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Effect of Cow Manure on Growth, Yield and Nutrient Content of Mungbean

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Authors' contributions

This work was carried out in collaboration between all authors. Author STM wrote the protocol and worked in the field. Author MSHK managed the literature searches. Author HEMKM helped in statistical analysis, writing the paper and corresponding with the journal. Author SS helped in data collection in the field and author MHT designed the total study. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted at the farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during the period from March to June 2014 to study the effect of cowdung on the growth, yield and nutrient content of mungbean (*Vigna radiata* L.). The variety BARI Mung-5 was used as the test crop. The experiment consist of single factor: Cowdung (3 levels); C_0: 0 ton cowdung ha^{-1} (control), C_1: 5 ton cowdung ha^{-1} and C_2: 10 ton cowdung ha^{-1}. The experiment was laid out in Randomized Complete Block Design (RCBD) with five replications. Data on different growth parameters and yield showed statistically significant variation for different levels of cowdung. The tallest plant, the highest number of leaves $plant^{-1}$, the highest number of branches

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plant^{-1}, the minimum number of days required for 1st flowering, the minimum number of days required for 80% pod maturity, the highest number of pods plant^{-1}, the highest number of seeds pod^{-1}, the longest pod, the maximum weight of 1000-seeds, the highest seed yield, the highest stover yield and nitrogen, phosphorus, potassium and sulphur content in seeds were recorded from 10 ton cowdung ha^{-1}, whereas the lowest value was found from control treatment.

Keywords: Vigna radiate; organic manure; growth; yield and nutrient content.

1. INTRODUCTION

Bangladesh grows various types of pulse crops namely grass pea (*Lathyrus sativus*), lentil (*Lens culinaris*), mungbean (*Vigna radiata*), blackgram (*Vigna mungo*), chickpea (*Cicer arietinum*), field pea (*Pisum sativum*) and cowpea (*Vigna unguiculata*). Among them Mungbean (*Vigna radiata* L.) belongs to the family Leguminosae and sub-family Papilionaceae is one of the most important pulse crop of Bangladesh. It ranks the fifth considering both acreage and production. The area under pulse crops in Bangladesh is 0.406 million hectares with a production of 0.322 million tones where mungbean is cultivated in the area of 0.108 million hectares with production of 0.03 million tons [1]. It is considered as a quality pulse in the country but production per unit area is very low (0.736 t ha^{-1}) as compared to other countries of the world [2]. Mungbean plays an important role to supplement protein in the cereal-based low-protein diet of the people of Bangladesh, but the acreage production of mungbean is gradually declining [1]. Mungbean is cultivated with minimum tillage, local varieties with no or minimum fertilizers, pesticides and very early or very late sowing, no practicing of irrigation and drainage facilities etc. All these factors are responsible for low yield of mungbean which is incomparable with the yields of developed countries [3].

Mungbean is an important food crop because it provides a cheap source of easily digestible dietary protein which complements the staple rice in the country. It's seed contains 24.7% protein, 0.6% fat, 0.9 fiber and 3.7% ash [4]. Pulses, being leguminous crops, are capable of fixing atmospheric nitrogen in the soil and enrich soil fertility and productivity. Thus they are considered as soil fertility development crops. It can also fix atmospheric nitrogen through symbiotic relationship with soil bacteria and improve the soil fertility [5]. The global mungbean growing area has increased during the last 20 years at an annual growth rate of 2.5% [6]. The crop has many advantages in cropping system because of its rapid growth, early maturation and short duration. The low yield of mungbean besides other factors may partially be due to lack of knowledge and nutrition and modern production technology [7]. Moreover, lack of attention on fertilizer use both organic and inorganic is also instrumental in lowering mungbean yields [8]. Being leguminous in nature, mungbean needs low nitrogen but require optimum doses of other major nutrients as recommended.

The present study was, therefore undertaken to investigate the effect of different levels of cowdung on growth and yield performance of mungbean cultivar with the following objectives to observe the effect of cowdung on growth and yield of mungbean and to find out the effect of cowdung on N, P, K and S content of mungbean.

2. MATERIALS AND METHODS

2.1 Climate and Soil

The experiment was conducted during the period from March to June 2014 to study the effect of cowdung on the growth, yield and nutrient content of mungbean. The soil of the experimental field belongs to the Tejgaon series under the Agroecological Zone, Madhupur Tract (AEZ- 28). The location of the experimental site was at 23°46' N latitude and 90°22' E longitudes with an elevation of 8.24 meter from sea level and the General Soil Type is Deep Red Brown Terrace Soils. The climate of experimental site is subtropical, characterized by three distinct seasons, the monsoon from November to February and the pre-monsoon period or hot season from March to April and the monsoon period from May to October [9]. The variety BARI Mung-5 was used as the test crop. The main Characteristics of test crop are, the leaf and seed size are comparatively larger and more green in color. 1000-seed weight is 40-42 g and all the pods ripe at the same time. The seeds were collected from the Pulse Seed Division of Bangladesh Agricultural Research Institute, Joydevpur, Gajipur. The first ploughing and the final land preparation were done on March, 2014.

2.2 Experimental Design

The experiment consist of single factor: Cowdung (3 levels); C_0: 0 ton cowdung ha^{-1} (control), C_1: 5 ton cowdung ha^{-1} and C_2: 10 ton cowdung ha^{-1}. The nutrient composition of cowdung is N - 0.5%, P_2O_5 - 0.3%, K_2O - 0.5%, Ca - 0.3%, Mg - 0.1%. The experiment was laid out in Randomized Complete Block Design (RCBD) with five replications. Urea, Triple super phosphate (TSP), Muriate of potash (MOP) and gypsum were used as a source of nitrogen, phosphorous, potassium and sulphur, respectively. Urea (46% N content), TPS (48% P_2O_5 content) and MOP (60% K_2O content) were applied at the rate of 45, 50 and 40 kg per hectare, respectively following the Bangladesh Agricultural Research Institute (BARI) recommendation. As organic manure cowdung was applied as per treatment. The size of the each unit plot was 4.0 m × 3.0 m. The space between two blocks and two plots were 1.0 m and 0.5 m, respectively. The seeds of mungbean were sown on April 07, 2014 in solid rows in the furrows having a depth of 2-3 cm and row to row distance was 40 cm. Thinning was done two times; first thinning was done at 8 DAS (Days After Sowing) and second was done at 15 DAS (Days After Sowing) to maintain optimum plant population in each plot.

2.3 Data Collection

Five plants from each plot were randomly selected and marked with sample card. Plant height and number of branches $plant^{-1}$ were recorded from selected plants at an interval of 10 days started from 20 DAS to 50 DAS and at harvesting time. Harvesting was done when 90% of the pods became brown to black in color. The matured pods were collected by hand picking from a pre demarcated area of three linear meter at the center of each plot. The following data were collected during the experimentation: plant height, number of leaves $plant^{-1}$, number of branches $plant^{-1}$, days to 1st flowering, days to 80% pod maturity, pod length (cm), number of pods $plant^{-1}$, number of seeds pod^{-1}, 1000-seed weight (g), seed yield (kg ha^{-1}), stover yield (kg ha^{-1}) and N, P, K, S content of mungbean seed.

2.4 Data Analysis

The mean values of all the characters were calculated and analysis of variance was performed by the 'F' (variance ratio) test. The significance of the difference among the treatment means was estimated by the Duncan's Multiple Range Test (DMRT) at 5% level of probability [10].

3. RESULTS AND DISCUSSION

3.1 Plant Height

Data revealed that plant height of mungbean varied significantly for different levels of cowdung at 20, 30, 40, 50 DAS and at harvest (Fig. 1). At 20, 30, 40, 50 DAS and at harvest, the tallest plant (22.60, 35.78, 55.58, 61.57 and 64.21 cm, respectively) was found from 10 ton cowdung ha^{-1} (C_2), which was statistically similar (21.45, 35.63, 53.11, 60.31 and 61.99 cm, respectively) with 5 ton cowdung ha^{-1} (C_1), whereas the shortest plant (15.62, 30.34, 48.61, 53.13 and 55.36 cm, respectively) was observed from 0 ton cowdung ha^{-1} (C_0). It was revealed that with the increase of cowdung plant height increased following an increasing trend. Cowdung might have positive role on the soil moisture content, soil porosity and other plant growth characters and for that reason increasing dose of cowdung increased plant height. Scientists have reported that different levels of organic manure significantly increased plant height [11,12].

3.2 Number of Branches $Plant^{-1}$

Number of branches $plant^{-1}$ of mungbean varied significantly for different levels of cowdung at 20, 30, 40, 50 DAS and at harvest (Fig. 1). At 20, 30, 40, 50 DAS and at harvest, the highest number of branches $plant^{-1}$ (1.77, 2.03, 3.08, 5.04 and 5.53, respectively) was found from C_2, which was statistically identical (1.70, 1.90, 3.02, 4.94 and 5.52, respectively) with C_1, whereas the lowest number (1.33, 1.70, 2.78, 4.47 and 4.96, respectively) was found from C_0 i.e. control condition.

3.3 Days Required for 1st Flowering

Days required for 1st flowering of mungbean varied significantly for different levels of cowdung (Table 1). The maximum number of days required for 1st flowering (44.11) was observed from 0 ton cowdung ha^{-1} whereas, the minimum days (41.22) was recorded from 5 ton cowdung ha^{-1} which was statistically identical (41.89) with 10 ton cowdung ha^{-1}.

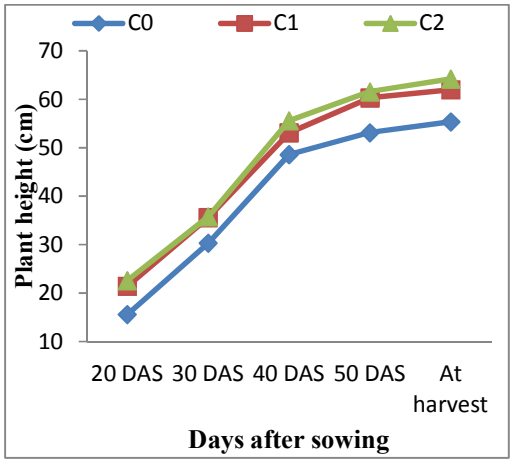

Fig. 1. Effect of different levels of cowdung on plant height of mungbean
Note: C_0- 0 ton ha^{-1}, C_1- 5 ton ha^{-1} and C_2- 10 ton ha^{-1}

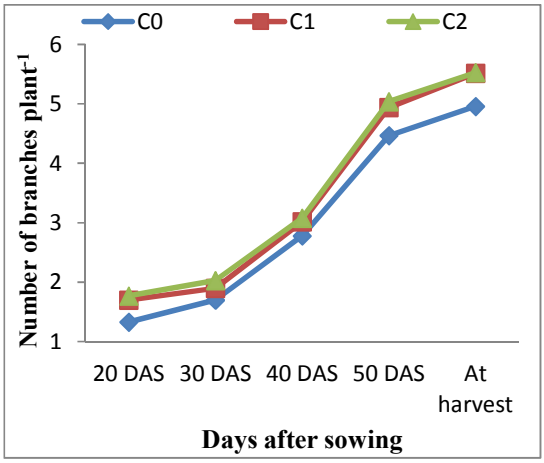

Fig. 2. Effect of different levels of cowdung on number of branches per plant
Note: C_0- 0 ton ha^{-1}, C_1- 5 ton ha^{-1} and C_2- 10 ton ha^{-1}

3.4 Days Required for Harvesting (80% Pod Maturity)

Days required for 80% pod maturity of mungbean varied significantly for different levels of cowdung (Table 1). The maximum number of days required for 80% pod maturity (63.44) was observed from 0 ton cowdung ha^{-1}, whereas the minimum days (58.56) was recorded from 5 ton cowdung ha^{-1} which was statistically identical (58.67) with 10 ton cowdung ha^{-1}.

3.5 Number of Pods Plant^{-1}

Number of pods plant^{-1} of mungbean varied significantly for different levels of cowdung (Table 1). The highest number of pods plant^{-1} (28.93) was observed from 10 ton cowdung ha^{-1}, which was closely followed (27.37) by 5 ton cowdung ha^{-1}, whereas the lowest number (24.47) was recorded from 0 ton cowdung ha^{-1} i.e. control condition. These are in agreement with one report that different levels of organic manure significantly increased number of pods per plant of mungbean [12].

3.6 Pod Length (cm)

Pod length of mungbean varied significantly for different levels of cowdung (Table 1). The longest pod (7.01 cm) was observed from 10 ton cowdung ha^{-1}, which was statistically identical (6.52 cm) with 5 ton cowdung ha^{-1}, whereas the shortest pod (4.94 cm) was recorded from 0 ton cowdung ha^{-1} i.e. control condition.

3.7 Number of Seeds Pod^{-1}

Number of seeds pod^{-1} of mungbean varied significantly for different levels of cowdung (Table 1). The highest number of seeds pod^{-1} (7.00) was observed from 10 ton cowdung ha^{-1}, which was statistically identical (6.94) with 5 ton cowdung ha^{-1}, whereas the lowest number (5.66) was recorded from 0 ton cowdung ha^{-1} i.e. control condition.

3.8 Weight of 1000-seed (g)

Weight of 1000-seed of mungbean varied significantly for different levels of cowdung (Table 1). The highest weight of 1000-seed (43.86 g) was observed from 10 ton cowdung ha^{-1}, which was statistically identical (42.98 g) with 5 ton cowdung ha^{-1}, while the lowest weight (36.18 g) was recorded from 0 ton cowdung ha^{-1} i.e. control condition.

3.9 Seed Yield (t ha^{-1})

Seed yield of mungbean varied significantly for different levels of cowdung (Table 1). The highest seed yield (1.32 t ha^{-1}) was observed from 10 ton cowdung ha^{-1}, which was closely followed (1.06 t ha^{-1}) by 5 ton cowdung ha^{-1}, while the lowest seed yield (0.89 t ha^{-1}) was recorded from 0 ton cowdung ha^{-1} i.e. control condition. Probably cowdung supplied the necessary requirements for the proper vegetative growth that helped in obtaining the highest yield of mungbean. These are in agreement that

different levels of organic manure significantly increased grain yield [12,13].

3.10 Stover Yield (t ha^{-1})

Stover yield of mungbean varied significantly for different levels of cowdung (Table 1). The highest stover yield (3.62 t ha^{-1}) was observed from 10 ton cowdung ha^{-1}, which was closely followed (3.31 t ha^{-1}) by 5 ton cowdung ha^{-1}, while the lowest stover yield (2.81 t ha^{-1}) was recorded from 0 ton cowdung ha^{-1} i.e. control condition.

3.11 Nitrogen Content in Seed

Significant differences were recorded for nitrogen content in seed of mungbean for different levels of cowdung (Table 2). The highest nitrogen content in seed (3.39%) was observed from 10 ton cowdung ha^{-1}, which was statistically identical (3.29%) with 5 ton cowdung ha^{-1}, while the lowest content (2.57%) was recorded from 0 ton cowdung ha^{-1} i.e. control condition. Bansal and Kapoor reported that maximum N uptake of mungbean were given by compost prepared from a 3:7 mixture of cattle manure and rice straw [14].

3.12 Phosphorus Content in Seeds

Significant differences were recorded for phosphorus content in seed of mungbean for different levels of cowdung (Table 2). The highest phosphorus content in seed (1.01%) was observed from 10 ton cowdung ha^{-1}, which was statistically identical (1.01%) with 5 ton cowdung ha^{-1}, while the lowest content (0.48%) was recorded from 0 ton cowdung ha^{-1}. Bansal and Kapoor reported that maximum P uptake of mungbean were given by compost prepared from a 3:7 mixture of cattle manure and rice straw [14].

3.13 Potassium Content in Seeds

Significant differences were recorded for potassium content in seed of mungbean for different levels of cowdung (Table 2). The highest potassium content in seed (1.01%) was observed from 10 ton cowdung ha^{-1}, which was statistically identical (0.96%) with 5 ton cowdung ha^{-1}, while the lowest content (0.38%) was recorded from 0 ton cowdung ha^{-1} i.e. control condition.

3.14 Sulphur Content in Seeds

Significant differences were recorded for sulphur content in seed of mungbean for different levels of cowdung (Table 2). The highest sulphur content in seed (1.01%) was observed from 10 ton cowdung ha^{-1}, which was statistically identical (0.98%) with 5 ton cowdung ha^{-1}, while the lowest content (0.38%) was recorded from 0 ton cowdung ha^{-1} i.e. control condition.

Table 1. Effect of different levels of cowdung on yield contributing characters and yield of mungbean

Treatment	1st flowering (days)	Harvesting time (days)	Pod plant^{-1} (no.)	Pod length (cm)	Seeds pod^{-1} (no.)	Weight of 1000-seed (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})
0 ton ha^{-1}	44.11 a	63.44 a	24.47 c	4.94 b	5.66 b	36.18 b	0.89 c	2.81 c
5 ton ha^{-1}	41.22 b	58.56 b	27.37 b	6.52 a	6.94 a	42.98 a	1.06 b	3.31 b
10 ton ha^{-1}	41.89 b	58.67 b	28.93 a	7.01 a	7.00 a	43.86 a	1.32 a	3.62 a
$LSD_{(0.05)}$	2.283	0.700	1.358	0.493	0.241	1.139	0.066	0.147
CV (%)	5.11	6.58	5.46	9.10	7.69	7.78	6.48	5.12

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

Table 2. Effect of different levels of cowdung on nutrient content of mungbean

Treatment	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Sulphur (%)
0 ton ha^{-1}	2.57 c	0.476 c	0.382 c	0.377 c
5 ton ha^{-1}	3.29 a	1.009 a	0.962 a	0.984 a
10 ton ha^{-1}	3.39 a	1.012 a	1.005 a	1.014 a
$LSD_{(0.05)}$	0.136	0.072	0.054	0.066
CV (%)	5.13	4.65	8.20	4.47

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

4. CONCLUSION

10 ton cowdung ha^{-1} was found best in respect to growth, yield and nutrient content of mungbean. Further studies may be carried out with different doses of organic manure.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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