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FOLIAL APPLICATION OF CHITOSAN IMPROVED MORPHOLOGICAL ATTRIBUTES AND YIELD IN SUMMER MUNGBEAN

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ABSTRACT

Islam MT, Khatoon M (2021) Folial application of chitosan improved morphological attributes and yield in summer mungbean. *Int. J. Expt. Agric.* 11(1), 1-3.

Chitosan improves crop growth and yield and also stimulates immunity of plants. Two experiments were conducted to investigate the effect of foliar application of chitosan on growth and yield of summer mungbean. The experiment comprised five levels of chitosan concentrations *viz*., 0 (control), 25, 50, 75 and 100 ppm. The chitosan was sprayed two times, 25 and 35 days after sowing. Foliar application of chitosan increased plant height, number of branches, pods plant^{-1}, biomass and seed yield plant^{-1}. The highest yield was recorded at 50 ppm followed by 75 ppm and 25 ppm. Therefore, foliar application of chitosan at 50 ppm may be used at early growth stage for getting higherseed yield of summer mungbean.

Key words*: chitosan, summer mungbean, growth, yield, foliar spray*

INTRODUCTION

Mungbean (*Vigna radiata* L. Wilczek) is one of the most important pulse crops. It has yield potential of around 2000 kg ha^{-1} but productivity is low 821 kg ha^{-1} (BBS 2019). Mungbean yield is predetermined by the potential of a given variety and the environment. Optimum temperature for potential yield of mungbean lies between 28-30ºC (Poehlman 1991). High temperature affects mungbean yield. High temperature (36ºC) at pre-flowering and floweringstages decreases photosynthetic rate, biomass and yield in mungbean (Islam 2018; 2015; Islam and Razzaque, 2010). In Bangladesh, mungbean is cultivated in winter and summer and both low and high temperature affects its growth and yield. Summer varieties are often facing high temperature (34-38ºC) during April-May. Chitosan is a natural biopolymer derived from chitin, a polysaccharide found in exoskeleton of shellfish such as shrimp, lobster or crabs and cell wall of fungi is known to possess biological activity (Gornik *et al*. 2008). The molecule of chitosan triggers a defensive mechanism within the plant, which leads to the formation of physical and chemical barriers against invading different plant pathogens. Chitosan seems to act as a stress tolerance inductor it enhanced a hyper sensible reaction and lignification, inducing lipid peroxidation, and production of defense against pathogens when directly applied to plant tissue (Ortiz *et al*. 2007). Seeds treated with chitosan reduced the mean germination time; increased germination index leads to improving seedling growth under low temperature stress and also reported that the application of chitosan reduced the vanadium toxicity when applied to wheat and barley in irradiated form (Tham *et al*. 2001). Although not known the exact mechanisms by which chitosan stimulates growth and development of plants, it has been proposed that is involved in physiological processes, it prevents water loss via transpiration (Young *et al*. 2005). Keeping in view the importance of chitosan application, this study was designed to find out the effect of chitosan on growth and yield of mungbean in summer season of Bangladesh.

MATERIALS AND METHODS

Two experiments were conducted with Binamoog-7 and Binamoog-8 during March-May 2020 at BINA farm, Mymensingh. In field experiment unit plot size was 4m × 5m and row to row and plant to plant distances were 30 and 10 cm, respectively. Five concentrations of chitosan *viz*., 0, 25, 50, 75 and 100 ppm were applied twice at 25 and 35 days after sowing by a hand sprayer in the afternoon. The field and pot experiments were laid out in RCBD and CRD with three replications. Each pot (30 × 25 cm) contained 12 kg soil. The soil was thoroughly mixed with urea, TSP, MP and gypsum at the rate of 2.0, 4.0, 3.0 and 2.0 g pot^{-1} corresponding to 40, 80, 60 and 40 kg ha^{-1}, respectively. Total amount of urea, TSP, MP and gypsum were applied as basal dose during soil preparation. Five seeds were sown in each pot and 15 days after sowing, they were thinned to two seedlings. Intercultural operations such as irrigation, weeding, mulching and pest control were followed as and when necessary. Plant samples were oven dried at 80±2ºC for 72 hrs. Morphologicaland yield attributes were recorded at harvest. Data were analyzed statistically using the computer package program, MSTAT-C and the mean differences were adjudged by Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Foliar application of chitosan increased plant height, number of branches, pods plant^{-1}, biomass and seed yield plant^{-1}(Table 1 and Table 2). The highest yield was recorded at 50 ppm followed by 75 ppm and 25 ppm. The highest yield was recorded at 50 ppm followed by 75 ppm and 25 ppm. The results are in conformity with Islam *et al*. 2016. Better growth, biomass and seed yield production of summer mungbean with chitosan might be due to capability of chitosan to better cell division and photosynthesis in mungbean plant under high temperature.

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Table 1. Effect of foliar application of chitosan on growth and yield of summer mungbean grown in pots

Treatments	Plant height (cm)	No. of pods plant^{-1}	No. of seeds pod^{-1}	1000-seed weight (g)	Seed yield plant^{-1} (g)
Variety					
Binamoog-7	31.5b	34.5a	10.6b	34.51b	7.6b
Binamoog-8	35.6a	27.6b	12.5a	41.32a	8.1a
Concentration (ppm) of chitosan					
0	31.5cd	20.6c	10.3b	38.32	7.2b
25	34.7b	21.7c	10.4b	37.23	7.6b
50	36.9a	25.7a	11.1a	37.34	8.8a
75	35.4b	22.3b	10.3b	36.25	7.8b
100	33.2c	22.8b	10.3b	36.30	7.6b
Interaction of variety and concentration					
Binamoog-7 × 0 ppm	29.2f	25.4d	10.2cd	31.2a	7.1b
Binamoog-7 × 25 ppm	30.1de	27.5c	10.5c	29.1bc	8.2a
Binamoog-7 × 50 ppm	32.6d	32.3a	11.1b	29.4bc	7.4b
Binamoog-7 × 75 ppm	30.2de	30.2b	10.6c	30.5b	8.3a
Binamoog-7 × 100 ppm	27.4g	30.0b	10.2cd	28.2d	7.4b
Binamoog-8 × 0 ppm	34.2bc	23.4f	11.3b	24.1ef	6.4c
Binamoog-8 × 25 ppm	35.1b	23.8f	11.7b	24.7ef	7.1b
Binamoog-8 × 50 ppm	39.4a	29.7bc	12.2a	26.2e	8.1a
Binamoog-8 × 75 ppm	33.2c	26.2cd	10.6c	26.6e	8.0a
Binamoog-8 × 100 ppm	33.0c	24.0e	11.1b	24.1ef	7.1b

In a column, figures with same letter(s) do not differ significantly at $P \leq 0.05$ by DMRT.

Table 2. Effect of foliar application of chitosan on growth and yield of summer mungbean in field condition

Concentration of chitosan (ppm)	Plant height (cm	Branches plant^{-1} (no.)	Pods plant^{-1} (no)	Pod length (cm)	1000-seed wt. (g)	Seeds pod^{-1} (no.)	Seed wt. plant^{-1} (g)	Straw wt. plant^{-1} (g)	Seed weight (Kg ha^{-1})
Variety									
Binamoog-7	37.5b	3.50ab	36.5a	7.1b	39.51b	9.6b	5.2b	7.23a	1588b
Binamoog-8	39.6a	4.41a	41.9b	7.8a	45.32a	11.5a	5.9a	7.34a	1670a
Concentration of chitosan									
0	60.6b	3.70cd	14.4e	7.3a	39.2	10.2b	3.75b	6.90c	1305d
25	62.2c	4.11b	19.4b	7.1ab	41.3	12.4a	3.83b	7.23ab	1567b
50	66.4a	4.41b	21.4a	7.0ab	36.4	10.1b	4.65a	7.45a	1677a
75	61.4cd	4.00a	18.2bc	7.3a	39.2	10.3b	4.21a	7.34ab	1588b
100	60.2e	3.32c	15.4d	7.1ab	34.2	10.1b	3.94b	6.35cd	1503c
Interaction									
Binamoog-7 × 0 ppm	60.2d	3.2bb	13.8d	6.3b	39.2bc	9.2bcd	3.7bc	6.2bcd	1365bc
Binamoog-7 × 25 ppm	62.4bc	3.0bc	14.1cd	6.5b	39.7bc	9.7bc	3.8bc	6.5bcd	1386bc
Binamoog-7 × 50 ppm	64.2b	4.1a	17.8b	7.1a	41.4b	10.4b	4.1b	7.6ab	1573a
Binamoog-7 × 75 ppm	62.2bc	4.2a	16.1c	7.1a	41.2b	10.0b	4.0ab	7.1ab	1543a
Binamoog-7 × 100 ppm	60.1d	3.0bc	14.0	6.3b	38.2bc	9.1bcd	3.7bc	6.9ab	1344bc
Binamoog-8 × 0 ppm	60.1	3.7b	13.6d	7.1a	40.2b	10.2b	4.2b	7.1ab	1275cd
Binamoog-8 × 25 ppm	64.5b	3.5b	17.4b	7.4a	42.3b	10.7b	4.7a	7.3ab	1484b
Binamoog-8 × 50 ppm	66.7a	4.4a	20.7a	7.5a	44.6a	11.4a	4.5a	7.8a	1595a
Binamoog-8 × 75 ppm	62.1bc	4.2a	17.3b	7.1a	39.3bc	10.3b	3.9bc	7.0ab	1586a
Binamoog-8 × 100 ppm	60.0d	3.1bc	16.3c	6.9b	39.1bc	9.5bc	3.8bc	6.9ab	1435b

In a column, the figures with similar letter(s) do not differ significantly by DMRT at $P \leq 0.05$.

CONCLUSION

Foliar application of chitosan at 50 ppm may be used at early growth stage for getting higher seed yield of summer mungbean.

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