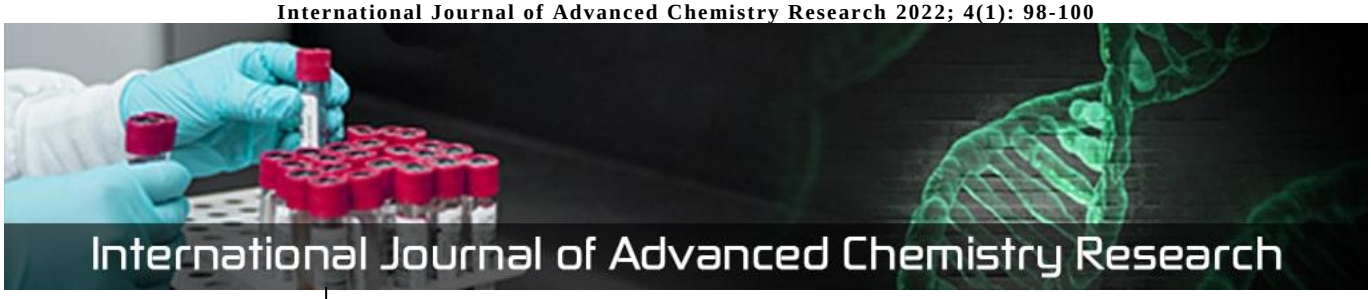

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Shruti Thakur
Department of Vegetable Science, BTC CARS, Bilaspur, IGKV, Raipur, Chhattisgarh, India

RK Bisen
Department of Vegetable Science, BTC CARS, Bilaspur, IGKV, Raipur, Chhattisgarh, India

HP Agrawal
Department of Vegetable Science, BTC CARS, Bilaspur, IGKV, Raipur, Chhattisgarh, India

SK Verma
Department of Vegetable Science, BTC CARS, Bilaspur, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Shruti Thakur
Department of Vegetable Science, BTC CARS, Bilaspur, IGKV, Raipur, Chhattisgarh, India

Study on effect of plant growth regulators on growth and yield of tomato (*Lycopersicon esculentum* Mill)

Shruti Thakur, RK Bisen, HP Agrawal and SK Verma

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Abstract
The experiment was conducted during Rabi season 2021-22 at Horticulture Research Farm, Barrister Thakur Chhedilal College of Agriculture & Research Station, Bilaspur, Chhattisgarh. The treatments consisted of different doses of plant growth regulators *viz*., control plot (T_1), GA_3-60 ppm (T_2), GA_3-80 ppm (T_3), GA_3-100 ppm (T_4), NAA-80 ppm (T_5), NAA-100 ppm (T_6), NAA-120 ppm (T_7), 2,4-D-5 ppm (T_8), 2,4-D-10 ppm (T_9), 2,4-D-15 ppm (T_{10}). Significantly, maximum no. of fruit 24.01 was found in T_7, fruit weight 44.01 gm in T_7, days of first fruit harvesting 58.14 days in T_7 and highest yield 393.94 q ha^{-1} in T_7 at harvest.

Keywords: Tomato, plant growth regulators, NAA, GA_3, 2,4-D

Introduction
Tomato (*Lycopersicon esculentum* Mill) is an annual vegetable crop grown throughout the world and ranks second in importance after potato which belongs to family Solanaceae. The tomato (*Lycopersicon esculentum* Mill) is originated from Central Africa and South America. Production of tomato is reported to be 21.1 Million Tonne, as against production of 20.6 Million Tone achieved in 2019-20 in Third advance estimates of Horticultural crops (2020-21). The cultivated area of tomato production in India estimated 852 thousand ha. In financial year 2021. (Source: Department of Agriculture and Farmers Welfare Report).
Tomato juice is popular as appetizer. The ripe tomato (per100 g) consist water (94.2%), calcium (1.0 g), and any other minerals. It contributes nutrition as well as a good source of income for farmers. Tomatoes are major contributors of antioxidants such as carotenoids (especially, lycopene and β-carotene), phenolics, ascorbic acid (vitamin C) and small amounts of vitamin E in daily diets. Tomato is an important protective food. In terms of human diet, it is a major component of daily meals in many countries and constitutes an excellent source of health providing compounds due to balanced mixture of minerals and antioxidants including vitamin C and total carotenoids.
Use of Plant growth regulators (PGRs) in horticulture for increment plant growth, and also benefit in yield by increase flower cluster, fruit cluster, fruit size, and weight also and Plant growth regulators (PGRs) influence the plant growth and development, it is cause change in morphological structure and physiologically processes in plant. Giberrelic acid and Napthelene acetic acid are the most important growth stimulating substances used in horticulture. Giberrelic acid is a chemical substance that occurs naturally in plants. GA_3 significantly influence growth characters, fruit characters, yield and yield attributes, and also improve the quality of fruit, whereas application of NAA influence the total soluble solid percentage substantially setting of fruit in tomato also improve by application of plant growth regulators.
There is great potential to increase the yield levels either by reducing the flower drop or by increasing the fruit set percentage. To achieve this, the plant growth regulators considered as a new generation of agro chemicals after fertilizers, pesticides and herbicides have been thought to come to the rescue since they are known to enhance source sink relation and stimulate the translocation of photosynthates there by helping in better retention of flowers and fruits.
The chemical hormones have important implications when we consider the feasibility of improving seed production by spray of growth regulators. Since the seeds not only synthesize the hormones in-situ but also import hormones from the mother plant.

But the time and method of application, the biological activity of growth regulators, its movement and persistence are important considerations when parent plant treatments are envisaged.

Materials and Methods

The experiment was conducted at Horticultural Research cum Instructional Farm, BTC CARS, Bilaspur, a constituent college of Indira Gandhi krishi vishwavidalaya, Raipur (C.G.). To study on the effect of plant growth regulators on growth and yield of tomato (*Lycopersicon esculentum* mill), during *Rabi* season of 2021-22. The experiment was carried out in RBD design with three replications. Ten treatments were created by different doses of plant growth regulators in tomato var. SW1501. The treatment were, control plot (T_1), GA_3-60ppm (T_2), GA_3-80ppm (T_3), GA_3-100ppm (T_4), NAA-80ppm (T_5), NAA-100ppm (T_6), NAA-120ppm (T_7), 2,4-D-5ppm (T_8), 2,4-D-10ppm (T_9), 2,4-D-15ppm (T_{10}). tomato variety 'SW1501 (Hybrid Tomato)' was sown on 11th October, 2021 in nursery and transplanting on 8th November, 2021 with a spacing of 60cm x 45 cm, first foliar spray of plant growth regulators was done on 8th December, and second foliar spray was done on 28th December and final picking was done on 13th March, 2022. the observations recorded were no. of fruit per plant, fruit weight (gm), days of first fruit harvesting (picking), and yield (q ha^{-1}).

Result and Discussion

The effect of plant growth regulators on fruit character, yield attributes and yields of Tomato was studied and the results obtained were discussed as under. The application of plant growth regulators indicated significant effect on fruit character, yield attributes and yields of Tomato (Table 1). The maximum no. of fruit per plant was noted in treatment T7 (NAA-120ppm) (24.01) which was at par with T_6 (NAA-100ppm) (23.18) T_4 (GA_3-100ppm) (21.73) T_5 (NAA-80ppm) (21.71) T_3 (GA_3-80ppm) (21.67) and T_2 (GA_3-60ppm) (21.38).

The fruit weight ranges from 38.69 gm to 44.01 gm. according, to data the weight of heaviest fruit was 44.01 gm, i.e. T_7 (NAA-120ppm), it is no influence with T_6 (NAA-100 ppm) 43.99gm, T_4 (GA_3-100ppm) 43.98gm, T_5 (NAA-80 ppm) 42.21gm, T_3(GA_3-80ppm) 41.08gm, and T_2 (GA3-60ppm) 40.63 gm and the minimal fruit weight 38.69 gm, i.e. T_1 (control plot).

The minimum days for first fruiting (58.14 days) recorded by T_7 (NAA-120ppm) which was at par with T_6 (NAA- 100 ppm) (61.61 days), T_4 (GA_3-100 ppm) (63.12 days), and T_5 (NAA- 80ppm) (67.91 days). Whereas maximum days to first fruiting recorded by T_1 (control plot) 79.83 days. The yield per plot (kg) goes from 12.12kg to 19.14kg. the highest yield 19.14 kg per plot was obtained with NAA-120 ppm (T_7) which was at par with NAA-100ppm (T_6) (18.38 kg) GA_3-100ppm (T_4) (17.08kg) NAA-80ppm (T_5) (16.79 kg) GA_3-80 ppm (T_3) (16.14kg) and GA_3-60ppm (T_2) (15.77kg) and minimum yield 12.12 kg per plot from the control plot (T_1).

The yield (q ha^{-1}) goes from 249.37 q ha^{-1} to 393.94 q ha^{-1}. the highest yield 393.94 q ha^{-1} was obtained by NAA- 120 ppm (T_7) which was at par with T_6 (NAA-100 ppm) (378.16 q ha^{-1}) T_4 (GA_3-100 ppm) (351.63 q ha^{-1}) and T_5 (NAA-80 ppm) (345.53 q ha^{-1}) and the lowest yield 249.37 q ha^{-1} was obtained with control (T_1).

Table 1: Effect of PGR's on fruit characters, yield attributes and yields of tomato

Treatments	Treatment Details	No. of fruit per plant	Fruit weight (gm)	Days of first fruit harvesting	Yield per plot (kg)	Yield (q ha^{-1})
T_1	Control plot	17.33	38.69	79.83	12.12	249.37
T_2	GA_3-60ppm	21.38	40.63	74.41	15.77	324.40
T_3	GA_3-80ppm	21.67	41.08	71.43	16.14	332.72
T_4	GA_3-100ppm	21.73	43.98	63.12	17.08	351.63
T_5	NAA-80ppm	21.71	42.21	67.91	16.79	345.53
T_6	NAA-100ppm	23.18	43.99	61.61	18.38	378.16
T_7	NAA-120ppm	24.01	44.01	58.14	19.14	393.94
T_8	2,4-D-5ppm	18.70	40.03	75.82	13.51	277.69
T_9	2,4-D-10ppm	18.01	39.27	77.74	12.94	266.68
T_{10}	2,4-D-15 ppm	17.39	38.76	78.60	12.17	250.24
	Mean	20.51	41.26	70.86	15.40	317.03
	S.E.M ±	1.08	1.32	3.70	1.15	18.19
	CD (p = 0.05)	3.19	3.92	10.99	3.40	54.04

Conclusions

Based on results of one season experimentation, it can be concluded that application of plant growth regulators are very effective in tomato. Application of NAA-120 ppm (T_7), was show most effective increment in fruit characters, such as no. of fruit per plant, fruit weight(gm), and yield and yield attributes, such as days of first fruit harvesting, yield per plot(kg) and yield (q ha^{-1}), as compared to control plot (T_1).

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