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FOLIAR APPLICATION OF CHITOSAN IMPROVED GROWTH AND YIELD IN WINTER AND SUMMER TOMATO

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ABSTRACT

Islam MT, Khatoon M (2021) Foliar application of chitosan improved growth and yield in winter and summer tomato. *Int. J. Sustain. Crop Prod.* 16(1), 15-17.

Chitosan stimulates immunity of plants and improves crop growth and yield. Two experiments were conducted to investigate the effect of foliar application of chitosan on growth and yield of winter and summer tomato. The experiment comprised four levels of chitosan concentrations *viz*., 0 (control), 50, 75 and 100 ppm. The chitosan was sprayed two times, 25 and 35 days after transplanting. Foliar application of chitosan increased plant height, number of branches, fruits plant^{-1}, individual fruit weight and fruit yield in winter and summer tomato. The higher fruit yield was recorded in 75 ppm of chitosan in both winter and summer tomato. Therefore, foliar application of chitosan at 75 ppm may be used at early growth stage for getting maximum fruit yield of winter and summer tomato.

Key words*: chitosan, tomato, growth, yield, foliar spray*

INTRODUCTION

Tomato (*Lycopersicum esculentum* L.) is an important vegetable crop which is grown worldwide for its taste and nutritional status. Temperature has a significant influence on many aspects of growth and development in tomato (*Lycopersicon esculentum* Mill.). The optimum temperature for tomato production is 21ºC to 25ºC with an average monthly minimum temperature >18ºC and a monthly maximum temperature of 27ºC (Adams *et al*. 2001; Araki *et al*. 2000; Haque *et al*. 1999). Photosynthetic rate and yield decrease in tomato with the temperature 32^0C at pre-flowering and flowering stages (Islam 2010). Fruit set is optimal between 18ºC and 20°C (De Koning 1994). In Bangladesh, congenial atmosphere remains for tomato production during November to February (winter) and yield reduces in other months (Islam *et al*. 2007; Rahman *et al*. 1996). So, tomato is widely grown in Bangladesh usually in winter season. Physical and chemical mutagenes are using along with conventional method for development of tomato varieties (Alim *et al*. 2007). Some summer tomato varieties have already been developed and attempts are also continued to increased yield by proper management and cultural practices. Plant growth regulators are one of the most important factors for increasing higher yield in crops.

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 tomato in winter and summer seasons of Bangladesh.

MATERIALS AND METHODS

Two experiments were conducted with Binatomato-7 suitable for cultivation in winter and summer seasons, at BINA farm, Mymensingh, Bangladesh during 2019-20. The field experiment was conducted in winter (November 2019 to February 2020). Unit plot size was 4m x 5m. Row to row and plant to plant distance was 50 cm. Recommended doses of fertilizers were applied and cultural practices were done whenever required. The experiment was laid out in RCBD with three replications. The pot experiment was carried out in summer (March to June 2020). Each pot contained 12 kg soil. The design of the experiment was CRD with three replications. Morphological, reproductive and yield attributes were recorded during tomato harvest. Reproductive efficiency was calculated as follows: Reproductive efficiency % = (Number of fruits plant^{-1} ÷ Number of flowers plant^{-1}) × 100. Harvesting was done at different dates depending on fruit ripening. The collected 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

In winter, the results showed that plant height, number of branch, single fruit weight increased both at 75 and 100 ppm compared to control (Table 1). The highest fruit yield was recorded at 75 ppm followed by 100 ppm. The highest fruit yield in 75 ppm due to production of higher number of fruits plant^{-1} and higher single fruit weight. In summer, the results revealed that number of flowers and fruits plant^{-1}, reproductive efficiency (RE) and fruit yield plant^{-1} were increased by applying chitosan compared to control (Table 2). Number of flowers increased at 75 ppm, number of fruits increased at 50, 75 and 100 ppm, single fruit increased at 75 ppm and reproductive efficiency at 50 ppm. The highest fruit yield was found at 75 ppm followed by 50 ppm. The highest fruit yield in 75 ppm due to production of higher number of fruits plant^{-1} and higher single fruit weight. The results are in conformity with many authors (El Amerany, 2020; Hassnain *et al*. 2020; Islam *et al*. 2016; El-Tantawy, 2009).

Table 1. Effect of different concentrations of chitosan on growth and yield of tomato in winter season

Concentration of Chitosan (ppm)	Plant height (cm)	No. of branch plant^{-1}	No. of fruit plant^{-1}	Single fruit wt.(g)	Fruit wt. plant^{-1} (kg)	Fruit yield (t ha^{-1})
0	105.3b	5.2b	31.3b	39.2b	1.4c	51.2d
50	105.4b	5.1b	33.1b	40.5b	1.48b	54.3c
75	110.3a	6.2a	39.4a	42.4a	1.79a	61.3a
100	109.2a	6.1a	34.4b	41.2a	1.58b	60.2b

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

Table 2. Effect of different concentrations of chitosan on yield attributes and yield of tomato in summer season

Concentration of chitosan (ppm)	No. of flowers plant^{-1}	No. of fruits plant^{-1}	Single fruit wt. (g)	Reproductive efficiency (%)	Fruit yield plant^{-1} (g)
0	22.8b	9.1c	40.1b	39.1bc	385.3e
25	23.9b	10.8bc	39.1c	45.1bc	402.5d
50	27.4b	14.3b	42.3b	52.2a	541.2ab
75	30.7a	16.2a	44.6a	54.2b	654.3a
100	24.3b	11.1b	43.1b	35.7b	532.3bc

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

CONCLUSION

Foliar application of chitosan at 75 ppm may be used at early growth stage for getting maximum fruit yield of winter and summer tomato.

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