and nitrogen fixation takes place. Inoculation of mungbean with effective *Bradyrhizobium* inoculants is necessary for soils, where the organisms are ineffective or where they are absent or scarce (Vincent, 1970). Franco (1978) revealed that *Bradyrhizobium* strains in association with the host plant were able to fix approximately 20% at the atmospheric dinitrogen throughout the world annually. In Bangladesh inoculation with *Bradyrhizobium* increased 57% effective nodule, 77% dry matter production, 64% grain yield and 40% hay yield over uninoculated control in mungbean cultivation (Chanda *et al.*, 1991). The present research work was conducted to evaluate the effect of *Bradyrhizobium* inoculation with nitrogenous and sulphur fertilizers on yield contributing characters of mungbean.

Materials and Method

The experiment was conducted at the Bangladesh Institute of Nuclear Agriculture (BINA) Farm, Mymensingh during the period from February to April 2008-2009 was characterized by high temperature and heavy rainfall during the *kharif* season (March-September) and low rainfall and moderately low temperature during *rabi* season (October-February) to evaluate the effect of N and S fertilizers with or without bio-fertilizer (*Bradyrhizobium*) on yield contributing characters of summer mungbean (*Vigna radiata* L.) cv. Binamoog-6. The experiment was laid out in Randomized Complete Block Design (RCBD) with nine treatments and three replications. The treatments were T₁-N₀S₀,

T₂-N₀S₅, T₃-N₀S₁₀, T₄-N₁₅S₀, T₅-N₁₅S₅, T₆-N₁₅S₁₀, T₇-N₃₀S₀, T₈-N₃₀S₅ and T₉-N₃₀S₁₀ kg ha⁻¹ with or without bio-fertilizer (*Bradyrhizobium*) having a size of each plot was 3 x 2m² with a distance between two adjacent blocks were 0.5m and between plots 0.40m aisles were prepared. The initial soil sample was analyzed for texture, P^H, organic carbon, total nitrogen, available phosphorous by using the appropriate methodology. A basal dose of K fertilizer at the rate of 35 kg K ha⁻¹ as muriate of potash (MoP), phosphorus fertilizer at the rate of 20 kg P ha⁻¹ as triple super phosphate (TSP), sulphur fertilizer as gypsum and nitrogen fertilizer as half urea was applied at final land preparation. The rest of half urea was applied 25 days after sowing (DAS). The fertilizers were then mixed well with the soil by spading and individual unit plots were leveled. The *Bradyrhizobial* inoculants BINA T301 and BINA 301 were prepared in Soil Microbiology and Bio-fertilizer Laboratory, BINA, Mymensingh. Viability count of *rhizobia* in the yeast extract mannitol broth media was made on the day before use the plate count method (Vincent, 1974). Before inoculant mixed with seeds and made black with each seed, molasses was added and mixed thoroughly with seed so that all the seed coats became sticky. Seeds were sown into the furrow maintaining a line to line distance of 40 cm and the furrows were covered by soils soon after seeding. Two wedding and thinning were done at 8-10cm and 22-25cm of plant height maintaining a plant to plant distance was 8 cm. Control of insect and pathogen and drainage of rain water was done as and when necessary. Data were recorded at 35 days after sowing (DAS), 49 DAS and at harvest. From each plot, 5 randomly selected plants were carefully uprooted with the help of a nirani so that no nodule was left in the soil. The nodules from main and branch root of each plant were collected and counted after carefully washed in water. Finally plant and nodule fresh weight and dry weight were recorded. All pods of mungbean was not matured at a time so, the crop was harvested in two times. The pod and straw from every plot was harvested separately. From each plot 5 randomly selected plants were collected at harvesting period and then plants of 2.5 sq. m. were harvested and tied with rope separately. Data on number of pods and grains plant⁻¹, 1000-grain weight were recorded from 10 plants. After 4 days sun drying processed grain and straw were again dried in the sun for 3 days. Grain and straw yields were recorded plot wise and converted in to kg ha⁻¹. The analysis of variance for various characters of mungbean and nutrient content was done following the F-statistics. The mean comparison of the treatments was made by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Pod number plant⁻¹

Number of pods plant⁻¹ was significantly affected the bio-fertilizer (*Bradyrhizobium*). The number of pod significantly increased by inoculation with *Bradyrhizobium*. Inoculated Binamoog-6 showed significant higher pod number plant⁻¹ compared to that found in uninoculated Binamoog-6. In uninoculated condition the number of pod was 13.00 and in inoculated condition it was 14.73. The different levels of N and S fertilizers and bio-fertilizer showed significant variation in number of pod plant⁻¹. The highest number of pod (15.32) was found in N₀S₁₀ treatment and the lowest 12.34 was found in N₁₅S₀ treatment (Table 1).

Seed number pod⁻¹

Number of seed pod⁻¹ was significantly affected by the bio-fertilizer (*Bradyrhizobium*). The number of seed significantly increased by inoculation with *Bradyrhizobium*. Inoculated Binamoog-6 showed significant higher number of seed compared to that found in uninoculated plants. In uninoculated condition the number of seed was 11.35 and that in inoculated condition was 11.00. The different levels of N and S fertilizers showed significant variation in number of seed. The highest number of seed (11.43) was found in N₁₅S₁₀ treatment and the lowest 10.81 was found in N₀S₀ treatment (Table 1).

1000-seed weight

Thousand seed weight of Binamoog-6 was insignificant due to *rhizobial* inoculation (Table 1). Inoculation of seed recorded insignificantly higher 1000-seed weight over uninoculated condition. The highest 1000-seed weight (42.52gm) was found in I₁ (Inoculated) treatment and the lowest 1000-seed weight (41.86gm) was found in I₀ (Uninoculated) condition. The different levels of nitrogen and sulphur fertilizers showed insignificant effect on 1000-seed weight of Binamoog-6. The highest 1000-seed weight (42.85gm) was found in N₁₅S₁₀ treatment and the lowest weight (41.33gm) was found in N₃₀S₀ treatment.

Stover yield

The inoculated plants showed significant variation in stover yield over uninoculated plants. Inoculated Binamoog-6 showed significant higher stover yield compared to that found in uninoculated Binamoog-6 (Table 1). Stover yield of (2.55 t ha⁻¹) and (3.13 t ha⁻¹) was observed in uninoculated and inoculated plant respectively. The different levels of nitrogen and sulphur fertilizers showed significant effect on stover yield of Binamoog-6. The highest stover yield 3.08 t

ha⁻¹ was found in N₀S₁₀ treatment and the lowest (2.18 t ha⁻¹) was found in N₃₀S₀ treatment.

Grain yield

Grain yield of mungbean was influenced significantly due to rhizobial inoculation (Table 1). Inoculation of the plants recorded significantly higher grain yields over uninoculated condition. In uninoculated condition

the grain yield was observed (1.63 t ha⁻¹) and in inoculated plants grain yield was observed (1.73 t ha⁻¹). The different levels of nitrogen and sulphur fertilizers showed significant effect on grain yield of Binamoog-6. The highest grain yield (1.58 t ha⁻¹) was found in N₃₀S₁₀ treatment and the lowest (1.23 t ha⁻¹) was found in N₃₀S₀ treatment.

Table 1. Effect of different levels of N and S fertilizers with or without bio-fertilizer on pod number plant⁻¹, seed number pod⁻¹, 1000-seed weight, stover yield and grain yield of Binamoog-6

Treatments	No. of pod plant ⁻¹	No. of seed pod ⁻¹	1000-seed weight (gm)	Stover yield (t ha ⁻¹)	Grain yield (t ha ⁻¹)
With or without bio-fertilizers					
I ₀	13.00	11.00	41.86	2.55	1.20
I ₁	14.73	11.35	42.52	3.13	1.63
LSD _{0.05}	0.18	0.16	0.71	0.00018	0.00018
Different levels of N and S fertilizers with or without bio-fertilizer					
N ₀ S ₀	13.03	10.81	41.36	2.63	1.33
N ₀ S ₅	14.14	11.22	42.16	2.98	1.45
N ₀ S ₁₀	15.32	11.19	42.24	3.08	1.50
N ₁₅ S ₀	12.34	11.13	41.69	2.65	1.30
N ₁₅ S ₅	14.35	11.30	42.75	2.93	1.43
N ₁₅ S ₁₀	14.90	11.43	42.85	3.07	1.48
N ₃₀ S ₀	12.61	10.87	41.33	2.18	1.23
N ₃₀ S ₅	13.80	11.35	42.55	2.95	1.47
N ₃₀ S ₁₀	14.29	11.27	42.79	3.03	1.58
LSD _{0.05}	0.37	0.34	1.5	0.0012	0.0012

I₀ = Uninoculated, I₁ = Inoculated, N₀, N₁, N₂= 0, 15, 30kg ha⁻¹ nitrogen and S₀, S₁, S₂= 0, 5, 10kg ha⁻¹ sulfur

The interaction effect of different levels of fertilizers with or without bio-fertilizer was significantly affected at 1% level of significance. The highest number of pod 18.78 was found in I₁N₀S₁₀ combination and the lowest number of pod 9.20 was found in I₀N₀S₀ combination (Table 2). These results are in conformity with the findings of Basu and Bandyopadhyay (1990) and Gill *et al.* (1985). Inoculation menaced plant growth and development through maximum N and S uptake which might have been resulted in increased number of pods. The highest number of seed 11.89 and the highest 1000-seed weight (43.40gm) was found in I₁N₀S₁₀

combination but the lowest number of seed 10.02 and the lowest 1000-seed weight (39.60gm) was found in I₀N₀S₀ combination (Table 2). Quah and Jafar (1994) found that the increase in 1000-seed weight of mungbean by the application of 50 kg N ha⁻¹. The highest stover yield (3.80 t ha⁻¹) and the highest grain yield (1.92 t ha⁻¹) was found in I₁N₀S₁₀ combination but the lowest stover yield (1.72 t ha⁻¹) and the lowest grain yield (0.87 t ha⁻¹) was found in I₀N₀S₀ combination (Table 2). Similar results also found by Sarkar and Banik (1991) in case of stover yield and in case of grain yield Ahmed (1989) was shown the same.

Table 2. Interaction effect of different levels of N and S fertilizers with or without bio-fertilizer on pod number plant⁻¹, seed number pod⁻¹, 1000-seed weight, stover yield and grain yield of Binamoog-6

Treatments	No. of pod plant ⁻¹	No. of seed pod ⁻¹	1000-seed weight (gm)	Stover yield (t ha ⁻¹)	Grain yield (t ha ⁻¹)
I ₀ N ₀ S ₀	9.20	10.02	39.60	1.72	0.87
I ₀ N ₀ S ₅	10.95	10.75	41.07	2.23	1.02
I ₀ N ₀ S ₁₀	11.85	10.50	41.08	2.38	1.08
I ₀ N ₁₅ S ₀	12.64	11.06	41.50	2.42	1.10
I ₀ N ₁₅ S ₅	14.10	11.27	42.55	2.75	1.25

I ₀ N ₁₅ S ₁₀	14.40	11.34	42.69	2.85	1.28
I ₀ N ₃₀ S ₀	13.52	11.15	42.32	2.62	1.20
I ₀ N ₃₀ S ₅	15.00	11.42	42.90	2.92	1.38
I ₀ N ₃₀ S ₁₀	15.35	11.49	43.05	3.02	1.58
I ₁ N ₀ S ₀	16.86	11.60	43.12	3.57	1.80
I ₁ N ₀ S ₅	17.33	11.68	43.25	3.73	1.88
I ₁ N ₀ S ₁₀	18.78	11.89	43.40	3.80	1.92
I ₁ N ₁₅ S ₀	12.04	11.19	41.87	2.88	1.50
I ₁ N ₁₅ S ₅	14.60	11.33	42.95	3.13	1.60
I ₁ N ₁₅ S ₁₀	15.40	11.52	43.02	3.28	1.68
I ₁ N ₃₀ S ₀	11.70	10.59	40.35	1.75	1.25
I ₁ N ₃₀ S ₅	12.60	11.28	42.20	2.98	1.53
I ₁ N ₃₀ S ₁₀	13.23	11.05	42.52	3.05	1.57
LSD _{0.05}	0.53	0.48	2.12	0.0017	0.0017

I₀ = Uninoculated, I₁ = Inoculated, N₀, N₁, N₂ = 0, 15, 30kg ha⁻¹ nitrogen and S₀, S₁, S₂ = 0, 5, 10kg ha⁻¹ sulfur

Recommendations

From the present study, it may be concluded that Binamoog-6 significantly responded to combined use of different levels of nitrogen and sulphur fertilizers with or without biofertilizer. Inoculation of *Bradyrhizobium* significantly increased the yield contributing characters of binamoog-6. However, further trials may be conducted at different agro-ecological zones to decide the exact dose of nitrogen and sulphur fertilizers with bio-fertilizer in specific areas of Bangladesh.

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