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Effect of Auxin Precursor (L-Tryptophan) on the Growth and Yield of Tomato (*Lycopersicon esculentum*)

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Abstract: Studies were conducted to observe the effect of L-tryptophan on growth and yield of tomato. It has been concluded that L-tryptophan improved the vegetative and reproductive growth of tomato. Higher concentrations of Ltryptophan i.e., 10^{-4} ML^{-1} and 10^{-1} ML^{-1} were found much suitable to boost up stem height, number of leaves per plant. Lower concentrations of L-tryptophan i.e., 10^{-2} ML^{-1} and 10^{-3} were found favourable to improve reproductive characters i.e., number of trusses, fruits per truss and per plant, weight of fruit and number of seeds. TSS was lowered with the application of the chemical and ascorbic acid was enhanced with 10^{4} ML^{-1} concentration of L-tryptophan.

Key words: Auxin, L-tryptophan, vegetative growth, trusses, flowers, fruits, TSS and ascorbic acid

Introduction

Tomato (*Lympersicon wulantum*) is an important vegetable crop in Pakistan and all over the world. Total area under this crop in Pakistan is 28880 hectares with a production of 313072 tonnes annually (Anonymous, 1998).

It is highly prized for its monitory gain and nutritional values especially for its richness in vitamin-C and minerals. It is commonly used in various forms such as processed like ketchup, paste etc. Yield of tomato crop is far low in Pakistan as compared to other advanced countries. Various techniques such as fertilizer application, cultural practices have been tried in past to improve the production of tomatoes in the country, but still the yield has not been increased progressively. A new biological technique for improving the yield of crops by use of growth regulators are being advocated in Agriculture and has become popular in vegetable growers all over the world.

Wu *et al.* (1994) reported that one month old transplanted tomato plants, when sprayed with IAA at 2500, 5000 and 10000 ppm, inhibited plant height, stem fresh and dry weight and increased number of trusses per plant. Sumiati (1997) reported that fruit setting as compared with control was hastened by 4-5 days in tomatoes by the application of 100 ppm IAA. Fruit number per plant and total fruit weight ha^{-1} was significantly increased. Shahan *et al.* (1987) reported that 500 ppm L-tryptophan gave the highest number of pods per plant in *Vicia faba.* Pod dry weight and yield per plant was also increased. Frankenbenger and Arshad (1991) reported that the application of L-tryptophan on the yield of two watermelon and one muskmelon cultivars were studied and it was observed that application of L-tryptophan increased the cumulative weight of water melon from 42 to 80 percent over control.

Frankenberger and Arshad (1991) in an experiment on pepper plants revealed that 60 ppm L-tryptophan applied through foliage spray resulted in maximum fresh fruit weight per plant. Edison (1991) reported the effect of IAA on the development of tomato fruit cv. Ratna by applying one drop of 0.0, 0.1, 0.2, 0.3, 0.4, and 0.5 percent IAA on pistil of young tomato flowers and repeated 10 days afterwards. The result showed that IAA significantly affected the development of reproductive organs of tomato flower, increased fruit size. Concentration of 0.4 and 0.5% of IAA was able to increase tomato yield due to the increasing of fruit weight and fruit size. However, concentration at 0.1 and 0.3%, IAA gave better results than the control. Azam (1994) reported in an experiment on potted potato plants that application of 10^{-5} g L-tryptophanikg enhanced plant height by 7.83 percent over control. Akhtar (1994) had reported that maximum yield was obtained where L-tryptophan 10^{-5}g kg^{-1} was applied on potted tomato plants. Keeping in view the above facts, present project was envisaged to evoke into the wonderful effects of Ltryptophan (precursor of IAA) on growth and yield of tomatoes.

Materials and Methods

The studies were carried out in the Vegetable Area, Department of Horticulture, University of Agriculture, Faisalabad during the year 1998. The experimental materials were comprised of tomato cv. Nagina, and a growth regulator, L-tryptophan, a precursor of IAA. After 40 days of seed sowing, the seedlings were dipped for half an hour in one beaker of water as a control and four beakers of different concentrations of L-tryptophan. These seedlings, after treatment, were transplanted in the field and irrigated immediately after transplanting. There were four replications for each treatment and various treatments were as:

T1 = Control
T2 = $1Cr^{2}M$ L-TRP L^{-1}
T3 = 10^{-3} M L-TRP L^{-1}
T4 = $10r^{4}M$ L-TRP
T5 = $10\text{-}^{5}M$ L-TRPL^{-1}

The experiment was laid out according to the RCB design. Data were analyzed statistically and the difference among treatment means was evaluated in view of DMR test (Steel and Torrie, 1980).

Results

The data recorded on various parameters is given in Table 1 and is discussed as under:-

Main Stem Height: It is clear from the Table 1 that highly significant results were obtained on main stem height. 10^{-5}M LTRP L1 produced maximum height, although it was statistically at par with 10^{-2} M L-TRP L^{-1}, 10^{-3} M L-TRP L^{-1} and 10^{-4} M LTRP L^{-1} while control gave the lowest plant height.

Number of Leaves/plant: It is interesting to note that 10^{-4} M LTRP L^{-1} gave maximum number of leaves per plant, although plant height was maximum in 10^{-5} M L-TRP L^{-1} but it came on fourth number for number of leaves per plant. 10^{-3}M L-TRP L^{-1} was similar to 10^{-4} M L-TRP L^{-1} statistically, next best treatment was 10^{-2} M L-TRP L^{-1} which was at par statistically with 10^{-5} M L-TRP L^{-1}. Control produced the lowest number.

Number of Trusses per plant: Table 1 indicates significant supremacy of 10^{2} M L-TRP L^{-1} over 10^{-4} M L-TRP L^{-1} and

Table 1: Effect of Auxin precursor (L-tryptophan) on the Growth and Yield of Tomato (*LycoBersicon esculentum*)

Treatments	1	2	3	4	5	6	7	8	9	10	11
T1	75.49b	285.8c	33.00b	1 .164ab	38.38b	22.88b	1.909c	85.10bc	1944.00b	5.460a	15.77d
T2	85.19a	356.Oab	42.50a	0.864c	36.75b	34.13a	2.243ab	91.88a	3281.00a	5.375ab	15.40d
T3	83.10a	373.4a	40.63a	1.084ab	43.25a	22.38b	2.461a	90.75ab	2003.00b	5.063c	19.09b
T4	84.290	385.1ab	37.75ab	0.969bc	36.13b	24.50b	2.236ab	83.63c	2105.00b	5.175bc	20.44a
T5	88.25a	339.1b	38.75a	1.229a	46.50a	25,50b	2.089bc	82.75c	2127.00b	5.125c	17.99c

1 = Main Stem Height (cm); 2 = No. of leaves per plant; 3 = No. of Trusses per plant; 4- No. of Flowers per truss; 5 = No. of Flowers per plant;6 = No. of Fruits per plant; 7 = Weight of Fruits per plant (Kg); 8 = No. of Seeds per fruit; 9 = No. of Seeds per plant; 10 = Total Soluble Solids; 11 = Ascorbic Acid Contents (mg per 100 gm); Values sharing same letters don't differ at 0.05 probability level.

control. While it stood at par with 10^{-3} M L-TRP L^{-1} and 10^{-5} M L-TRP L^{-1} lowest number of trusses were observed in control. While it stood at par with 10^{-3} M L-TRP L^{-1} and 10^{-5} M L-TRP L^{-1}. Lowest number f trusses use observed in control.

Number of flowers per truss: Significant difference of 10^{-5} M LTRP L^{-1} is revealed from Table 1. The control, 10^{-3} M L-TRP L^{-1} and 10^{-1} M L-TRP L^{-1} behaved statistically alike. The lowest number of flowers per struss was obtained in 10^{-2}M L-TRP L^{-1} even less than control.

Number of flowers per plant: Table 1 reveals significant supremacy of 10^{-5} M L-TRP L^{-1} over all other treatments except 10^{-3} M L-TRP L^{-1} with which it was similar statistically. All other treatments were statistically at par in order of merit as control, 10^{-2} M L-TRP L^{-1} and 10^{-4} M L-TRP L^{-1}.

Number of fruits per plant: It is evident from the Table 1 that there are two groups 10^{-2} M L-TRP L^{-1} occupied the highest position, whereas all other treatments formed the second group and found statistically similar by producing fruits per plant in an order of 10^{-5} M L-TRP L^{-1}, 10^{-4} M L-TRP L^{-1}, T1 and 10^{-3} M LTRP L^{-1}.

Weight of fruit per plant: Table 1 indicates the supreme position of $1T^{3}$M L-TRP L^{-1}. This was followed by 10^{-2} M L-TRP L^{-1} and 10^{-4} M L-TRP L^{-1} which were similar statistically. The next best treatment was 10^{-5} M L-TRP L^{-1} and lowest position was obtained by control.

Number of seeds per fruit: Highly significant results are revealed from Table 1. Maximum number of seeds per fruit were found in 10^{-2} M L-TRP L^{-1}, which was followed by 90.75 seeds per fruit produced by 10^{-3} M L-TRP L^{-1}. 10^{-5} M L-TRP L^{-1} occupied the bottom position and produced the least number of seeds per fruit. control and 10^{-4} M L-TRP L^{-1} got the intermediate position.

Number of seeds per plant: An examination of the Table 1 depicts a sequence of 10^{-2} M L-TRP L^{-1}, 10^{-5} M L-TRP L^{-1}, 10^{-4} M LTRP L^{-1}, 10^{-3} M L-TRP L^{-1} and control. 10^{-2} M L-TRP L^{-1} occupied the highest position than others and all other treatments were at par statistically.

Total soluble solids: Control outstead all other treatments for the amount of total soluble solids. 10^{-3} M L-TRP L^{-1} was found at the bottom. The second position was occupied by 10^{-2}M L-TRP L^{-1}. Other treatments lie in between.

Ascorbic Acid contents (mg/100 fruit): 10^{-4} M L-TRP L^{-1} was found more effective than other treatments in producing ascorbic acid contents in fruit. Next best treatment was 10^{-3}M L-TRP L^{-1}. 10^{-6} M L-TRP L^{-1} produced only 17.99 mg/100 g ascorbic acid yet it was found better than control and 10^{-2} M L-TRP L^{-1}.

Non significant results were obtained for height of seedlings, number of branches per plant, number of fruits per truss and fruit size, hence no need of discussion about these characters.

Discussion

L-tryptophan (precursor of IAA) was found much effective to improve various vegetative and reproductive growth characters. The endogenous level of harmones may be activated with the exogenous applications, thus growth and yield was improved. Results of our project are similar to the findings of Akhtar (1994), Azam (1994) and Edison (1991).

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