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Short communication

Effect of different concentration of plant growth regulators on the yield and quality attributes of tomato (*Lycopersicon esculentum* Mill.)

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Tomato is one of the most important vegetable crops because of its nutritive value. It is rich in vitamins and minerals. Several research workers have studied the effect of plant growth substances on vegetable crops. Among them, gibberellins particularly GA_3 and Naphthalene acetic acid (NAA) have been reported to show promising effect on tomato crop. Thus, it is imperative to determine their concentration, time and mode of application for Chitrakoot area of Bundelkhand.

Four varieties of tomato namely Pusa Ruby, Pusa early Dwarf, T-5 and improved local variety were taken for the present investigation. The seeds of these varieties were treated with two plant growth regulators, GA_3 and NAA with four concentrations, (control, 10 ppm (5 mg + 5 mg NAA) , 20 ppm (10 mg GA_3 +10 mg NAA), 30 ppm (15 mg GA_3 +15 mg NAA) and were grown in nursery. Four week old seedlings were transplanted in the field in randomised block design with three replications at Rajaula Farm, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna, M.P. during 2006-07. Each replication consisted of 16 treatment combinations. All the treatments were randomised separately in each replication. The row to row distance was kept 60 cm and plant to plant distance was 60 cm. The gross plot size was 180 cm X 180 cm and net plot size was 120 cm X 120 cm. A light irrigation was given immediately after transplanting. Recommended agronomic and plant protection measures were applied for raising a good crop. The first picking of mature fruits was done on 16th February 2007 and there after continuous picking was done at an interval of 7 days total 12 picking were done. Data were recorded on plant height (cm), number of branches per plant, number of flower clusters per plant, number of fruits per plant, weight per fruit (g), number of fruits per plot, yield per plot (kg) and yield per hectare (q).

The mean values of different treatments of tomato varieties are presented in Table 1. Mean plant height was recorded at 90 DAT. The level of plant growth regulators exerted significant effect on plant height with the increasing plant growth regulators up to 20 ppm (GA_3 + NAA) increased the plant height significantly (73.42 cm) Higher dose of plant growth regulator (30 ppm) has not shown increase in plant height.

The interaction between varieties and plant growth regulator levels were found to be non-significant. However, the overall mean value indicated that the seed treatment of 20 ppm (GA_3 + NAA) resulted in maximum plant height in Improved local. The number of branches/ plant was significantly influenced by the varieties and plant growth regulators. The variety Pusa Early dwarf

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exhibited maximum number of branches (16.40/plant) which was significantly superior to the remaining varieties. The plant growth regulators exhibited significant effect on the number of branches. Application of 20 ppm (GA_3 + NAA) showed significantly higher number of branches per plant (15.81/plant) followed by 10 ppm (GA_3 + NAA) with 14.80 branches /plant. The interaction effect of varieties growth regulators was found to be non-significant. However, the variety Pusa Early Dwarf with 20 ppm (GA_3 + NAA) give the maximum number of branches (17.33//plant)

The number of fruits was significantly influenced due to variety and plant growth regulators. However, the treatment interactions were found to be non-significant. The variety Pusa Early Dwarf produced maximum number of fruits up to 27.50/plant followed by improved local with 21.5 fruit/plant. These varieties were significantly superior to Pusa Ruby and Type-5.

Application of 20 ppm (GA_3 + NAA) give significantly higher number of fruits (28.0) as compared to control and 10 ppm (GA_3 + NAA) followed by 10 and 30 ppm (21.0 to 21.2 fruits/plant). The interaction effect among the treatments was found to be non-significant. However, the variety Pusa Early Dwarf with 20 ppm (GA_3 + NAA) produced higher number of fruits (34.5/ plant). The average weight per fruit was significantly affected due to varieties and plant growth regulators. The interaction between varieties and plant growth regulators was non-significant. The variety Pusa Early Dwarf exhibited the highest weight per fruit (68.5 g) which was significantly superior to Pusa Ruby (54.6 g) and the Improved variety (52.9 g) followed by Type-5 (60.9 g).

Application of increasing levels of plant growth regulators up to 20 ppm (GA_3 + NAA) increased the weight per fruit (70.8 g) significantly. Beyond this dose up to 30 ppm reduced the weight of fruit (60.0 g). The interaction effect between treatments was found to be non-significant. However, the variety Pusa Early Dwarf with 20 ppm (GA_3 + NAA) produced the maximum fruit weight (86.3 g) followed by Type-5 (76.8 g). The number of fruits /plot was significantly influenced due to variety and plant growth regulators. However, the treatment interactions were found to be non-significant. The variety Pusa Early Dwarf recorded maximum number of fruits per plot up to 246.2 followed by improved local (193.7) which were significantly superior to Pusa Ruby (169.2) and Type-5 (170.7 fruits). The application of 20 ppm (GA_3 + NAA) significantly increased the number of fruits (253.6) per plot over control and 10 ppm (GA_3 + NAA). The treatment interactions were found to be non-significant. However, with the application of Pusa Early Dwarf 20 ppm (GA_3 + NAA), resulted in highest number of fruits up to 308.8 per plot followed by Improved local growth with 10 ppm (GA_3 + NAA) with 278.6 per plot.

Per hectare yield of tomato was significantly influenced due to different varieties and plant growth regulators, but not due to their interactions. The variety Pusa Early Dwarf produced significantly higher yield (442 q/ha) of tomato than the other varieties followed by the second best variety was improved local which produced (329 q/ha). The application of increasing levels of plant growth regulators up to 20 ppm (GA_3 + NAA) produced significantly higher yield (433 q/ha) of tomato as compared to control (286 q/ha) and 10 ppm 9306 q/ ha). A dose of 30 ppm produced 355 q/ha which was found at par with 20 ppm (GA_3 + NAA). The treatment interactions did not have significant influence upon the yield/ha, Pusa Early Dwarf with 20 ppm (GA_3 + NAA) further increased the productivity up to the maximum (552 q/ha). This was followed by the same variety grown with 30 ppm concentration of growth regulators (425 q/ha). The fresh weight of tomato was significantly due to varieties and plant growth regulators but not due to interaction between varieties and treatments. Pusa Early Dwarf recorded significantly higher fresh weight (30.77 g) of tomato followed by Pusa Ruby (29.10 g) the lowest fruit weight was observed in local variety. The plant growth regulators up to 20 ppm (GA_3 + NAA) were found significantly superior than the control. But at par with 10 ppm (28.95 g) and 30 ppm (929.25 g). The interaction effect between treatments was found to be non-significant.

As regards with the treatment effect the tomato varieties deviated significantly in plant height recorded at the maturity stage. At this stage, the maximum height (73.39 cm) was measured in case of Improved local and Type-5 (72.41 cm) while Pusa Ruby resulted in significantly lower height (68.38 cm). This may be due to genetic variability among the genotypes which were developed from the different parental origin. Similar tends was not obtained in case of formation of branches/plant. The variety Pusa Early Dwarf recorded maximum number of branches (16.4 /plant) at the final stage which was significant than those of all other varieties. The difference in growth characters viz. plant height and branches in different tomato genotypes have been reported by several workers (Lawrence, 1957, Singh and Upadhyaya, 1966 and Neem *et al.* 2001).

Application of plant growth regulator mixture of (GA_3 + NAA) up to 20 ppm concentration increased the plant foliage and plant growth significantly. Plant growth regulators increase the plasticity of cell wall and

Table 1: Mean values of different treatments of Growth Regulators

Treatment/Variety	Plant height (cm)	Number of branches/ plant	Number of fruits/plant	Weight/unit (g)	Number of fruits/ plot	Total yield (q/ha)
Pusa Ruby	68.38	14.02	18.5	54.6	162.3	207
Pusa Dwarf-Early	69.62	16.40	27.5	68.5	246.2	442
Type-5	72.41	14.29	18.8	60.9	170.7	302
Improved Local	73.39	13.81	21.5	52.9	193.7	3.29
C.D. (P=0.5)	0.40	0.33	2.28	4.07	22.20	35.3
Growth regulators						
0 ppm	69.81	12.95	16.7	50.2	143.3	286
10 ppm	70.86	13.85	21.8	55.8	187.7	306
20 ppm	73.42	14.47	28.8	70.8	253.6	433
30 ppm	70.71	13.98	18.6	60.0	188.9	355
C.D. (P=0.05)	0.40	0.33	2.28	4.07	22.20	35.3

participate in the reaction where by additional cellulose molecules are deposited within cell wall, thus increase cell division and elongation causes overall increase in plant growth. The lower concentration caused little increase in height. The higher dose of plant growth regulators mixture resulted in short height, less number of branches, number of leaves per plant.

In the present study all the yield components were found more in case of Pusa Early Dwarf. The second best variety in respect of number of fruits per plant and per plot and yield per hectare was the improved local. The minimum yield was obtained from the variety type-5. The increasing the levels of plant growth regulators up to 20 ppm (GA_3 + NAA) applied to the tomato varieties increased the yield components as well as yield /hectare significantly as indicated in Table 1. This may be due to the increase in the vegetative growth as well as productive parameters as a result of application of plant growth regulators on yield and yield characters of tomato were found similarly as recorded by (Rappaport, 1957, Gustafson, 1961, Singh and Upadhyay, 1967, Sagar, 1976, Ginofeghara, 1981, Gupta *et al.* 2001). The higher dose of plant growth regulators up to 30 ppm decreased the yield. The reduction in tomato may be due to the adverse effect of higher concentration used as the yield trend was found to be decreased with the increased (GA_3 + NAA) concentration. The present findings are in close agreement with those of Kausik *et al* (1978).

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