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RESEARCH ARTICLE

Effect of foliar application of urea on the growth and yield of tomato

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Abstract **To study the effect of foliar application of urea fertilizer on the growth and yield of tomato and to find out the optimum concentration of foliar application of urea for maximum growth and yield of tomato, an experiment was conducted with different concentrations of foliar application of urea fertilizer, namely, 2500, 5000, 7500, and 10000 ppm. The experiment was laid out by a randomized complete block design (RCBD) with four replications. Results showed that different yield components and yield of tomato were influenced by the foliar application of different concentrations of urea. The maximum plant height (132.6 cm), number of leaves (30.73), number of green leaves per plant at harvest (21.08), days to first flowering (28.94), number of flower clusters (11.89), number of flowers (75.18), fruit clusters (5.81), fruits per cluster (4.14), and fruits per plant (21.49); length (4.72 cm), diameter (6.58 cm), and weight of individual fruit (151.0 g) were significantly influenced by the 10000 ppm concentration of foliar application of urea fertilizer. The 10000 ppm application gave the highest yield (63.69 t/hm^2) with the lowest (28.48 t/hm^2) in the control treatment. The yield per plant as well as per hectare increased with increasing concentrations of foliar application of urea fertilizer.**

Keywords growth, yield, foliar, concentration, tomato

Introduction

Tomato (*Lycopersicon esculentum* Mill.), a member of the family Solanaceae, is one of the most popular and important vegetables grown in Bangladesh during the rabi season. It is cultivated in different parts of the country (Hoque et al., 1999).The present leading tomato production countries of the world are China, the United States of America (U.S.A), India, Egypt, Turkey, Iran, Italy, Mexico, Brazil, and Indonesia (FAO, 2000). In Bangladesh, tomato is receiving increasing attention of the growers and consumers because of its high nutritive value and taste. However, the yield of tomato in this country is not satisfactory enough in comparison with other tomato-growing countries of the world (Aditya et al., 1999). Thus, the average yield of tomato is 6.72 t/hm^2, while it is 66.57, 15.07, and 7.43 t/hm^2 in U.S.A, India, and Indonesia, respectively (FAO, 2000). There is a great possibility of increasing tomato crop yield per unit area with the proper and judicious use of fertilizers. In indeterminate type of tomato, apart from vegetative and reproductive stages, the plants need nutrients up to fruit ripening. To get one ton of fresh fruit, the plants need to absorb, on the average, 2.5–3 kg N, 0.2–0.3 kg P, and 3–3.5 kg K (Hedge, 1997). In the absence of other production constraints, nutrient uptake and yield are very closely related.

By foliar application, the absorption of sprayed nutrients takes place through both upper and lower surfaces of the leaves. Plants absorb nutrients not only through their leaves but also through the young fruits, stems, flowers, and other parts of the plants (Donahue, 1961), although the root is the principal nutrient-absorbing organ of the plants. Young and rapidly expanding leaves are more efficient in absorption than the fully matured leaves (Mitsui, 1968). Foliar application of nitrogenous fertilizer is an important method because plants can absorb the nutrients much quicker, and smaller quantities may be required for normal growth as against the large quantities of the same generally required for soil application (Mudaliar, 1959). Hinsvark et al. (1953) found that a good portion of nitrogen applied as urea spray is absorbed readily

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by plants in several hours. The soil application of fertilizer is not, therefore, a better method because of stated practical disadvantages, while spray application may be the most useful to supply the nutrients to the plants. In view of the above-cited facts, the experiment was conducted to know the effect of foliar application of urea on the growth and yield of tomato.

Materials and methods

Experimental materials

The tomato cultivar used in the experiment was Marglobe. The experiment was a single factor type with five concentrations of urea as 0 ppm (control), 2500 ppm (0.25%), 5000 ppm (0.50%), 7500 ppm (0.75%), and 10000 ppm (1%).

Methods

Raising seedling transplanted and foliar application of urea
The experiment was laid out by the randomized complete block design with four replications. Thirty-day-old tomato seedlings were transplanted to a total of 20 plots of 2.4 m × 2.4 m each on November 27, 2001 by maintaining agricultural operations and applying the doses of manures and fertilizer as recommended by the fertilizer Recommendation Guide (BARC, 1997). According to the treatments and layout, five different concentrations of foliar application of urea fertilizer were first sprayed 7 days after transplanting and, thereafter, applied regularly at 7-day intervals up to one week before final harvest.

Determining the effect of growth and yield of tomato
Ten plants were selected randomly from each plot, and the parameters were recorded including plant height, total number of leaves, number of green leaves per plant at harvest, days to first flowering, number of flower clusters per plant, number of fruits per cluster, number of fresh ripe fruits per plant, fruit length, frit length, fruit diameter, weight of individual fruit, weight of fruit per plant fruit yield per plot , and fruit yield per hectare.

The collected data on various parameters were statistically analyzed using MSTAT statistical package programmed, and the difference between means was evaluated by LSD.

Results

The results of the experiment revealed that all the physiological traits of the plant studied were significantly influenced by foliar application of urea. Plants grown in higher concentrations of urea showed a gradual increase in height at different DAP.

Effect of foliar application of urea on yield components

Foliar application of urea at 10000 ppm produced the tallest plants (132.6 cm), while the shortest plants (104.5 cm) were produced by 0 ppm (control) in the experiment (Table 1). Total number of leaves and number of green leaves per plant at harvest time were significantly influenced by different concentrations of foliar application of urea. The maximum values 30.73 and 21.08 of these traits were found at the higher concentration of urea (10000 ppm), and minimum values 17.65 and 9.8 were obtained from 0 ppm (control).

Effect of foliar application of urea on yield of tomato

The first flower truss appeared earlier at 10000 ppm (28.94) than the days required and that was delayed at 0 ppm (44.56). The highest number of flower clusters, number of flowers per plant, fruit clusters, fruits per cluster, and fresh ripe fruits per plant were significantly influenced by different concentrations of urea. The maximum values of these traits (11.89, 75.18, 5.81, 4.14, and 21.49) were found at the higher concentration of urea (10000 ppm). It was evident that there was an increasing response of all the parameters to the increasing concentrations of urea. However, the plants showed the minimum response to the treatment with no urea. The maximum length (4.72 cm), diameter (6.58 cm) and weight of individual fruit (151.0 g) were recorded at the higher concentration of urea (10000 ppm), while the minimum (2.18 cm, 2.57 cm and 50.90 g) were found in the 0 ppm treatment (control).

Different concentrations of urea exhibited marked influences on the fruit yield of tomato. The highest fruit yield per plant (3.17 kg) was produced by the plants receiving the 10000 ppm treatment. Plants fertilized with 10000 ppm urea gave the highest fruit yield per plot (36.69 kg) as well as per hectare (63.69 t), while the minimum fruit yield per plot (16.40 kg and 28.48 t) was in the control treatment.

Discussion

The most efficient utilization or economical use of fertilizers has become pertinent because of recent hike in their prices. Foliar feeding is one of the ways toward this goal because nutrients are applied directly to the site of their metabolism and are not subjected to the losses as in case of soil application. In respect to all the yield attributes and yield, foliar-applied urea showed a better performance at the higher concentration (10000 ppm). Increased foliar application of urea gave the highest total yield (Al-Sahhaf, 2000). Foliar application of urea fertilizer to increase tomato yield has also been reported by others (Chaudhuri and De 1975; Das and Patro 1989; Das and Singh 1989; Singh et al., 2000). The results indicated that further study should be undertaken by taking further increased concentrations of urea to find out the

Table 1 Effects of foliar application of urea on yield components and yield of tomato

Treatment	Plant height at final harvest (cm)	Total no. of leaves per plant	No. of green leaves per plant at final harvest	Days to first flowering	No. of flower clusters per plant	No. of flowers per cluster	No. of flowers per plant	No. of fruit clusters per plant
0 (F0)	104.50	17.65	9.80	44.56	6.30	4.74	28.69	2.70
0.25% (F1)	112.70	21.60	13.08	40.53	7.65	5.41	41.75	3.51
0.50% (F2)	114.80	24.45	15.38	36.13	9.25	5.49	54.69	3.67
0.75% (F3)	125.10	27.95	18.60	32.97	10.50	6.12	63.69	4.70
1.0% (F4)	132.60	30.73	21.08	28.94	11.89	6.93	75.18	5.81
LSD (0.05)	5.19	1.98	1.75	2.87	0.915	0.449	6.02	0.619
LSD (0.01)	7.28	2.78	2.45	4.03	1.28	0.630	8.44	0.853
Level of significance	**	**	**	**	**	**	**	**

Treatment	No. of fruits per cluster harvested	No. of fresh ripe fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Weight of individual fruit (g)	Yield of fresh ripe fruits per plant (kg)	Yield of fresh ripe fruits per plot (kg)
0 (F0)	1.92	5.78	2.18	2.57	50.90	0.24	16.40
0.25% (F1)	2.60	8.70	3.06	3.84	78.30	0.68	22.21
0.50% (F2)	2.80	11.20	3.28	3.94	95.75	1.29	26.77
0.75% (F3)	3.48	16.20	3.69	5.21	122.90	1.99	32.94
1.0% (F4)	4.14	21.49	4.72	6.58	151.00	3.17	36.69
LSD (0.05)	0.475	2.04	0.304	0.908	19.21	0.234	2.16
LSD (0.01)	0.666	2.87	0.427	1.27	26.93	0.328	3.03
Level of significance	**	**	**	**	**	**	**

peak point of maximum urea concentration corresponding to the maximum growth and yield of tomato.

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