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# RESPONSE OF NAA, 2, 4-D AND CCC ON GROWTH, FLOWERING AND YIELD OF CHILLI (*CAPSICUM ANNUM* L.) CV. KASHI RATNA

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**ABSTRACT**

The Experiment was carried out to study the "Response of NAA, 2, 4-D and Cycocel (CCC) on growth, flowering and yield of Chilli (*Capsicum annum* L.) Cv. Kashi Ratna in experimental field of Horticulture Farm, Udai Pratap College, Varanasi (U.P) during Ravi season 2020-21. The experiment consisted of 7 treatment combinations with 3 plant growth regulators viz., NAA @ 20 ppm, NAA @ 30 ppm, 2,4-D @ 10 ppm, 2,4-D @ 15 ppm, Cycocel @ 100 ppm and Cycocel @ 200 ppm and 3 three different intervals spraying 30, 45 and 60 DAT as well as one control where in no spraying carried out. The investigation revealed that, the vegetative growth observations with plants height was reduced in the treated with CCC, 2, 4-D followed by NAA. While, number of branches per plant, number of leaves per plant and days to 50 % flowering were produced significantly the maximum due to application of CCC @ 200 ppm. As regards to the yield parameters which were recorded viz number of fruits/plant, fruit yield kg/ plant, fruit yield kg/ plot and fruit yield/ ha green chilli were produced significantly the maximum while reducing fruit length, fruit weight and fruit diameter reducing under CCC at 200 ppm followed by CCC at 100 ppm. Treatment combination CCC at 200 ppm was found significantly economical.

***Key word*:** Chilli, NAA, 2, 4-D and CCC (Cycocel), growth, flowering and yield.

## Introduction

Chilli (*Capsicum annum* L.) is an important vegetable cum spice crop grown in almost all parts of tropical and subtropical regions of the world. It belongs to the family Solanaceae and originated from South and Central America where it was domesticated around 7000 BC. At present chillies and grown in all most all states of the country. India is leading in chilli production with 17.64 lakh tonnes followed by China (3.21 lakh tonnes), Ethiopia (2.94 lakh tonnes), Thailand (2.47 lakh tonnes), and Pakistan (1.48 lakh tonnes) in 2018-19. The India total chillies (green) area account for 377 Mha and production around 3783MT in during 2018-19,(NHB). There is a great potential to increase yield of chilli by reducing flower drops and by increasing fruit set. To achieve this, plant growth regulators are considered of agrochemicals after fertilizer, pesticides and herbicides. The beneficial effect of NAA is being attributed to an increased rate of photosynthetic activity, accelerated transport and efficiency of utilizing photosynthetic products resulting in rapid cell elongation cell division in the meristem. Foliar spray of 300 ppm CCC or 200 ppm Ethrel on flower initiation stage induced flowering, increased the number of pods / plant and their by yield of soybean crop (Singh *et al.*, 1987). CCC, ethylene and fungicide play an important role in delay in sprouting and extant shelf-life in onion. Plants treated with CCC, a compound that blocks GA biosynthesis, have shortened internodes and enhanced photosynthesis (Davies *et al.*, 1995). CCC is a growth regulator that is particularly effective in reducing plant height. This is an important factor for okra crops where normal plant height may exceed 2 m, thus making manual work difficult. Chlormequat or chlorocholine chloride (2-chloroethyltrimethyl-ammonium chloride, CCC) is an anti-

**Table 1:** Response of NAA, 2,4-D and CCC on growth characters of chilli.

| Treatment | Plant height (cm) | | | No. of leaves/plant | | | No. of branches/plant | | |
|---|---|---|---|---|---|---|---|---|---|
| | 30 DAT | 45 DAT | 60 DAT | 30 DAT | 45 DAT | 60 DAT | 30 DAT | 45 DAT | 60 DAT |
| $T_1$- NAA @ 20 ppm | 27.26 | 44.66 | 59.06 | 36.10 | 45.70 | 55.30 | 8.50 | 14.65 | 18.23 |
| $T_2$- NAA @ 30 ppm | 30.21 | 46.32 | 61.72 | 37.25 | 47.62 | 57.19 | 10.26 | 17.21 | 22.16 |
| $T_3$- 2,4-D @ 10 ppm | 23.18 | 38.22 | 52.26 | 38.69 | 50.20 | 62.15 | 11.92 | 18.50 | 23.87 |
| $T_4$- 2,4-D @ 15 ppm | 20.29 | 33.60 | 42.89 | 41.43 | 53.68 | 68.86 | 13.66 | 19.98 | 26.18 |
| $T_5$- CCC @ 100 ppm | 19.72 | 30.81 | 38.61 | 43.16 | 57.17 | 70.95 | 15.18 | 21.99 | 30.24 |
| $T_6$- CCC @ 200 ppm | 17.16 | 24.08 | 30.23 | 46.57 | 60.33 | 76.16 | 16.30 | 24.46 | 34.62 |
| $T_7$- Control | 24.12 | 40.22 | 57.05 | 34.18 | 44.10 | 54.24 | 7.18 | 13.14 | 17.10 |
| **S.Ed.** | 0.20 | 0.38 | 0.55 | 0.25 | 0.33 | 0.38 | 0.19 | 0.22 | 0.31 |
| **CD (p = 0.05)** | 0.60 | 1.16 | 1.68 | 0.77 | 1.02 | 1.19 | 0.58 | 0.67 | 0.97 |

gibberellin growth retardant (Sharma *et al.*, 1998) that inhibits both cell division and cell elongation (Bode and Wild, 1984). The application of CCC to plants represses the growth of stems, leaves and stolons, but improves photosynthetic capacity by increasing leaf chlorophyll content (Huiqun *et al.*, 2009). Experimental studies have shown that CCC significantly increased yield (Shul-gina and Ledovskii, 1978) and seed germination (Irulappan and Muthukrishnan, 1973) in tomato.

## Material and Method

The experiment was conducted during Ravi season 2020-21 at the main experimental field, Department of Horticulture College of Agriculture Udai Pratap College, Varanasi (U.P) in a randomized block design with 7 treatments having 3 replication. Hybrid seed of chilli cultivar Kashi Ratna was buyed from Indian Institute of Vegetable Research (IIVR) Varanasi. A recommended dose of FYM- 25 tonne/ha, Nitrogen, Phosphorus and Potassium @ 150, 80, and 80 kg/ha was supplied by using Urea, di-ammonium phosphate (DAP) and Sulphate of potash (SOP) one week before final tilth. Seedling was transplanted at 60 × 45 cm spacing and plant growth regulators were sprayed at 30, 45 and 60 DAT. The treatments comprised of $T_1$ – NAA @ 20 ppm, $T_2$- NAA @ 30 ppm, $T_3$- 2,4-D @ 15 ppm, $T_4$- 2,4-D @ 20 ppm, $T_5$- CCC @ 100 ppm, $T_6$- CCC @ 200 ppm and $T_7$- Control, respectively.

## Result and Discussion

### Growth Parameters

The growth parameter like plant height, number of leaves/plant and number of branches/plant in chilli were significantly influenced by the application of plant growth regulators (Table 1). Form the present study it is observed that NAA, 2,4-D and CCC markedly influenced the growth attributed *viz.*, plant height, number of leaves/ plant and number of branches/plant (Table 1) Compared to control, plant height (30.21, 46.32 and 61.72 cm) were significantly improved due to spraying of NAA @ 30 ppm at 30, 45 and 60 DAT. The promoting effect of Auxins on cell enlargement which induces cell elongation and rapid multiplication of cells in sub apical meristem might have resulted in higher plant height. Similar results of increase in vegetative growth due to application of NAA were also reported by Rana and Singh (2012). In green house capsicum. Athaneria *et al.*, (2011), Kalshyam *et al.*, (2012) in chilli.

However, spraying CCC by way of its effect on reducing the plant height which was evidenced in the present experiment with least plant height (17.16, 24.08

**Table 2:** Response of NAA, 24-D and Cycocel on flowering and yield characters of chilli.

| Treatment | Days to 50% flowering | Number of fruit/plant | Fruit length (cm) | Weight of 25 fruit (g) | Fruit diameter (cm) | Fruit yield (kg/plant) | Fruit yield (kg/plot) | Fruit yield (q/ha) |
|---|---|---|---|---|---|---|---|---|
| $T_1$ NAA 20 ppm | 42.12 | 102.20 | 8.20 | 75.40 | 0.51 | 1.25 | 6.50 | 223.40 |
| $T_2$ NAA 30 ppm | 39.10 | 110.68 | 8.45 | 74.36 | 0.54 | 1.40 | 7.60 | 225.26 |
| $T_3$ 2,4-D 10 ppm | 38.00 | 122.91 | 7.72 | 75.33 | 0.57 | 1.55 | 8.40 | 227.31 |
| $T_4$ 2,4-D 15 ppm | 35.15 | 136.80 | 7.19 | 78.21 | 0.60 | 1.72 | 8.80 | 230.43 |
| $T_5$ CCC 100 ppm | 32.22 | 147.41 | 7.05 | 70.18 | 0.47 | 1.81 | 9.95 | 232.23 |
| $T_6$ CCC 200 ppm | 30.13 | 159.56 | 6.77 | 68.15 | 0.45 | 1.89 | 10.15 | 235.55 |
| $T_7$ Control | 45.30 | 99.90 | 7.84 | 71.07 | 0.50 | 1.10 | 5.90 | 180.49 |
| **SEm±** | 0.30 | 0.98 | 0.12 | 0.15 | 0.0026 | 0.014 | 0.20 | 0.92 |
| **CD (p = 0.05)** | 0.91 | 3.01 | 0.36 | 0.47 | 0.0081 | 0.043 | 0.60 | 2.83 |

and 30.23 cm) by spraying CCC @ 200 ppm. CCC reduced the plant height without affecting flower induction and fruit set and increasing the yield. Similar finding has been reported by Sanjan *et al*., (2004) and porwal *et al.,* (2002). They reported that application of 2,4-D resulted in growth retardation in comparison to control (Kar *et al*., 2016). However, spraying number of leaves/plant (46.57, 60.33 and 76.16) and number of branches/plant (16.30, 24.46 and 34.62) were significantly improved due to spraying of CCC @ 200 ppm at 30, 45 and 60 DAT which was followed by $T_7$ (control).

The possible reason for increase in all growth character of chilli plant may be due to the increased osmotic uptake of water and nutrients under the influence of which CCC would have maintained a constant swelling force against softening of cell walls. The result of the experiment is in agreement with the result of Chaudhary *et al*., (2016) in chilli. Prajapti *et al*., (2014) in chilli.

**Yield and yield parameters**

The yield parameters of chilli *viz*., days to 50 % flowering, number of fruits per plant, fruit length (cm), weight of 25 fruit (g), fruit diameter (cm), fruit yield (kg/ plant), fruit yield (kg/plot) and fruit yield (q/ha) were observed with considerable due to the application of plant growth regulators and their spraying intervals (Table 2). Form the present study, CCC @ 200 ppm ($T_6$) also it takes 30.13 days to 50 % flowering which shows earliness when compared with control and all the treatments. Pepper plant spraying of $GA_3$ @ 25 to 200 ppm showed delayed flowering, while those treated with CCC at 100 ppm or 500 ppm flowered early (Rylski *et al.,* 1972).

In the present observed concentration of NAA, 2,4-D and CCC produces all of the yield parameter were appreciably increased under CCC @ 200 ppm of all yield attributes and yield characters *viz*. number of fruits per plant (159.56), fruit yield (1.89 kg/ plant), fruit yield (10.15 kg/plot) and fruit yield (235.17 q/ha) followed by CCC @ 100 ppm. While reduced under CCC @ 200 ppm of yield characters *viz*., fruit length (6.77 cm), fruit weight (68.15 cm) and fruit diameter (0.45cm) followed by control. Contrasting, spraying CCC at 200 ppm recorded significantly least fruit length, fruit weight and fruit diameter by way of its diminishing effect on fruit size. Similar results of recorded fruit length due to application of Cycocel have been reported by Ouzounidou *et al*., (2010).

## Conclusion

Based on the results it was concluded that, plant growth regulators sprayed at different intervals had significant influence on vegetative growth, yield and yield parameter of capsicum. Application of NAA, 2,4-D and Cycocel was found to be optimum as it recorded better in growth and in higher fruit yield and yield contributing character but in case of CCC reduces fruit length, fruit weight and fruit diameter.

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