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Effect of Phosphorus and Boron Application on the Nutrient Contents of Grain and Stover of Mungbean

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Authors' contributions

This work was carried out in collaboration between all authors. Authors BAH and MAKC designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors MMR and IM managed the literature searches, analyses of the study performed the spectroscopy analysis. Author MZR managed the experimental process and author UH identified the species of plant. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from February 2012 to May 2012 to investigate the effect of four different doses of phosphorus (0, 20, 40 and 60 kg ha^{-1}) and boron (0, 1.0, 1.5 and 2.0 kg ha^{-1}) on nutrient content of summer mungbean cv. BINAmung-8. The experiment was laid out in a randomized complete block design (RCBD) with sixteen treatment combinations having three replications. The contents of N, P, K, Ca, Mg and S influenced significantly due to different treatments. The uptakes of N, P, K, S, Ca and Mg in grain and stover were expressively affected

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due to different treatments. In grain, combination of 60 kg P ha^{-1} × 2.0 kg B ha^{-1} gave the maximum contents of N, P, K, Ca, Mg and S. The highest content of P, K, Ca, Mg and S in stover was obtained in the combination of 60 kg P ha^{-1} × 2.0 kg B ha^{-1} and N content in stover was not significant. The results suggest that mungbean crop may preferably be fertilized with a combination of 60 kg P ha^{-1} × 2.0 kg B ha^{-1} to obtain better quality of BINAmung-8 in the agroclimatic condition of the study area.

Keywords: Phosphorus; boron; nutrient content; mungbean.

1. INTRODUCTION

Mungbean has special importance in intensive cropping systems of the country for its short growth period. The agro-ecological conditions of Bangladesh are favorable for growing this crop. It can be cultivated both in summer and winter seasons in the country. To fix nitrogen in soil, an adequate phosphorus supply must be satisfied for the legumes, other factors being adequate. As mungbean is a legume crop, it responds well to added phosphorus. Phosphorus deficiency causes yield reduction by limiting plant growth [1]. It influences nutrient uptake by promoting root growth and nodulation [2]. Mungbean responds favorably to phosphorus fertilization [3].

Among the pulses, mungbean is the best in nutritional value having about 51% carbohydrates, 26% proteins, 4% minerals and 3% vitamins [4]. The mungbean cultivation in Bangladesh during the year 2011-2012 was about 91 thousand acres and total production was about 26 thousand metric ton [5]. The total production of pulses in Bangladesh is about 5.0 lac tons [6] which can ensure approximately 12.0 g of pulses per head per day while the intake standard should be at least 28.5 g per head per day to meet the protein deficiency in the daily diet of an adult due to shortage of animal protein. This deficiency causes serious malnutrition problem which adversely affects the health of people of Bangladesh. To overcome this problem, our diet should be enriched with protein and this can easily be done by increasing intake of pulses.

The average production of mungbean is declining day by day. In general, mungbean is grown in marginal low lands of poor fertility and low moisture status and under poor management conditions. In spite of the many advantages of mungbean the area coverage and the production are in declining trend. This trend is mainly because the pulses in general cannot compete with HYV cereals in terms of production and economic return, and are thus being pushed to marginal lands where nutrient limitations are severe. The study was planned to assess the effects of phosphorus and boron on N, P, K, Ca, Mg and S contents of mungbean.

2. MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from February 2012 to May 2012. Mungbean variety BINAmung-8 was used as a test crop. The experimental site belongs to the Old Brahmaputra Floodplain under Agro-ecological Zone AEZ-9 having non-calcareous dark grey floodplain soil under Sonatola soil series. It was a medium high land of silty loam soils having pH 6.8, 1.29% organic matter,0.101% total N and 13.9 µg g^{-1} soil available P. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. There were sixteen treatment combinations comprising seven different chemical fertilizers and one control. Each treatment received an equal amount of NPKS. All the plots received N, P, K and S as basal treatment. Four levels of phosphorus (0, 20, 40 and 60 kg ha^{-1}) and boron (0, 1.0, 1.5 and 2.0 kg ha^{-1}) were employed. Phosphorus was applied in the form of triple super phosphate (TSP) and boron was applied in the form of boric acid. Seeds were sown on 12 February 2012 in lines. The line to line distance was 30 cm and plant to plant distance was 10 cm. There were 8 rows in each plot. Two seeds were sown per hill. The seed rate was 35 kg ha^{-1} for BINAmung-8 recommended by BINA. The crop was harvested at 65 days after sowing when the crop attained the full maturity. Seed and stover samples were chemically analyzed for the determination of total N, P, K, S, Ca and Mg. Total nitrogen was determined by semi-micro kjeldahl method [7] and Phosphorus by $SnCl_2$ method [8]. Potassium was determined by flame photometer method [9] and sulphur by turbidimetric method [7]. Calcium and Magnesium were determined by complexometric method of titration [9].

Data were analyzed with the help of MSTAT-C [10]. Duncan's Multiple Range Test (DMRT) was used to compare variations among the treatments.

3. RESULTS AND DISCUSSION

3.1 Nutrient Content in Grain

3.1.1 Nitrogen

Phosphorus affected significantly on N content in mungbean grain (Table 1). The highest N content (7.05%) in grain was observed when the plot was treated with 60 kg P ha^{-1} and the lowest was recorded in control plot. Phosphorus is involved in the synthesis of ATP that is required in nitrogen uptake and protein synthesis. Higher seed protein content in mungbean in response to P application have also been reported by Dewangan [11] and Nazir [12]. Nitrogen content in grain of mungbean was significantly affected by the different levels of boron (Table 2). The highest N content (7.24%) in grain was observed when the plot was treated with 2.0 kg B ha^{-1}. It may be due to boron plays an important role in the development and differentiation of tissue, cell division and nitrogen absorption from the soil [13]. The lowest N content (5.45%) was recorded in control. The interaction of phosphorus and boron had a significant effect on N content in mungbean grain (Table 3). The highest N content (7.52%) in grain was observed with 60 kg P ha^{-1} × 2.0 kg B ha^{-1}and the lowest from no phosphorus and no boron. The content of N in mungbean grain was higher than that of mungbean stover.

3.1.2 Phosphorus

Phosphorus content differed significantly due to phosphorus fertilizer. The highest P content (0.50%) was obtained with 60 kg P ha^{-1} (Table 1) and the lowest (0.42%) in the control treatment which is statistically similar with 40 kg P ha^{-1} and 20 kg P ha^{-1}. Phosphorus content in mungbean grain increased significantly due to the application of the different levels of boron fertilizer. The highest P content (0.49%) was found when the plot was treated with 2.0 kg B ha^{-1}while the lowest in control (Table 2). There was a significant effect on P content between the interaction of phosphorus and boron (Table 3). The highest P content (0.56%) was observed in 60 kg P ha^{-1} × 2.0 kg B ha^{-1}. The lowest P content (0.33%) was recorded in control plot (Table 3). The content of P in mungbean grain was higher than that of mungbean stover.

Table 1. Effect of phosphorus on nutrient content in grain of summer mungbean (cv. BINAmung-8)

Levels of phosphorus	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
P_0	5.34d	0.42b	0.46d	0.49c	0.23d	0.25b
P_{20}	6.00c	0.44b	0.49c	0.51c	0.27c	0.26b
P_{40}	6.74b	0.44b	0.60b	0.59b	0.32b	0.26b
P_{60}	7.05a	0.50a	0.73a	0.69a	0.36a	0.34a
CV (%)	5.40	9.09	9.49	8.38	7.98	15.57
Level of sig.	**	**	**	**	**	**

P_0= No phosphorus, P_{20} =20 kg P ha^{-1}, P_{40} =40 kg P ha^{-1} and P_{60}=60 kg P ha^{-1}. In a column same letter (s) do not differ significantly at P ≤ 0.05 by DMRT, ^{NS}-Not-significant, **- significant at 1% level of probability

Table 2. Effect of boron on nutrient content in grain of summer mungbean (cv. BINAmung-8)

Levels of boron	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
B_0	5.45c	0.42b	0.53b	0.43d	0.24c	0.22b
B_1	5.71c	0.44b	0.56b	0.48c	0.27b	0.23b
$B_{1.5}$	6.73b	0.45b	0.69a	0.64b	0.29b	0.32a
B_2	7.24a	0.49a	0.71a	0.72a	0.36a	0.34a
CV(%)	5.40	9.09	9.49	8.38	7.98	15.57
Level of sig.	**	**	**	**	**	**

*B_0 = No boron, B_1= 1.0 kg B ha^{-1}, $B_{1.5}$= 1.5 kg B ha^{-1} and B_2= 2.0 kg B ha^{-1}. In a column, same letter (s) do not differ significantly at P≤ 0.05 by DMRT, **- Significant at 1% of probability*

Table 3. Interaction Effect of phosphorus and boron on nutrient content in grain of summer mungbean (cv. BINAmung-8)

Interaction (phosphorus × boron)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
$P_0 \times B_0$	3.70g	0.33g	0.36i	0.35f	0.19f	0.12f
$P_0 \times B_1$	4.62f	0.40efg	0.51gh	0.42def	0.20f	0.12f
$P_0 \times B_2$	6.03d	0.48a-e	0.82ab	0.70b	0.22f	0.38ab
$P_0 \times B_3$	7.01abc	0.50abc	0.89a	0.85ab	0.30cd	0.36abc
$P_1 \times B_0$	5.36e	0.40efg	0.52fgh	0.42def	0.20f	0.23de
$P_1 \times B_1$	4.97ef	0.42c-f	0.48gh	0.45de	0.24ef	0.25de
$P_1 \times B_2$	6.57cd	0.44b-f	0.45hi	0.49d	0.28de	0.25de
$P_1 \times B_3$	7.09abc	0.49a-d	0.52fgh	0.58c	0.35bc	0.27d
$P_2 \times B_0$	6.12d	0.47b-e	0.56efg	0.37ef	0.29de	0.26de
$P_2 \times B_1$	6.46cd	0.40d-g	0.58d-g	0.45de	0.30cd	0.18ef
$P_2 \times B_2$	7.04abc	0.37fg	0.66de	0.62c	0.32bcd	0.27de
$P_2 \times B_3$	7.34ab	0.42c-f	0.62def	0.58c	0.37b	0.29cd
$P_3 \times B_0$	6.62cd	0.47b-e	0.68cd	0.57c	0.28de	0.30bcd
$P_3 \times B_1$	6.79bc	0.52ab	0.66de	0.59c	0.35bc	0.31bcd
$P_3 \times B_2$	7.26ab	0.51ab	0.76bc	0.76b	0.36b	0.37abc
$P_3 \times B_3$	7.52a	0.56a	0.90a	0.87a	0.43a	0.43a
CV(%)	5.40	9.09	9.49	8.38	7.98	15.57
Level of sig.	**	**	**	**	**	**

P_0 =No phosphorus, P_{20}=20 kg P ha^{-1} , P_{40}=40 kg P ha^{-1}, P_{60}=60 kg P ha^{-1}, B_0 = No boron, B_1= 1.0 kg B ha^{-1}, $B_{1.5}$ = 1.5 kg B ha^{-1} and B_2 = 2.0 kg B ha^{-1}. In a column same letter (s) do not differ significantly at P ≤ 0.05 by DMRT, ^{NS}- Not-significant, **- significant at 1% level of probability

3.1.3 Potassium

Application of phosphorus significantly increased K content in mungbean grain compared to the control plot (Table 1). The highest K content (0.73%) of mungbean grain was observed with 60 kg P ha^{-1}, while the lowest (0.46%) from control plot. Potassium content significantly varied due to boron (Table 2). The highest K content (0.71%) of mungbean grain was observed when the plot was treated with 2.0 kg B ha^{-1}, which was statistically similar with 1.5 kg B ha^{-1} and the lowest K content (0.53%) was recorded in control plot, which was statistically similar with 1.0 kg B ha^{-1}. The interaction of phosphorus and boron was significant. However the K content in grain was highest (0.90%) with 60 kg P ha^{-1} and 2.0 kg B ha^{-1} (Table 3) and the lowest was recorded in control. The result indicates that phosphorus and boron affected K content in grain individually and by their combination.

3.1.4 Calcium

Ca content in mungbean grain was significantly affected by phosphorus level. The highest Ca content (0.69%) was at 60 kg P ha^{-1}. The lowest Ca content (0.49%) was produced in the 0 kg P ha^{-1}, which was statistically similar with 20 kg P ha^{-1} treated plot (Table 1). The effect of boron on Ca content in grain of mungbean was statistically significant. The highest Ca content (0.72%) was found in 2.0 kg B ha^{-1} and the lowest with control (Table 2). The interaction of phosphorus and boron on Ca content in mungbean grain was significant. The highest Ca content (0.87%) in grain was observed with 60 kg P ha^{-1} × 2.0 kg B ha^{-1}. The lowest Ca content (0.35%) was recorded in control plot (Table 3).

3.1.5 Magnesium

The effect of different levels of phosphorus on Mg content in mungbean grain was statistically significant. Maximum Mg content (0.36%) in grain was obtained with 60 kg P ha^{-1} and it was minimum (0.23%) in control plot (Table 1). Boron levels affected Mg content in mungbean grain significantly. Maximum Mg content (0.36%) in grain was found in 2.0 kg B ha^{-1} and it was minimum (0.24%) in control plot (Table 2). The combined effect of phosphorus and boron on Mg content in grain of mungbean was also significant. The highest Mg content (0.43%) in grain was observed when the plot was treated with 60 kg P ha^{-1} × 2.0 kg B ha^{-1} while the lowest in control. The results clearly indicated that Mg content was increased in mungbean grain due to the application of phosphorus and boron.

3.1.6 Sulphur

Sulphur content in mungbean grain was significantly influenced by different treatments of phosphorus (Table 1). The treatment 60 kg P ha^{-1} gave the highest S content (0.34%) in mungbean grain while the minimum S content in mungbean grain (0.25%) was recorded in control plot. However, the S content in mungbean due to the application of phosphorus at the rate of 0, 20, 40 kg P ha^{-1} was identical. The effect of different levels of boron on S content in mungbean grain found significant. Maximum S content (0.34%) in grain was obtained with 2.0 kg B ha^{-1} and it was minimum (0.22%) in control. The results indicated that S content was increased to some extent in mungbean grain due to the application of boron. The interaction effect of phosphorus and boron on S content in grain of mungbean was significantly affected by the different levels of phosphorus and boron. The highest S content (0.43%) in grain was observed when the plot was treated with 60 kg P ha^{-1} × 2.0 kg B ha^{-1}. The lowest S content (0.12%) was recorded in control plot (Table 3). The results also indicated that S content was increased much in mungbean grain due to boron than phosphorus application.

3.2 Nutrient Content in Stover

3.2.1 Nitrogen

Experimental results in Table 4 indicated that N content in stover of mungbean was significantly affected by different levels of phosphorus. The highest N content (1.63%) in stover was observed when the plot was treated with 60 kg P ha^{-1}. The lowest N content (1.22%) was recorded in control. N content in stover of mungbean was significantly affected by the different levels of boron (Table 5). The result might be due to boron, which affected cell division, carbohydrate metabolism, sugar and starch formation, which increased N content [14]. The highest N content (1.64%) in stover was observed when the plot was treated with 2.0 kg B ha^{-1} and the lowest N content (1.31%) was recorded in control plot. Nitrogen content in stover of mungbean was not significant in the interaction effect of phosphorus and boron.

3.2.2 Phosphorus

Significant difference was recorded due to different levels of phosphorus. The maximum P content (0.25%) in stover was observed with 60 kg P ha^{-1} while the lowest (0.18%) was recorded in control plot which was significantly inferior to all other treatments.

P content in stover of mungbean was significantly affected by the different levels of boron (Table 5). The highest P content (0.24%) in stover was observed from 2.0 kg B ha^{-1} and the lowest (0.18%) was recorded in control. Yaseen et al. [15] showed that boron supply increases the uptake and reutilization of N, P, K, Na, Ca and other. Variation was recorded due to combined effect of phosphorus and boron. The highest P content (0.28%) in stover was observed when the plot was treated with 60 kg P ha^{-1} × 2.0 kg B ha^{-1}. The lowest P content (0.12%) was recorded in control plot (Table 6).

3.2.3 Potassium

Significant variation was observed in terms of K content in mungbeanstover. The highest K content (1.59%) was observed from 60 kg P ha^{-1} where the lowest (1.22%) was recorded in control plot (Table 4). The result showed that the K content was increased with the application of boron. The highest K content (1.59%) in mungbeanstover was observed when the plot was treated with 2.0 kg B ha^{-1} while the lowest K content (1.20%) was recorded in control plot (Table 5). Since boron works on the level of plasma membranes in the root system [16], its deficiency caused a dramatic decrease in all nutrient contents in the plant tissues [17]. The interaction effect of phosphorus and boron on K content in stover of mungbean was significantly affected by the different levels of phosphorus and boron. The highest K content (1.80%) in stover was observed when the plot was treated with 60 kg P ha^{-1} × 2.0 kg B ha^{-1} and the lowest was in control plot (Table 6).

3.2.4 Calcium

The effect of phosphorus fertilizer on Ca content in stover of mungbean was significant. The highest Ca content (0.34%) was found when the plot was treated with 60 kg P ha^{-1} which was statistically similar with 40 kg P ha^{-1} (0.33%) and the lowest Ca content (0.22%) in mungbeanstover was recorded in control plot (Table 4). Variation of Ca content in mungbeanstover due to different levels of boron application was significant. The maximum Ca content (0.38%) was found in 2.0 kg B ha^{-1} and the minimum (0.23%) was in control plot (Table 5). The results clearly indicated that Ca content was increased in mungbeanstover by the application of boron. Interaction between phosphorus and boron exerted significant effect on Ca content in stover (Table 6). The highest

Ca content (0.44%) was observed when the plot was treated with 60 kg P ha^{-1} × 2.0 kg B ha^{-1}. The lowest Ca content (0.13%) was recorded in control plot.

Table 4. Effect of phosphorus on nutrient content in stover of summer mungbean (cv. BINAmung 8)

Levels of phosphorus	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
P_0	1.22c	0.18c	1.22d	0.22b	0.13d	0.12b
P_{20}	1.47b	0.20bc	1.28c	0.29c	0.16c	0.17a
P_{40}	1.52b	0.21b	1.45b	0.33a	0.18b	0.17a
P_{60}	1.63a	0.25a	1.59a	0.34a	0.19a	0.19a
CV (%)	5.76	17.46	5.21	10.31	10.85	17.02
Level of sig.	**	**	**	**	**	**

P_0= No phosphorus, P_{20} =20 kg P ha^{-1}, P_{40} =40 kg P ha^{-1} and P_{60} =60 kg P ha^{-1}. In a column same letter (s) do not differ significantly at $P \leq 0.05$ by DMRT, ^{NS}-Not-significant, **- significant at 1% level of probability.

Table 5. Effect of boron on nutrient content in stover of summer mungbean (cv. BINAmung-8)

Levels of boron	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
B_0	1.31c	0.18b	1.20c	0.23c	0.12d	0.12b
B_1	1.33c	0.19b	1.23c	0.25c	0.16c	0.14b
$B_{1.5}$	1.56b	0.23a	1.51b	0.34b	0.17b	0.19a
B_2	1.64a	0.24a	1.59a	0.38a	0.20a	0.20a
CV(%)	5.76	17.46	5.21	10.31	10.85	17.02
Level of sig.	**	**	**	**	**	**

*B_0 = No boron, B_1= 1.0 kg B ha^{-1}, $B_{1.5}$ = 1.5 kg B ha^{-1} and B_2 = 2.0 kg B ha^{-1}. In a column, same letter (s) do not differ significantly at $P \leq 0.05$ by DMRT, **- Significant at 1% of probability*

Table 6. Interaction effect of phosphorus and boron on nutrient content in stover of summer mungbean (cv. BINAmung-8)

Interaction (phosphorus × boron)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
$P_0 \times B_0$	0.88	0.12h	0.69h	0.13g	0.09h	0.06g
$P_0 \times B_1$	0.94	0.13gh	0.73h	0.16fg	0.12g	0.11fg
$P_0 \times B_{1.5}$	1.49	0.23a-e	1.64bc	0.44ab	0.13fg	0.25ab
$P_0 \times B_2$	1.58	0.24a-d	1.73ab	0.43ab	0.16de	0.20bcd
$P_{20} \times B_0$	1.41	0.16fgh	1.28g	0.20ef	0.13fg	0.12fg
$P_{20} \times B_1$	1.38	0.18efg	1.25g	0.22ef	0.15ef	0.12fg
$P_{20} \times B_{1.5}$	1.49	0.26ab	1.31fg	0.20ef	0.16de	0.12fg
$P_{20} \times B_2$	1.59	0.22a-e	1.30g	0.24de	0.19c	0.13ef
$P_2 \times B_0$	1.42	0.21b-f	1.33fg	0.29d	0.15ef	0.15c-f
$P_{40} \times B_1$	1.42	0.19v-f	1.43ef	0.35c	0.17cd	0.14def
$P_{40} \times B_{1.5}$	1.62	0.19def	1.47e	0.35c	0.21b	0.18cde
$P_{40} \times B_2$	1.63	0.25abc	1.55cde	0.38bc	0.21b	0.20bcd
$P_{60} \times B_0$	1.54	0.25abc	1.50de	0.29d	0.13fg	0.16c-f
$P_{60} \times B_1$	1.57	0.21b-f	1.51de	0.25de	0.18c	0.18cde
$P_{60} \times B_{1.5}$	1.65	0.24a-d	1.61bcd	0.36c	0.19c	0.21bc
$P_{60} \times B_2$	1.76	0.28a	1.80a	0.44a	0.24a	0.27a
CV (%)	5.76	17.46	5.21	10.31	10.85	17.02
Level of sig.	NS	**	**	**	**	**

P_0 = No phosphorus, P_{20} =20 kg P ha^{-1} , P_{40} =40 kg P ha^{-1}, P_{60} =60 kg P ha^{-1}, B_0 = No boron, B_1= 1.0 kg B ha^{-1}, $B_{1.5}$ = 1.5 kg B ha^{-1} and B_2 = 2.0 kg B ha^{-1}. In a column same letter (s) do not differ significantly at $P \leq 0.05$ by DMRT, ^{NS}- Not-significant, **- significant at 1% level of probability

3.2.5 Magnesium

Mg content in mungbeanstover was significantly affected by different phosphorus levels (Table 4). Maximum Mg content (0.19%) in stover was obtained with 60 kg P ha-1 and it was minimum (0.13%) in control plot. Different levels of boron affected Mg content in mungbeanstover significantly. Maximum Mg content (0.20%) in stover was obtained when the plot was treated with 2.0 kg B ha^{-1} and it was minimum (0.12%) in control plot. Significant influence was observed by interaction between phosphorus and boron on Mg content in mungbeanstover. Results indicated that the highest Mg content (0.24%) was observed in the treatment combination of 60 kg P ha^{-1} × 2.0 kg B ha^{-1}. The lowest Mg content (0.09%) was recorded in control plot (Table 6).

3.2.6 Sulphur

Sulphur content in mungbeanstover was significantly influenced by the different treatments of phosphorus (Table 4). The sulphur content in mungbeanstover varied from 0.12 to 0.19%. It gave the highest S content (0.19%) when the plot was treated with 60 kg P ha^{-1} while the minimum S content in mungbeanstover (0.12%) was recorded in control plot. Statistically significant variation in S content was recorded due to different treatments of boron (Table 5). The highest S content (0.20%) in mungbeanstover was observed from 2.0 kg B ha^{-1} while the minimum (0.12%) was recorded in control plot. Combined effect of phosphorus and boron significantly affected S content in stover of mungbean. The highest Mg content (0.27%) in stover was observed when the plot was treated with 60 kg P ha^{-1} × 2.0 kg B ha^{-1}. The lowest S content (0.09%) was recorded in control plot (Table 6).

4. CONCLUSION

From the overall results of the experiment, it can be concluded that application of 60 kg P ha^{-1} × 2.0 kg B ha^{-1} is more suitable for optimum N, P, K, Ca, Mg and S contents of mungbean (cv. BINAmung-8).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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