J. Sher-e-Bangla Agric. Univ., 11(1 & 2): 39-46, January & July 2020 ISSN 1997-6038

YIELD AND YIELD COMPONENTS OF BARI MUNG-6 AS INFLUENCED BY DIFFERENT LEVELS OF SULPHUR AND POTASSIUM

F. Karmokar[1], H. M. M. T. Hossain[2], M. J. Ullah[3] and M. Salahuddin[4]

ABSTRACT

An experiment was carried out at the research field of Sher-e-Bangla Agricultural University, Dhaka, during March to June, 2019 to study the effect of different levels of sulfur and potassium on yield and yield components of BARI Mung-6. The treatments consisted of 2 factors: Sulfur (04 levels *viz.* S_0 = No sulfur (Control), S_1 = 3 kg S ha^{-1}, S_2 = 6 kg S ha^{-1}, S_3 = 12 kg S ha^{-1} and Potassium 04 levels *viz.* K_0 = No potassium (Control), K_1 = 20 kg K ha^{-1}, K_2 = 40 kg K ha^{-1}, K_3 = 60 kg K ha^{-1}), which were assigned in a randomized complete block design (RCBD) with three replications. Data on different yield contributing characters and yield were recorded and analyzed statistically. The highest branches plant^{-1} (3.55), pods plant^{-1} (14.72), seeds pod^{-1} (9.74), 1000 seeds weight (51.27 g), seed yield (1.24 t ha^{-1}), stover yield (2.35 t ha^{-1}) and biological yield (3.59 t ha^{-1}) were observed in S_2 (6 kg S ha^{-1}) treatment, whereas the highest number of branches plant^{-1} (3.57), pods plant^{-1} (14.20), seeds pod^{-1} (9.65), 1000 seeds weight (51.16 g), seed yield (1.24 t ha^{-1}), stover yield (2.36 t ha^{-1}) and biological yield (3.6 t ha^{-1}) were observed in K_2 (40 kg K ha^{-1}) treatment. The number of branches plant^{-1} (4.73), pods plant^{-1} (16.47), seeds pod^{-1} (10.87), 1000 seeds weight (56 g), seed yield (1.51 t ha^{-1}), stover yield (2.92 t ha^{-1}) and biological yield (4.43 t ha^{-1}) were observed in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}). The highest values of both the treatment factors and their combinations were significantly highest over that of control treatments.

Keywords: BARI Mung-6, potassium, sulphur

INTRODUCTION

Mungbean (*Vigna radiata* L.) is one of the most important short durated pulse crop in Bangladesh and other South Asian countries. It belongs to the family of Leguminosae. Its seed is more palatable, nutritive, digestible and non-flatulent than other pulses (Anjum *et al.*, 2006). It not only plays an important role in human diet but also in improving the soil fertility by fixing the atmospheric nitrogen (Nadeem *et al.*, 2004) through symbiotic relationship with Rhizobia. It can fix N in soil by 63-342 kg ha^{-1} per season (Kaisher *et al.*, 2010). Mungbean contains 59.9 g carbohydrate, 24.5 g protein, 75 mg calcium, 8.5 mg iron and 49 mg β-carotene per 100 g of split dal (Afzal *et al.*, 2004). The total production of pulses is only 0.65 million tons in Bangladesh against the requirement of 2.7 million tons i.e., shortage is almost 76% of the total requirement which is mostly due to low yield (MoA, 2005). In Bangladesh per capita consumption of pulses is only 14.72 g (BBS, 2012) as against 45.0 g recommended by World Health Organization. For maintaining the supply of this level, pulse production should be increased urgently to meet up the demand. Among all other pulses, mungbean ranks third in area and production but first in market price. The total production of mungbean in Bangladesh in 2011-12 was 19,972 metric tons from an area of 20,117 hectares with average yield is about 0.98 tons ha^{-1} (BBS, 2012). So, the importance of pulse production is very much topical for food and improving the farm-family income in order to ensure food security, nutritional security and economic security. Mungbean is highly responsive to fertilizers and manures. The recommendation of fertilizer for soils and crops is a dynamic process and the management of fertilizers is one of the important crop production factors that greatly affect the growth, development and yield of mungbean (Hoque *et al.*, 2004; Singh *et al.*, 2013). The crop has a marked response to nitrogen, phosphorus and potassium. These nutrients play a key role in plant physiological processes. A balanced supply of essential nutrients is indispensable for optimum plant growth. Continuous use of large amount of N, P, K, S and B are expected to influence not only the availability of other nutrients to plants because of

[1]MS Student, [2&3]Professor, Dept. of Agronomy, Sher-e-Bangla Agriculturtal University, Dhaka, [4]Project Coordinator, Bangladesh Regional Connectivity Project -1 (BRCP-1), Society for Bright Social Services (SBSS), Flat # A-1, East Asia R View, 22, North Mugda, Dhaka 1214, Bangladesh.

possible interaction between them but also the buildup of some of the nutrients creating imbalances in soils and plants leading to decrease fertilizer use efficiency (Nayyar and Chhibbam, 1992). Among the essential plant nutrients, potassium is the third macronutrient required for plant growth, after nitrogen and phosphorus (Abbas *et al*., 2011) and also plays a vital role as macronutrient in plant growth and sustainable crop production (Baligar *et al.,* 2001). Potassium plays a remarkable role in plant physiological processes. Potassium is not only a constituent of the plant structure but it also has a regulatory function in several biochemical processes related to protein synthesis, carbohydrate metabolism and enzyme activation. Several physiological processes depend on K such as stomatal regulation and photosynthesis (Hasanuzzaman *et al.,* 2018). It influences nutrient uptake by promoting root growth and nodulation. Sangakara (1990) carried out a field experiment to study the effects of 0-120 kg K_2O ha^{-1} on growth, yield parameters and seed quality of mungbean and reported that K application increased plant growth rate, flowers/plant, percent pod set seeds/pod, 1000 seed weight and yield/plant. Its adequate supply during growth period improves the water relations of plant and photosynthesis (Garg *et al*., 2005), maintains turgor pressure of cell which is necessary for cell expansion, helps in osmotic-regulation of plant cell, assists in opening and closing of stomata (Yang, *et al*., 2004), activates more than 60 enzymes (Bukhsh, *et al*., 2012), synthesizes the protein, creates resistance against the pest attack and diseases and enhances the mungbean yield (Ali *et al*., 2010).

Moreover, sulphur plays as an important macro nutrient element, next to NPK that has a profound effect on pulse crops. In broad sense, the functions of nitrogen and sulphur are similar and they are synergistic. Sulfur plays a remarkable role in protein metabolism and it is required for the synthesis of proteins, vitamins and chlorophyll. The S containing amino acids such as Methionine (21% S) and Cysteine (27%), which are essential components for proteins (Kumar *et al*., 2012). The application of sulfur increases the concentration as well as total uptake of N, P, K, Ca, S, Zn and B at different stages of crop growth (Agrawal *et al*., 2000). Lack of S causes retardation of terminal growth and root development. The deficiency of S induces chlorosis in young leaves and decreases seed yield by 45% (BARI, 2004). However, inadequate application of fertilizer is one of the major constrains to low productivity of mungbean (Jackson, 2010). Farmers have a wrong view that mungbean does not need fertilizers. It is noted that a standard levels of potassium and sulfur give better yield of mungbean. So, there is an adequate scope of increasing the yield of mungbean by balanced fertilization including both potassium and sulfur containing fertilizers. For these reasons, the study was undertaken to evaluate the effect of different levels of sulfur and potassium on the growth and yield of mungbean.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy field of Sher-e-Bangla Agricultural University (SAU) during the period from March to June-2019 in Kharif-I season to determine the effect of different levels of sulfur and potassium on growth and yield of mungbean. BARI Mung-6 was used as a plant material. There were two fertilizers used for sources of sulfur and potassium in the experiment namely Muriate of Potash and Gypsum as variables of the experiment mentioned below:

Factor A. Rates of sulfur (4 levels):

1. S_0 = No sulfur (Control)
2. S_1 = 3 kg S ha^{-1}
3. S_2 = 6 kg S ha^{-1}
4. S_3 = 12 kg S ha^{-1}

Factor B. Rates of potassium (4 levels):

1. K_0 = No potassium (Control)
2. K_1 = 20 kg K ha^{-1}
3. K_2 = 40 kg K ha^{-1}
4. K_3 = 60 kg K ha^{-1}

There were sixteen combinations of treatment considered for the experimentation as below: S_0K_0, S_0K_1, S_0K_2, S_0K_3, S_1K_0, S_1K_1, S_1K_2, S_1K_3, S_2K_0, S_2K_1, S_2K_2, S_2K_3, S_3K_0, S_3K_1, S_3K_2 and S_3K_3. The experiment was laid out in a Randomized Complete Block Design (RCBD). There were 16 treatment combinations and replicated in 3 times. Total numbers of plots were 48. The unit plot size was 3.24 m^2 (1.8 m x 1.8 m). There was a gap of 0.75 m between the replication to replication and between plot to plot was 0.5 m. Land preparation was completed on 28th March, 2019 and was ready for sowing seeds. Seeds were sown at the rate of 40 kg ha^{-1} in the furrow on 29th March, 2019 and the furrows were covered with the soils soon after seeding. The line to line distance was maintained with by 30 cm continuous sowing of seeds in the line.

Application of fertilizers

The fertilizers were applied as basal dose at final land preparation. Urea and TSP, were applied at 40 kg ha^{-1} and 80 kg ha^{-1}, respectively. The MoP and gypsum were applied as per treatment in all plots at 7 days after sowing. All fertilizers were applied by broadcasting and mixed thoroughly with soil.

Data collection

Data on plant height (cm), number of leaves plant^{-1}, total dry matter weight plant^{-1} (g), branches plant^{-1}, pods plant^{-1}, seeds pod^{-1}, 1000 seed weight (g), seed yield (t ha^{-1}), stover yield (t ha^{-1}), biological yield (t ha^{-1}) and harvest index (%) were recorded.

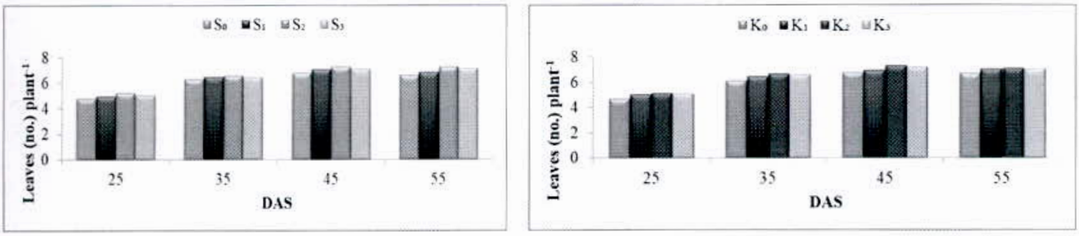
Analysis of data

The collected data were compiled and analyzed statistically using the analysis of variance (ANOVA) technique with the help of a computer package program Statistix 10. Data analysis software and the mean differences were adjusted by Least Significant Difference (LSD) test at 5% level of probability.

RESULTS AND DISCUSSION

Number of leaves plant^{-1}

Application of sulfur at different level showed significant variation in respect of number of leaves. (Fig. 1). From the experiment result revealed that highest number of leaves (5.22, 6.62, 7.28 and 7.47 at 25, 35, 45 and 55 DAS respectively) were observed in S_2 (6 kg S ha^{-1}) treatment. Whereas, the lowest numbers of leaves (4.82, 6.32, 6.83 and 6.92) were measured in S_0 (control). The highest number of leaves (5.17 at 25 DAS) was observed in K_3 treatment. At 35, 45 and 55 DAS, respectively the highest number of leaves (6.67, 7.35 and 7.48) was observed in K_2 (40 kg K ha^{-1}) treatment but the lowest number of leaves 4.73, 6.13, 6.78 and 6.77 were observed in the K_0 treatment. The highest number of leaves (5.4) at 25 DAS was observed in S_3K_2 (12 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination, at 35 DAS the highest number of leaves (7) was observed in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination. At 45 and 55 DAS, respectively the highest number of leaves (7.60 and 7.67) was observed in S_2K_3 (6 kg S ha^{-1} + 60 kg K ha^{-1}). Whereas, the lowest number of leaves 4.33, 5.87, 6.60 and 6.33 were observed in S_0K_0 (Table 1).



(a) S_0 = Control, S_1 = 3 kg S ha^{-1}, S_2 = 6 kg S ha^{-1}, S_3 = 12 kg S ha^{-1}

(b) K_0 = Control, K_1 = 20 kg K ha^{-1}, K_2 = 40 kg K ha^{-1}, K_3 = 60 kg K ha^{-1}

Fig. 1 . Effect of different levels of sulfur and potassium on number of leaves plant^{-1} of mungbean at different days after sowing. a. Effect of different levels of sulfur; b. Effect of different levels of potassium

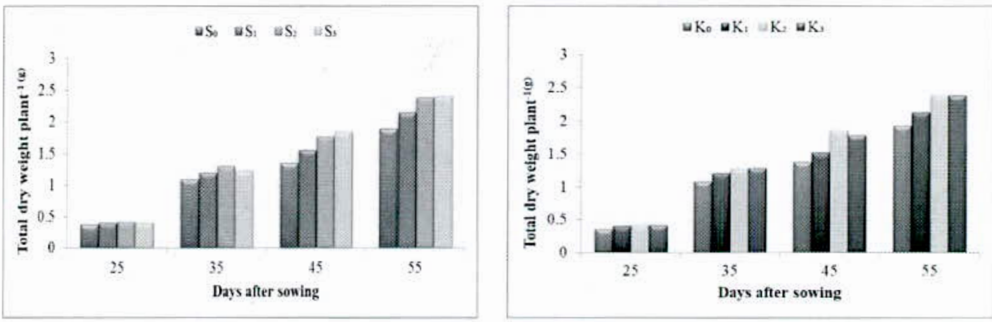
Total dry weight plant^{-1} (g)

Sulfur and potassium have significant effects on total dry weight. From the experimental results, it was revealed that the highest total dry weight (0.42 and 1.31g at 25 and 35 DAS) was observed in S_2 (6 kg S ha^{-1}) treatment. At 45 and 55 DAS, the highest total dry weight (1.86 and 2.41g, respectively) was observed in S_3 (12kg S ha^{-1}) treatment. On the other hand, the lowest total dry weight (0.38, 1.10, 1.36 and 1.90 g) was observed in S_0 (control). The highest total dry weight (0.44, 1.29, 1.86 and 2.40 g at 25, 35, 45 and 55 DAS, respectively) was observed in K_2 (40 kg K ha^{-1}) treatment. This result clearly indicates that total dry weight increased gradually with increasing levels of sulfur. On the other hand, the lowest total dry weight (0.36, 1.09, 1.38 and 1.93 g) was observed in the K_0 treatment where no potassium was applied. The highest total dry weight (0.47, 1.40 and 2.24g at 25, 35 and 45 DAS, respectively) was observed in S_2K_3 (6 kg S ha^{-1} + 60 kg K ha^{-1}) treatment combination. At 55 DAS highest total dry weight (2.75 g) was found in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination. On the other hand, the lowest total dry weight (0.32, 1.06, 1.32 and 1.77g at 25, 35, 45 and 55 DAS respectively) was observed in S_0K_0 (no sulfur + no potassium) (Table 2).

Table 2. Combined effect of sulfur and potassium on total dry weight of mungbean at different days after sowing

Treatment combinations	Total dry weight plant^{-1} (g)			
	25 DAS	35 DAS	45 DAS	55 DAS
S_0K_0	0.32 c	1.06 e	1.32 h	1.77 h
S_0K_1	0.38 bc	1.09 e	1.41 gh	1.95 fg
S_0K_2	0.39 bc	1.12 c-e	1.41 gh	1.99 f
S_0K_3	0.37 bc	1.06 e	1.39 gh	2.00 f
S_1K_0	0.39 bc	1.1 de	1.35 h	1.9 g
S_1K_1	0.41 ab	1.15 b-e	1.55 e-g	2.15 e
S_1K_2	0.42 ab	1.36 ab	1.45 f-h	2.16 e
S_1K_3	0.41 ab	1.22 a-e	1.77 d	2.31 d
S_2K_0	0.38 bc	1.11 de	1.39 gh	1.94 fg
S_2K_1	0.43 ab	1.26 a-e	1.61 d-f	2.16 e
S_2K_2	0.46 a	1.40 a	2.21 ab	2.75 a
S_2K_3	0.47 a	1.40 a	2.24 a	2.72 ab
S_3K_0	0.42 ab	1.13 c-e	1.39 h	1.99 f
S_3K_1	0.43 ab	1.35 a-c	1.66 de	2.32 d
S_3K_2	0.42 ab	1.37 ab	2.06 bc	2.66 bc
S_3K_3	0.41 ab	1.32 a-d	2.04 c	2.59 c
$LSD_{(0.05)}$	0.07	0.22	0.17	0.09
CV (%)	5.95	6.03	3.36	1.32

Note -S_0 = Control, S_1 = 3 kg S ha^{-1}, S_2 = 6 kg S ha^{-1}, S_3 = 12 kg S ha^{-1} ; K_0 = Control, K_1 = 20 kg K ha^{-1}, K_2 = 40 kg K ha^{-1}, K_3 = 60 kg K ha^{-1}



a) S_0 = No sulfur (Control), S_1 = 3 kg S ha^{-1}, S_2 = 6 kg S ha^{-1}, S_3 = 12 kg S ha^{-1}

b) K_0 = No potassium (Control), K_1 = 20 kg K ha^{-1}, K_2 = 40 kg K ha^{-1}, K_3 = 60 kg K ha^{-1}

Fig. 2. Effect of different levels of sulpher and potassium on total dry weight of mungbean at different days after sowing. a. Effect of different levels of sulpher on total dry weight; b. Effect of different levels of potassium on total dry weight ($LSD_{(0.05)}$ = 0.03, 0.08, 0.06 and 0.03 at 25, 35, 45 and 55 DAS respectively).

Yield and yield contributing parameters

Number of branches plant^{-1}

Different levels of sulfur and potassium fertilizers showed significant variation in respect of number of branches plant^{-1} of mungbean (Table 3). The highest number of branches plant^{-1} (3.55) was observed in S_2 treatment. Where the lowest number of branches plant^{-1} (1.44) was measured in S_0. From the experimental results, it was revealed that the highest number of branches plant^{-1} (3.57) was observed in K_2 treatment. On the other hand, the lowest number of branches (1.29) was observed in the K_0. The highest number of branches plant^{-1} (4.73) was observed in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination, which was statistically similar with S_2K_3 treatment combination. On the other hand, the lowest number of branches (1.07) was observed in S_0K_0 (no sulfur + no potassium) treatment combination (Table 4).

Number of pods plant^{-1}

Application of different levels of sulfur and potassium fertilizers showed significant variation in respect of number of pods plant^{-1} (Table 3). From the experiment result revealed that the highest number of pods plant^{-1} (14.72) was recorded in S_2 (6 kg S ha^{-1}) treatment where the lowest number of pods plant^{-1} (10.29) was measured in S_0 (control). The highest number of pods plant^{-1} (14.20) was observed in K_2 (40 kg K ha^{-1}). On the other hand, the lowest number of pods plant^{-1} (10.2) was observed in the K_0. From the experimental result, it was revealed that the highest number of pods plant^{-1} (16.47) was observed in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination, which was statistically similar with S_3K_2, S_2K_3 and S_3K_3 treatment combination. On the other hand, the lowest number of pods plant^{-1} (9) was observed in S_0K_0 (Table 4).

Number of seeds pod^{-1}

Application of different level of sulfur and potassium fertilizers showed significant variation in respect of number of seeds pod^{-1} (Table 3). The highest number of seeds pod^{-1} (9.74) was recorded in S_2 (6 kg S ha^{-1}) treatment which was statistically similar with S_3 treatment. Where the lowest number of seeds pod^{-1} (8.28) was observed in S_0. From the experimental results it was revealed that the highest number of seeds pod^{-1}(9.65) was observed in K_2 (40 kg K ha^{-1}) treatment which was statistically similar with K_3. On the other hand, the lowest number of seeds pod^{-1} (8.30) was observed in the K_0

1000 seeds weight (g)

From the experimental results shown in table 3, it was revealed that the highest 1000 seeds weight (51.27 g) was observed in S_2 (6 kg S ha^{-1}) treatment where the lowest 1000 seeds weight (43.57 g) was measured in S_0 (control). The highest 1000 seeds weight (51.16 g) was observed in K_2 (40 kg K ha^{-1}) treatment. On the other hand, the lowest 1000 seeds weight (44.17 g) was observed in the K_0 treatment (Table 3). Combined effect of sulfur and potassium showed significant effect on 1000 seeds weight of mungbean (Table 4). From the experimental results it was revealed that the highest 1000 seeds weight (56 g) was observed in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination which was statistically similar with S_3K_2 and S_2K_3 treatment combination. On the other hand, the lowest 1000 seeds weight (41.53 g) was observed in S_0K_0 (no sulfur + no potassium).

Seed yield (t ha^{-1})

Application of different level of sulfur and potassium fertilizers showed significant variation on seed yield. It was revealed that the highest seed yield (1.24 t ha^{-1}) was observed in S_2 (6 kg S ha^{-1}) treatment where the lowest seed yield (0.62 t ha^{-1}) was measured in S_0 (control) treatment. The highest seed yield (1.24 t ha^{-1}) was observed in K_2 (40 kg K ha^{-1}) treatment. On the other hand, the lowest seed yield (0.65 t ha^{-1}) was observed when no potassium was applied (K_0). Combined effect of sulfur and potassium showed significant effect on seed yield of the crop (Table 4). The highest seed yield (1.51 t ha^{-1}) was observed in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination. On the other hand, the lowest seed yield (0.52 t ha^{-1}) was observed in S_0K_0 (no sulfur + no potassium) treatment combination.

Stover yield (t ha^{-1})

Application of different levels of sulfur and potassium fertilizers showed significant variation in respect of stover yield of BARI Mung-6 (Table 3). The highest stover yield (2.35 t ha^{-1}) was recorded in S_2 (6 kg S ha^{-1}) treatment and that of the lowest (1.14 t ha^{-1}) in S_0 (control). It was also revealed that the highest stover yield (2.36 t ha^{-1}) was observed in K_2 (40 kg K ha^{-1}) treatment. On the other hand, the lowest stover yield (1.17 t ha^{-1}) was recorded in the plots with no potassium applied. The highest stover yield (2.92 t ha^{-1}) was observed in S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination. On the other hand, the lowest stover yield (0.97 t ha^{-1}) was observed in S_0K_0 (no sulfur + no potassium) (Table 4).

Table 3. Effect of different levels of sulfur and potassium on branches plant^{-1}, pods plant^{-1}, seeds pod^{-1}, 1000 seeds weight, seed yield and stover yield of mungbean

Treatment	No. of branch plant^{-1}	No. of pods plant^{-1}	No. of seeds plant^{-1}	1000 seed wt. (g)	Seed yield (t ha^{-1})	Stover yield(t ha$^{-1)}$
S_0	1.44 c	10.29 d	8.28 c	43.57 c	0.62 d	1.14 c
S_1	2.73 b	11.55 c	9.02 b	47.96 b	1.05 c	2.12 b
S_2	3.55 a	14.72 a	9.74 a	51.27 a	1.24 a	2.35 a
S_3	3.47 a	14.57 a	9.64 a	50.89 a	1.13 b	2.34 a
$LSD_{(0.05)}$	0.21	0.3	0.31	0.66	0.03	0.03
CV%	36.24	14.36	9.72	7.10	27.80	28.96
K_0	1.29 c	10.2 c	8.30 c	44.17 c	0.65 d	1.17 c
K_1	2.43 b	12.5 b	8.88 b	46.89 b	1.00 c	2.09 b
K_2	3.57 a	14.20 a	9.65 a	51.16 a	1.24 a	2.36 a
K_3	3.56 a	13.95 a	9.48 a	51.19 a	1.16 b	2.34 a
$LSD_{(0.05)}$	0.13	0.3	0.31	0.66	0.03	0.03
CV%	35.89	16.17	9.81	6.53	28.90	29.45

Note - S_0 = Control, S_1 = 3 kg S ha^{-1}, S_2 = 6 kg S ha^{-1}, S_3 = 12 kg S ha^{-1}; K_0 = Control, K_1 = 20 kg K ha^{-1}, K_2 = 40 kg K ha^{-1}, K_3 = 60 kg K ha^{-1}

Table 4. Combined effect of sulfur and potassium on branches, pods, seeds, 1000 seeds weight, seed and stover yield of mung bean

Treatments	No. of branches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	1000 seeds wt. (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})
S_0K_0	1.07 g	9.00 g	7.60 i	41.53 i	0.52 h	0.97 h
S_0K_1	1.33 f	10.67 e	8.27 h	43.60 h	0.67 g	1.16 g
S_0K_2	2.20 e	10.80 d	8.67 fg	44.25 f-h	0.76 f	1.17 g
S_0K_3	1.33 f	10.67 de	8.60 gh	44.88 f-h	0.66 g	1.28 f
S_1K_0	1.33 f	9.47 fg	8.27 h	43.77 gh	0.55 h	1.17 g
S_1K_1	2.80 d	11.20 d	9.00 ef	47.40 de	1.25 cd	2.34 e
S_1K_2	3.20 c	13.40 b	9.07 de	49.13 d	1.21 d	2.50 c
S_1K_3	3.20 c	12.13 c	9.20 de	51.53 c	0.97 e	2.48 c
S_2K_0	1.47 f	12.40 c	8.67 fg	45.70 ef	0.66 g	1.27 f
S_2K_1	3.40 c	14.20 b	9.40 d	49.13 d	1.31 c	2.41 de
S_2K_2	4.73 a	16.47 a	10.87 a	56.00 a	1.51 a	2.92 a
S_2K_3	4.60 a	15.80 a	10.00 c	54.23 ab	1.47 ab	2.81 b
S_3K_0	2.00 e	9.93 ef	8.67 fg	45.67 e-g	0.75 f	1.26 f
S_3K_1	3.40 c	13.93 b	9.40 d	47.43 de	0.97 e	2.43 cd
S_3K_2	4.13 b	16.13 a	10.00 c	55.27 ab	1.49 a	2.85 ab
S_3K_3	4.00b	15.80 a	10.44 b	53.50 b	1.42 b	2.80 b
$LSD_{(0.05)}$	0.26	0.83	0.35	1.91	0.07	0.07
CV (%)	5.62	3.96	2.27	2.38	2.37	1.24

Note - S_0 = Control, S_1 = 3 kg S ha^{-1}, S_2 = 6 kg S ha^{-1}, S_3 = 12 kg S ha^{-1}; K_0 = Control, K_1 = 20 kg K ha^{-1}, K_2 = 40 kg K ha^{-1}, K_3 = 60 kg K ha^{-1}

CONCLUSION

From the above findings it was observed that, most of the growth, yield and yield contributing characteristics of mungbean gave the best performance in S_2 treatment (6 kg S ha^{-1}), K_2 (40 kg K ha^{-1}) and combined effect S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}). The highest seed yield 1.51 t $ha^{-1}$was obtained from the application of 6 kg S ha^{-1} sulfur along with 40 kg K ha^{-1} potassium fertilizer as S_2K_2 (6 kg S ha^{-1} + 40 kg K ha^{-1}) treatment combination. So, this treatment combination (S_2K_2) can be treated as the best treatment combination under the present study. However, to reach a specific conclusion and recommendation, more research work on mungbean under these treatment variables should be done in different Agro-ecological zones of Bangladesh to fit in cropping system for rich diet and improve the soil health.

REFERENCES

Abbas, G., Aslam, M., Malik, A.U., Abbas, Z., Ali, M. and Hussain, F. 2011. Potassium sulphate effects on growth and yield of mungbean (*Vigna radiata* L.) under arid climate. *Intl. J. Agric. Appl. Sci.*, 3(2): 72-75.

Afzal, M.A., Baker, M.A., Hamid, A., Haque, M.M. and Aktar, M.S. 2004. Mungbean in Bangladesh. Lentil Blackgram and Mungbean development pilot project. Pulses Research Centre, BARI, Gazipur- 1701. 60p.

Agrawal, M.M., Verma, B.S. and Kumar, C. 2000. Growth and yield response of mungbean (*Vigna radiata* L.) as influenced by sulphur and boron application. *Indian J. Agron.*, 45: 184-187.

Ali, M.A., Abbas, G.Q., Mohyuddin, K., Abbas, G. and Aslam, M. 2010. Growth and yield of Mungbean as influenced by potassium and sulphur. *J. Anim. Pl. Sci.*, 20(2): 83-86.

Amrutsagar, V., More, N., Pawar, A. and Imas, P. 2019. Potash management in black gram-sorghum sequence on dryland soils old Maharashtra. *Indian J. Fert.*, 15(7): 758-764.

Anjum, M.S., Ahmed, Z.I. and Rauf, C.A. 2006. Effect of Rhizobium inoculation and nitrogen fertilizer on yield and yield components of mungbean. *Intl. J. Agril. Biol.*, 8: 238-240.

Baligar, V.C., Fageria, N.K. and He, Z.L. 2001. Nutrient use efficiency in plants. *Soil Sci. Pl. Anal.*, 32: 921-950.

BBS (Bangladesh Bureau of Statistics), 2012. Statistical Year Book of Bangladesh Bur. Stat., Stat. Div., Min. Plan., Govt. People's Repub. of Bangladesh, Dhaka. 47-50pp.

BARI (Bangladesh Agricultural Research Institute), 2004. Mungbean cultivation in Bangladesh. A booklet in Bengali. Bangladesh Agricultural Research Institute, Joydebpur, Gazipur.

Bukhsh, M.A., Ahmad, A.R., Malik, A.U., Hussain, S. and Ishaque, M. 2012. Nutritional and Physiological Significance of Potassium Application in Maize Hybrid Crop Production. *J. Anim.Pl. Sci.*, 11(2): 187- 202.

Dharwe D.S., Dixit, H.C., Malvi, V. and Dotaniya C.K. 2019. Effect of phosphorus and sulfuron the yield and nutrient content of green gram. *Intl. J. Chel. Studies.*, 7(2): 01-05.

Gadi, Y., Ariina, M.S., and Nakhro, A.E. 2020. Studies on responses of green gram (*Vigna radiata*) to phosphorus and potassium under north-eastern region. *Nat. Res. Mng. Sust. Agri.*, 28:169.

Garg, B.K., Burmin, U. and Kathju, S., 2005. Growth and yield of mungbean (BARI mung 6) as influenced by potassium and sulphur. *J. Arid. Legumes.*, 2: 61-66.

Hasanuzzaman, M., Bhuyan, B. Nahar, M.H.M., Hossain, K., Masud, S., Moumita, A.A.C. and Fujita, M. 2018. Potassium: A vital regulator of plant responses and tolerance to abiotic stresses. *Agron.*, 8(31): 1-29.

Hoque, R., Hossain, M.K., Mohiuddin, M. and Hoque, M.M. 2004. Effect of inorganic fertilizer on the initial growth performance on Anthocephalus chinensis (lam) Rich. Ex. Walp. Seedling in the nursery. *J. Appl. Sci.*, 4: 477-485.

Kaisher, M.S., Rahman, M.A., Amin, M.H.H. and Ahsanullah, A.S.M. 2010. Effects of sulphur and boron on the seed yield and protein content of mungbean. *Bangladesh Res. Pub. J.*, 3(4): 1181-1186.

Kumar, R., Singh, Y.V., Singh, S., Latare, A.M., Mishra, P.K. and Supriya 2012. Effect of phosphorus and sulphur nutrition on yield attributes, yield of mungbean (*Vigna radiata* L. Wilczek). *J. Chem. and Pharma. Res.*, 4(5): 2571-2573.

Laxmi, S., Meena, R., Meena, R.N., Patel, M.K., Paul, A., Dubey, A., and Meena, K. 2020. Effect of Graded Dose of Sulfur and Boron on Yield and Nutrient Uptake by Mungbean (*Vigna radiata*). *Environ. Ecol.,* 38(1): 1-5.

Mazed, H.E.M.K., Moonmoon, J.F., Haque, M.N., Pulok, M.A.I. and Rahman, M.H. 2015. Growth and yield of mungbean as influenced by potassium and sulphur. *Annals Biol. Res., 6(1): 6-10.*

MoA (Ministry of Agriculture), 2005. Hand Book of Agricultural Statistics, December. Ministry of Agriculture, Government of People's Repub., Bangladesh, Dhaka, 14p.

Nadeem, A., Ahmad, R. and Ahmad, M.S. 2004. Effect of seed inoculation and different fertilizer levels on the growth and yield of mungbean (*Vigna radiata* L.). *J. Agron*., 3(1): 40-42.

Nayyar, V.K. and Chibbam, I.M. 1992. Interactions of zinc with other plant nutrients in soils and crops. In: Management of Nutrient Interactions in Agriculture. (Ed. H. L. S. Tandon). FDCO, New Delhi, India, 116 – 142 pp.

Parmar, P.K., Desai, N.H., Rabari, K.V. and Chaudhary, P.P. 2021. Effect of phosphorus, sulfur and biofertilizers on growth, yield and quality of Moth bean. *J. Pharm. Phytochem.,* 10(1): 1434-1437.

Sangakara, U.R. 1990. Effect of potassium fertilizer on growth and yield of mungbean (*Vigna radiata* L. Wilczek*). J. Appl. Seed Prodn.,* 8: 33-38.

Sindhu, G.P., Swetha, R.K., Gunasekar, J. and Maragani, V. 2019. Effect of muriate of potash (MOP) and sulphate of potash (SOP) on growth characters of green gram (*Vigna radiata* (L.) Wilczek) cv. VBN 2 in pot and field condition. *Int. J. Curr. Microbiol. App. Sci.,* 8(2): 2577-2592.

Yang, X.E., Wang, W.M. and He, Z.L. 2004. Physiological and genetic characteristics of nutrient efficiency of plants in acid soils. *Indian. J. Agric. Sci.,* 61(1): 78-83.