*Environment & Ecology* 29 (3) : 1091—1093, 2011
 *ISSN 0970-0420*

# Role of NAA on Growth, Yield and Quality of Tomato (*Lycopersicon esculentum* Mill.) Cultivars

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**Abstract**

An experiment was carried out during the *rabi* season of 2007-2008 to find out the effect of different doses of NAA ($N_0$ 0 ppm, $N_1$ 50 ppm, $N_2$ 100 ppm and $N_3$ 120 ppm) on vegetative growth, yield and quality of three tomato cultivars viz., NUN-1560 ($V_1$), NUN-964 ($V_2$) and NUN-963 ($V_3$). The results revealed that cultivars, NAA doses and their interaction effect were significant regarding yield and yield contributing characters and quality parameters. The maximum plant height (cm), diameter of main shoot (mm), number of fruit clusters per plant, number of seeds per fruit, number of fruits per plant and fruit yield per ha (q) was observed in cultivar $V_1$. The highest plant height (cm), number of branches per plant, number of fruit clusters per plant, number of fruits per plant, fruit length (cm), fruit width (cm), fruit yield per ha (q), storability (day) and total soluble solids (TSS). $^0$Brix were recorded with $N_1$ (NAA 50 ppm). The cultivar $V_1$ with growth regulator $N_1$ exhibited the highest value for almost all the characters.

**Key words : Tomato, Naphthalene acetic acid (NAA), Cultivar, Growth, Yield.**

Tomato (*Lycopersicon esculentum* Mill.) is commercially important throughout the world both for fresh fruit market and for the processed food industries, and it ranks second in importance after potato in many countries. There are many methods adopted to increase the yield of the crop which comprise mainly of cultural and chemical practices. Both these techniques have been successfully exploited by many to increase the yield of tomato. In the present study we are concerned with the chemical i.e. growth regulator NAA. The specific quantities of growth regulators in the plants are directly responsible for the promotion, inhibition or otherwise modification in the physiological processes. Synthetic auxin analogs include 1-naphthalene acetic acid (NAA), 2, 4-dichlorophenoxyacetic acid (2, 4-D), and others. The effect of NAA has been observed to mainly effect cell elongation, improves phototropism, apical formation, respiration and flower bud initiation (1). NAA is commonly used in horticulture crops. The higher concentrations of NAA inhibit growth and exert toxic effects on the plants so optimum concentrations are required for beneficial effects of NAA. The NAA perhaps interfere with the variation in temperature which in turn affects the flowering adversely. It also affects the physiological processes, hastens maturity and produces better quality fruits. Therefore, the present experiment was planned to study the role of NAA on growth, yield and quality of tomato.

## Methods

The present investigation was carried out during *rabi* season from September 2007 to April 2008 at the Vegetable Research Farm of the Department of Horticulture, Institute of Agricultural Sciences, B.H.U., Varanasi (UP). Three hybrid varieties of tomato ($V_1$ : NUN-1560, $V_2$ : NUN-964 and $V_3$ : NUN-963) was selected for the present study. The treatments comprised of four levels of plant growth substances i.e. NAA ($N_0$ : control, $N_1$ : 50, $N_2$ : 100 and $N_3$ : 120 ppm). The experiment was laid out in factorial randomized block design with three replications. The soil was sandy loam and had good fertility. The plot size was 3 × 2.25 m and spacing was 60 × 45. NAA applied was in the form of planofix and was applied with hand sprayer. It was used at 50% flowering stage of the plant. The observations were recorded from 10 competitive plants from each replication on thirteen parameters viz., plant height (cm), number of branches per plant, fruit length (cm), fruit width (cm), number of fruit clusters per plant, number of fruits per cluster,

**Table 1.** Combined effect of cultivars and NAA doses on vegetative growth, yield and quality of tomato.

| Treatment combination | Plant height (cm) | Number of branches per plant | Fruit length (cm) | Fruit width (cm) | Number of fruit clusters per plant | Number of fruits per cluster | Number of fruits per plant | Average fruit weight (g) | Number of seeds per fruit | Fruit yield per ha (q) | Storability (day) | Total soluble solids (TSS) $^0$Brix | Reducing sugar (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $V_1N_0$ | 59.30 | 7.21 | 2.81 | 3.23 | 4.51 | 4.07 | 15.38 | 65.86 | 86.33 | 428.61 | 10.00 | 2.90 | 1.15 |
| $V_1N_1$ | 65.70 | 9.20 | 3.78 | 3.79 | 7.68 | 5.67 | 23.37 | 71.54 | 97.70 | 591.58 | 12.84 | 3.50 | 1.40 |
| $V_1N_2$ | 63.41 | 7.70 | 3.45 | 3.38 | 7.19 | 5.14 | 22.33 | 68.59 | 94.70 | 571.50 | 11.62 | 3.21 | 1.43 |
| $V_1N_3$ | 61.21 | 7.53 | 3.30 | 3.27 | 6.92 | 4.55 | 20.22 | 67.79 | 93.66 | 515.30 | 10.62 | 3.01 | 1.41 |
| $V_2N_0$ | 57.19 | 7.20 | 3.20 | 3.21 | 5.11 | 4.10 | 15.84 | 65.33 | 80.88 | 394.81 | 8.58 | 2.80 | 1.19 |
| $V_2N_1$ | 63.62 | 9.23 | 4.67 | 4.24 | 7.44 | 5.98 | 21.00 | 72.18 | 82.89 | 555.80 | 11.90 | 3.27 | 1.45 |
| $V_2N_2$ | 62.26 | 8.43 | 4.10 | 3.48 | 6.18 | 5.35 | 19.64 | 67.90 | 76.60 | 474.44 | 11.36 | 3.17 | 1.56 |
| $V_2N_3$ | 59.23 | 7.57 | 4.06 | 3.39 | 5.87 | 4.71 | 19.52 | 66.37 | 69.62 | 441.84 | 9.92 | 3.16 | 1.53 |
| $V_3N_0$ | 57.58 | 6.17 | 3.27 | 2.85 | 3.66 | 4.17 | 12.74 | 63.62 | 68.20 | 315.32 | 9.64 | 2.96 | 1.25 |
| $V_3N_1$ | 64.32 | 7.53 | 4.65 | 4.01 | 4.98 | 6.81 | 18.25 | 73.00 | 78.52 | 480.00 | 13.21 | 3.71 | 1.63 |
| $V_3N_2$ | 62.49 | 7.50 | 4.51 | 3.60 | 4.66 | 6.61 | 16.93 | 71.06 | 75.73 | 444.94 | 12.44 | 3.53 | 1.70 |
| $V_3N_3$ | 59.84 | 5.93 | 3.98 | 3.37 | 4.02 | 5.53 | 16.76 | 69.05 | 74.22 | 428.39 | 11.16 | 3.36 | 1.66 |
| SE ± | 0.62 | NS | NS | NS | 0.45 | 0.27 | NS | NS | NS | 6.75 | 0.46 | 0.14 | 0.03 |
| CD at 5% | 1.81 | NS | NS | NS | 1.30 | 0.78 | NS | NS | NS | 19.81 | 1.37 | 0.42 | 0.10 |

number of fruits per plant, average fruit weight (g), number of seeds per fruit, fruit yield per hectare (q), storability (days), total soluble solids (T. S. S. in $^0$Brix) and reducing sugar (%). The analysis of variance was done as suggested by Panse and Sukhatme (2).

## Results and Discussion

All the cultivars studied showed significant difference for all characters related to growth, yield and quality attributes (Table 1). The growth and yield attributes were also found significant in relation to varying levels of NAA doses. The maximum plant height (65.70 cm) was recorded in treatment combination $V_1N_1$ followed by $V_3N_1$ (64.32) and $V_2N_1$ (63.92), while, it was found minimum in treatment combination $V_2N_0$ (57.19 cm). As for as the number of branching is concerned, the maximum number of branches per plant was exhibited by treatment combination $V_2N_1$ (9.23) and it was at par with $V_1N_1$ (9.20) followed by $V_2N_2$ (8.43), whereas, the minimum number of branches per plant was recorded by treatment combination $V_3N_3$ (5.93). Fruit length was maximum by treatment combination $V_2N_1$ (4.67 cm) which was at par with $V_3N_1$ (4.65 cm) followed by $V_3N_2$ (4.51 cm), while , it was registered minimum in treatment combination $V_1N_0$ (2.81 cm). But in case of fruit width, almost similar pattern was observed. The maximum fruit width was exhibited by treatment combination $V_2N_1$ (4.24 cm) followed by $V_3N_1$ (4.01 cm) and $V_1N_1$ (3.79 cm) and minimum value was observed in treatment combination $V_3N_0$ (2.85 cm). In case of number of fruit clusters per plant, the highest number of fruit clusters was exhibited by treatment combination $V_1N_1$ (7.68) which was at par with $V_2N_1$ (7.44) followed by $V_1N_2$ (7.19) while, it was found minimum in treatment combination $V_3N_0$ (3.66). However, number of fruits per cluster was observed maximum with treatment combination $V_3N_1$ (6.81) which was at par with $V_3N_2$ (6.61) followed by $V_2N_1$ (5.98) and $V_1N_1$ (5.67), whereas, minimum value was observed in treatment combination $V_1N_0$ (4.07). The number of fruits per plant is a very important character, if there is more number of fruits, obviously there is more yield. The maximum number of fruits per plant was recorded with treatment combination $V_1N_1$ (23.37) followed by $V_1N_2$ (22.33) and $V_2N_1$ (21.00), while, it was found minimum in treatment combination $V_3N_0$ (12.74). The maximum average fruit weight was recorded with treatment combination $V_3N_1$ (73.00 g) followed by $V_2N_2$ (72.18 g) and $V_1N_1$ (71.54 g), whereas, it was minimum in treat-

ment combination $V_3N_0$ (63.52 g). It was also noted that, if the number of fruits was more, the average fruit weight was less. As for as, number of seeds per fruit is concerned, it was found highest in variety $V_1$ with treatment combination of $V_1N_1$ (97.70) followed by $V_1N_2$ (94.70) and $V_1N_3$ (93.66). Whereas, the minimum number of seeds per fruit was recorded with treatment combination $V_3N_0$ (68.20 g). Yield is also very important character for any crop and it was found highest in treatment combination $V_1N_1$ (591.58 q) followed by $V_1N_2$ (571.50 q) and $V_2N_1$ (555.80 q), while it was observed minimum with treatment combination $V_3N_0$ (315.32 q).

A significant variation of cultivars and NAA levels was found on quality parameter of tomato (Table 1). The maximum storability was recorded with treatment combination $V_3N_1$ (13.21), which was statistically at par with $V_1N_1$ (12.84) followed by $V_3N_2$ (12.44). The minimum storability was recorded in treatment combination $V_2N_0$ (8.58). The maximum T. S. S. was recorded with treatment combination $V_3N_1$ (3.71 $^0$Brix) which was statistically at par with $V_3N_2$ (3.53 $^0$Brix) followed by $V_1N_1$ (3.50 $^0$Brix), but, minimum value was registered by treatment combination $V_2N_0$ (2.80 $^0$Brix). In case of reducing sugar, it was found maximum with treatment combination $V_3N_2$ (1.70%) followed by $V_3N_3$ (1.66%) and $V_3N_1$ (1.63%) and the lowest value was recorded in treatment combination $V_1N_0$ (1.15%). The results of the experiment were in agreement with the findings of Akhtar et al. (3), Bhosle et al. (4), Perez-Zabath and Ramirez (5), Phookan et al. (6) and Singh (7) for so many characters.

On the basis of the present investigation it could be concluded that, the veriety $V_1$ (NUN-1560) and $V_2$ (NUN-964) along with concentration of $N_1$ (50 ppm NAA) were found to be superior for almost all characters. Hence these hybrids cultivars and 50 ppm concentration of NAA could be recommended for commercial cultivation under the agro-climatic conditions of Varanasi after large scale testing in farmer's fields.

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