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Effect of GA_3 and NAA on growth and yield of tomato

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Abstract: A field trial on the effect of GA_3 and NAA was conducted on tomato cv. Kashi Vishesh during the rabi season of 2011-12. The different concentration of GA_3 (20, 40, 60 and 80 ppm) and NAA (25, 50, 75 and 100 ppm) were sprayed on the crop to study the growth behavior and yield and yield attributes of tomato. It was found that there was a linear increase in growth parameters like plant height and number of branches per plant with increasing level of GA_3 and NAA. The maximum plant height was recorded as 85.3 cm and 82.3 cm with the application of GA_3 @ 80ppm and NAA @ 100ppm, respectively after 60 days of transplanting. Similarly, the yield and yield attributes were also affected significantly with increasing concentrations of GA_3 and NAA. A maximum yield of 483.6q/ha and 472.2 q/ha was obtained with the use of GA_3 @ 80ppm and NAA @100ppm, respectively.

Keywords: Tomato, GA3, NAA, growth character, yield and yield attributes.

Introduction

Vegetable is the most important component of a balanced human diet and act as a protective food. Among vegetables, tomato (*Solanum lycopersicum* Mill.) is one of the most popular and widely grown vegetables in the world, ranking second after potato and it is grown under wide range of climatic conditions. Presently, a large number of growth regulators are available in the market but basically they are of two types i.e. growth promoters and growth inhibitors or retardants. Among growth promoters, Gibberellic Acid (GA_3) and Naphthalene Acetic Acid (NAA) play an important role to in improving the plant growth and yield of vegetable crops. GA_3 is one of the important growth stimulating substances which promote cell elongation and cell division thus help in the growth and development of many plants. NAA affects the physiological processes, hastens maturity and improving the quality of fruits. There are many cultural and chemical practices to increase the yield of the crops. Application of plant growth regulator for improving the yield and quality of many vegetable crops has been emphasized by several workers (Pundir and Yadav, 2001, Bhosle *et al.,* 2002 and Meena, 2008). However, the improvement in the yield and quality of the crops mainly depends on the concentration of plant growth regulator and time of application (Singh, 1995). Therefore, the present investigation was carried out to study the effect of Naphthalene Acetic acid (NAA) and Gibberellic Acid (GA_3) on growth and yield of tomato cv Kashi Vishesh.

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Materials and Methods

The present experiment was conducted at the experimental farm of Indian Institute of Vegetable Research, Varanasi during Rabi season of 2011-12. The soil of the experimental site was Typic Ustochrept having silt loam texture and slightly alkaline reaction (pH 7.75). It was non-saline in salt content (EC 0.574 dS/m) low in organic carbon (0.43%) and available nitrogen (215.0 kg/ha), medium in ammonium acetate extractable K (215 kg/ha) and high in available P (36.5 kg/ha). The experiment was laid out in Randomized Block Design (RBD) with three replications .The treatments comprised of four levels each of Gibberellic Acid (GA3) i.e. (20, 40, 60 & 80 ppm) and NAA (25, 50, 75 & 100 ppm) along with a control. Twenty one days old seedlings of tomato (cv. Kashi Vishesh) were transplanted on 28.10.2011 at a distance of 90 cm X 60 cm in 5mx3m plots. Nitrogen was applied @120kg/ha in three split doses. Half dose of nitrogen was applied as basal and rests half in the two equal split doses at 30 and 50 days after transplanting. Potassium and phosphorus were applied @ 60kg /ha each as basal through muriate of potash and single super phosphate, respectively. For the application of growth regulators, first of all a stock

solution of 1000 ppm of GA_3 and NAA was prepared. Then, working solutions of 20, 40, 60, 80 ppm of GA_3 and 25, 50, 75, 100 ppm of NAA were prepared by diluting the sock solutions with distilled water. The spraying of these solutions of GA_3 and NAA was done as per the treatments at different time intervals. The first spray was done after 15 days of transplanting and subsequently three sprays were done at 15 days intervals. The crop was raised following standard agronomic practices. The data on growth parameter like plant height, number of branches were recorded at different growth stages by selecting five plants randomly in each experimental plot. Similarly, the yield and yield attributing parameters were also recorded and the data were analyzed as per standard analytical procedures.

Results and Discussion

The data on growth parameters i.e. plant height and number of branches as influenced by GA_3 and NAA application at various growth stages are presented in Fig 1 & 2. It is evident from the data that the plant height and number of branches/plant increased significantly with the increasing level of GA_3 and NAA. The maximum plant height was recorded as 85.3cm and 82.3cm with the spray of GA3 @ 80 ppm and NAA @ 100 ppm, respectively at 60 days after transplanting (DAT). Similar trend was also noticed with the number of branches per plant. This might be due to rapid increase in cell division and cell elongation in the meristematic region. These results are in conformity with those of Gupta and Gupta (2000) and Rai *et al.*, (2006). The results presented in table 1 clearly show that fruiting and yield parameters such as percent fruit set, number of fruits/plant, average fruit weight, length of fruit, fruit width and fruit yield/ha increased significantly with the application of GA_3 and NAA. It is due to the fact that application of GA_3 and NAA check the flowers and fruit drop and ultimately increase the percent of fruit set. These findings are in accordance with the work reported by Meena, (2008).

Application of GA_3 and NAA significantly increased the number of fruits per plant. The increasing number of fruits per plant by GA_3 and NAA treatment might be due to rapid and better nutrient translocation from roots to apical parts of the plant. These results are in accordance with those reported by Singh *et al.,* (2001) and Bhosle *et al.,* (2002). The size and weight of fruit is also an important aspect as these characters are useful for yield determination and consumer's acceptability. The average fruit weight, length of fruit and width of fruit were significantly increased with the application of GA_3 and NAA and the maximum values were recorded at 80 ppm of GA_3 and 100 ppm of NAA. This may be attributed to the increased supply of photosynthetic materials and its

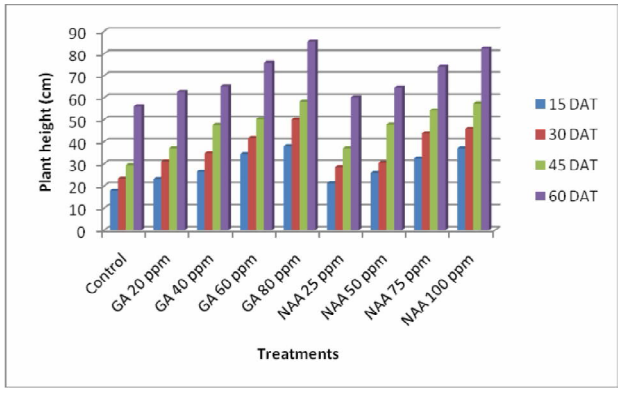

Fig. 1: Plant height of tomato as affected by GA and NAA

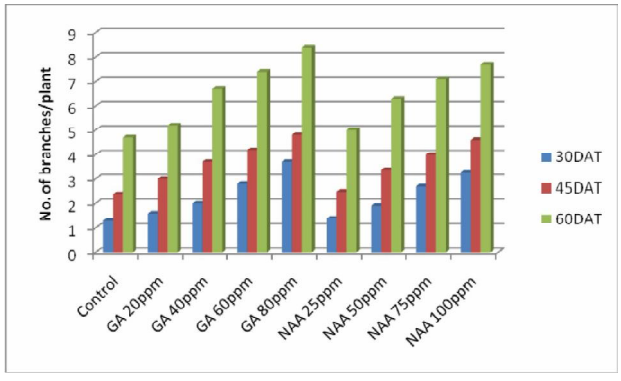

Fig. 2: Number of branches in tomato as affected by GA and NAA

Table 1. Effect of GA_3 and NAA on yield and yield attributing characters of tomato

Treatment	Percent fruit set	No. of fruits/ plant	Fruit weight (g)	Fruit length (cm)	Fruit width (cm)	Rind thickness (cm)	Fruit yield (q/ha)
Control	30.6	13.2	80.5	4.3	4.4	0.40	380.7
GA 20 ppm	35.4	18.7	85.1	4.8	4.92	0.45	396.2
GA 40 ppm	40.2	22.7	120.2	5.06	5.21	0.48	418.6
GA 60 ppm	47.3	26.2	125.7	5.92	6.20	0.52	446.5
GA 80 ppm	51.6	30.2	130.8	6.46	6.86	0.56	483.6
NAA 25 ppm	32.1	18.5	84.1	4.6	4.72	0.44	390.5
NAA 50 ppm	37.7	21.7	118.2	4.82	4.90	0.45	402.7
NAA 75 ppm	44.5	23.4	121.8	5.78	6.11	0.50	433.6
NAA 100 ppm	49.1	24.7	128.6	6.08	6.38	0.55	474.2
CD (0.05)	3.42	9.50	6.48	1.23	1.01	NS	12.6

efficient mobilization in plants giving rise to increased stimulation of fruit growth ultimately resulting in increased fruit weight, fruit length and fruit width Bhosle *et. al*., (2002) and Pundir and Yadav (2001).

The fruit yield per hectare significantly increased with the application of NAA and GA3 as compared to control. The maximum fruit yield (483.6q/ha) was obtained with application GA_3 @80 ppm closely followed by NAA@ 1000 ppm (474.2q/ha). The possible reason for increasing in fruit yield per hectare is due to increase in number of fruits per plant, average fruit weight and fruit yield per plant. These results are in conformity with the finding of Akhtar *et al*., (1996) and Soha *et al*., (2009).

From these results, it may be inferred that the application of GA_3 @80 ppm or NAA 100 ppm may be adopted to enhance the productivity of tomato.

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