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Effect of plant growth regulators on growth parameters of sweet pepper under naturally ventilated poly house

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Abstract
The present investigation entitled "Effect of plant growth regulators on growth, yield and quality parameters in sweet pepper (*Capsicum annum* L.) Under naturally ventilated poly house" was conducted at Vegetable Research Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during two consecutive Rabi season 2020-21 and 2021-22 to find out the effect of PGRs and their spray schedules on sweet pepper under protected cultivation. The experiment was laid out in Factorial Randomized Block Design with 12 treatment combinations and replicated thrice. The experiment comprised four levels of plant growth regulators *viz*., NAA @ 50 ppm (P1), NAA @ 100 ppm (P2), Triacontanol @ 5 ppm (P3) and Triacontanol @10 ppm (P4) and three spray schedules *viz*., spray at 30 & 45 DAT (I1), spray at 30, 45 & 60 DAT (I2) and spray at 30, 45, 60 & 75 DAT (I3). The sweet pepper hybrid 'Indra' was used in experiment. Results of the experiment revealed that the application of Triacontanol @ 10 ppm recorded significantly highest plant height (96.29 and 97.63 cm), no. of branches/plant (30.29 and 31.34), in ternodal length (9.78 and 10.48 cm), stem girth (1.40 and 1.55 cm), fruit set (57.77 and 58.98%), average fruit weight (189.13 and 193.75 g), fruit weight/plant (1.63 and 1.62 kg), fruit yield/plot (9.33 and 9.31 kg), fruit yield/1000 m2 (4320.47 and 4310.37 kg), pericarp thickness (7.40 and 8.02 mm), shelf life (7.88 and 8.44 days), fruit dry weight/plant (22.54 and 22.27g), total soluble solid (6.56 and 6.65) and titratable acidity (0.150 and 0.139%) during both the years. In case of spray schedules, the plants were sprayed at 30, 45, 60 and 75 days after transplanting (DAT) produced significantly highest plant height (86.12 and 87.62 cm), number of branches/plant (29.24 and 30.35), stem girth (1.34 and 1.44 cm).

Keywords: regulators, parameters, sweet pepper, naturally

Introduction
The genus sweet pepper (*Capsicum annuum* L. var. grossum Sendt; 2n = 24) is belongs to the family Solanaceae. It is one of the very profitable vegetable, cultivated throughout the world. Now-a-days, it is very valuable vegetable crop of India because of its pleasant favours, taste and nutrients and coupled with rich content of ascorbic acid and other vitamins and minerals.
The northern plains of India had very fertile soil, enriched with natural macro and micro nutrients essential for crop cultivation. But the vegetable cultivation is confined to region specific and season specific due to varied climatic conditions. The extremes of temperature range from 0 °C to 48 °C prevails in northern plains, which restrict year-round production of *Capsicum* to meet the daily requirement. Thus, protected cultivation delimits the vagaries of extreme of adverse climatic conditions. It is well known fact that protected cultivations has so many advantages like early fruit yield, high yield per unit area, excellent marketable quality of produce on demand, year round production of *Capsicum*, better utilization of land and space, minimum use of ground water by using drip irrigation system, controlled environmental conditions like temperature, humidity and light, eco-friendly use of inorganic chemical like fertilizers and pesticide, management of biotic and abiotic stresses, more scope to adopt bio solutions to control biotic and abiotic stress etc.
The growth, of bell pepper are largely dependent on number of interacting factors such as agro-climatic conditions, quality of seed, sowing time, intercultural operations, plant protection measures, integrated nutrient management system, irrigation, use of plant growth regulators and other cultural practices. Among them, application of plant growth regulators is one of the most crucial as well as basic factor and is found to exert a great influence not only on growth, yield and quality of bell pepper but also for obtaining sustained productivity. The role of plant growth regulators is well established in various physiological forms and functions.

The plant growth regulators are a wide category of compounds that can promote, inhibit or change plant physiological or morphological processes at very low concentrations. Plant growth regulators can affect rooting, flowering, fruiting which ultimately increased the productivity.

Material and Method

The present investigation entitled "Effect of Plant Growth Regulators on Growth Parameters of Sweet Pepper under Naturally Ventilated Poly house." was conducted during Rabi season of 2020-21 and 2021-22 at Vegetable Research Farm, Department of vegetable science Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur.

The experiment comprises four levels of plant growth regulator and three levels of spray schedule, thus the total no. of treatment combinations was twelve. NAA @ 50 ppm (P1), NAA @ 100 ppm (P2), Triacontanol @ 5ppm (P3) and Triacontanol @ 10 ppm (P4). The experiment was laid out under naturally ventilated poly house having an area of 200 m2 for raising crop. The irrigation and fertigation were applied through drip system. The experiment was carried out in Factorial Randomized Block Design with three replications. In all, there were twelve treatment combinations and were randomly allotted to different plots/beds with the help of fisher' random number table (Fisher, 1950) [17]. The observation to be recorded plant height(cm), number of branches/plant, intermodal length, stem girth (cm), number of flowers per plant, days to 50% flowering and days to first fruit set.

Result and Discussion

This chapter includes the important findings of the experiment entitled 'Effect of plant growth regulators on growth, yield and quality parameters in sweet pepper (*Capsicum annum* L.) under naturally ventilated poly house.

The height of the plants was significantly influenced by plant growth regulators and spray schedule under naturally ventilated poly house during both the years of sweet pepper experimentation. In both the years, application of Triacontanol @ 10 ppm recorded tallest plant (96.29 and 97.63 cm). It was followed by application of NAA @ 100 ppm with (88.63 and 90.45 cm) during first and second year, respevtively. The lowest plant height was found with application of NAA @ 50 ppm during both the years. Interaction between plant growth regulator and spray schedule levels were observed to be significantly in both the years. The application of Triacontanol @ 10 ppm with spray schedule at 30, 45, 60 and 75 days after transplanting (DAT) recorded tallest plants (101.03 and 102.70 cm). The no. of branches per plant was significantly influenced by plant growth regulators and spray schedule under naturally ventilated poly house during both the years of sweet pepper experimentation. In both the years, application of Triacontanol @ 10 ppm recorded significantly highest no. of branches per plant (30.28 and 31.33). It was followed by application of NAA @ 100 ppm with 29.70and 30.89 during first and second year, respevtively. The lowest no. of branches per plant was found with application of Triacontanol @ 5ppm during both the years.

Internodal length was significantly influenced by plant growth regulators and spray schedule under naturally ventilated poly house during both the years of sweet pepper experimentation. In both the years, application of Triacontanol @ 10ppm ppm recorded significantly maximum internodal length (9.78 and 10.48cm). It was followed by application of NAA @ 100 ppm with 9.61 and 10.17 cm during first and second year, respectively. The lowest internodal length was found with application of Triacontanol @ 5 ppm during both the years. The stem girth was significantly influenced by plant growth regulators and spray schedule under naturally ventilated poly house during both the years of sweet pepper experimentation. In both the years, application of Triacontanol @ 10 ppm produced significantly highest stem girth (1.40and 1.55 cm). It was followed by application of Triacontanol NAA @ 100 ppm with 1.04 and 1.30 cm during first and second year, respectively. The lowest stem girth was found with application of NAA @ 50ppm during both the years. The no. of flowers per plant was significantly influenced by plant growth regulators and spray schedule under naturally ventilated poly house during both the years of sweet pepper experimentation. In both the years, application of NAA @ 100 ppm recorded significantly highest no. of flowers per plant (32.16 and 32.80). It was followed by application of Triacontanol @ 10 ppm with 31.58 and 32.97 during first and second year, respectively. The lowest no. of flowers per plant was found with application of NAA @ 50ppm during both the years.

The days for 50% flowering was significantly influenced by plant growth regulators and spray schedule under naturally ventilated poly house during both the years of sweet pepper experimentation. In both the years, application of Triacontanol @ 10 ppm recorded earliest days for 50% flowering 42.33 and 44.10 days. It was followed by application of NAA @ 100 ppm with 42.60 and 43.99 days during first and second year, respevtively. The latest days for 50% flowering was found with application of Triacontanol @ 5ppm during both the years.

All the growth characters *viz.*, plant height, number of branches per plant, stem girth, number of internodes per plant and length of interned were increased significantly by spraying of plant growth regulators. Spraying of Triacontanol @ 10 ppm recorded tallest plant followed by application of NAA @ 100 ppm during both the years. Whereas, the lowest plant height was found with application of NAA @ 50ppm during both the years. In case of number of branches per plant, application of Triacontanol @ 10 ppm recorded significantly highest no. of branches per plant followed by application of NAA @ 100 ppm while lowest no. of branches was found with application of Triacontanol @ 5 ppm during both the years. Growth regulators are involved in increasing photosynthetic activity, efficient translocation and utilization of photosynthates causing rapid cell elongation and cell division at growing region of the plant leading to stimulation of growth (Dicks, 1980) [12].

In both the years, application of Triacontanol @ 10 ppm recorded significantly highest internodal length and stem girth followed by application of NAA @ 100 ppm. Whereas, the lowest value of internodal length and stem girth was found with Triacontanol @ 5 ppm and NAA @ 50 ppm, respectively. No. of flowers per plant was significantly highest with NAA @ 100 ppm followed by application of Triacontanol @ 10ppm while lowest value was found with NAA @ 50 ppm during both the years. In case of days to first fruit set, application of Triacontanol @ 10 ppm produced significantly earliest first fruit followed by application of

NAA @ 100 ppm. The latest first fruit set was noticed with application of Triacontanol @ 5 ppm during both the years. Similar trend was also observed in case fruit set percent.

It indicated that sweet pepper responded well to application Triacontanol @ 10 ppm and NAA @ 100 ppm. Since plant growth regulators stimulates cell division and increases plasticity of cells might have resulted in better growth parameters. Similar results were reported by Dhotre and Mantur (2018) [11], Kalshyam *et al.* (2012) [18] and Rana and Singh (2012).

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