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# Effect of different level of Gibberllic acid, naphthalene acetic acid and Cycocel on growth and yield of bitter gourd (*Momordica charantia* L.) C.V, Kashi Mayuri

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**Abstract**
A field experiment was carried out on bitter gourd during 2021 March to June in an open field, Central Research Farm, Department of Horticulture, from, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The experimental field was laid out in a randomized block design (RBD) with ten treatments of different concentrations of three kinds of Plant growth regulators, namely GA3, NAA and Cycocel CCC with just one variety replicated thrice. The variety used in this experiment was Kashi Mayuri (IIVR). The experiment comprised of nine foliar applications consisting of GA3 @ 40 ppm l-1, 60 ppm l-1, 80 ppm l-1,; NAA @ 100 ppm l-1, 150 ppm l-1, 200 ppm l-1; CCC @ 100 ppm l- 1, 200 ppm l-1, 300 ppm l-1 with control Experiment results revealed that Flowering parameters *viz*., days to male flower initiation (35.08) and female flower intiation (24.87) maximum was recorded by (NAA @ 100 ppm and 150 ppm).Whereas, Yield parameters *viz*. fruit weight (105.89 g), fruit length (16.30 cm), fruit diameter (7.60 cm), no. of fruits/plant (38.67), fruit yield/ hectare (35.25 t/ha) was recorded maximum in (GA3 @ 60 ppm l-1).

**Keywords:** Bitter gourd, plant growth regulators, growth, Flowering, fruit yield

## Introduction
Bittergourd (*Momordica charantia* L.) is one of the most important and round the year cultivated popular vegetable crops. It belongs to the family cucurbitaceae. Bittergourd also known as balsom pear, karela, or bitter melon is a fast growing tropical vegetable crop. It has immense medicinal properties due to the presence of beneficial phytochemicals which are known to have antibiotic, antimutagenic, antioxidant, antiviral, antidiabetic and immune enhancing properties (Grover and Yadav, 2004) [1]. A compound known as charantin, present in the bitter gourd is used in the treatment of diabetes in reducing blood sugar level (Lotlikar *et al*. 1966) [2].

Plant growth regulators are artificially generated chemicals that operate in extremely low levels at places other than the site of synthesis to influence various physiological processes that modulate plant growth and development. It is a collection of tiny molecules produced from different key metabolic processes that are structurally unrelated (Santner *et al*., 2009; Davies, 2010) [5]. Plant growth regulators, also known as phytohormones, are organic compounds spontaneously produced in higher plants that govern growth or other physiological processes at a distance from their source and are only active in trace amounts. Plant growth regulators include auxin, gibberellins, cytokinins, ethylene, and growth regulators. Auxins were the first hormones identified in plants, followed by gibberellins and cytokinins. Auxin promotes root development by disrupting the cytokinin-induced root apical dominance (Cline, 2000) [4]. Plant growth regulators are used to improve the vegetative growth, production, and quality of numerous horticultural crops. NAA is a popular fertiliser in horticultural crops.

Bitter gourd is a monoecious plant naturally, inducing greater number of male flowers than the female flowers and this flowering behavior is not advantageous and economical, because it results in lower fruit set and yield (Mangave *et al*., 2016) [6]. To have the higher yield, the male and female flower ratio needs to be decreased and synchronized. Maleness and femaleness can usually be altered by environmental variables such as temperature, photoperiod and nutrition or by the application of growth regulators (Krishnamurthy, 1981) [3]. It is seen that proper and judicious use of plant growth regulators (PGRs) is one of the ways to increase the yield of bitter gourd by inducing female flowers and reducing male flowers.

Gibberellic acid (GA3) and naphthalene acetic acid (NAA) are two important growth regulators that are used to modify the growth, yield and yield contributing characters of cucurbitaceous crops (Rafeekar *et al.,* 2002) [7]. GA3 plays a key role in promoting male sex expression and are antagonistic to that of ethylene and abscisic acid (Rudich, 1983: Zhang *et al*., 2017) [8, 9].

Exogenous application of GA3 promotes female flowers as well as fruit setting and development of bitter gourd crop (Banerjee and Basu, 1992) [3]. Since, very little information is available on the effect of growth regulators on sex expression and yield of bitter gourd, the present investigation was undertaken to find out the suitable plant growth regulators with appropriate doses for increasing the fruit yield potential of bitter gourd.

Yield is the ultimate economic product of the crop, which is determined mainly by fruit weight and number of fruits per plant. Most of the yield components show a direct influence on fruit yield. Under good crop management conditions, the highest yield levels could be obtained through improved package of practices, which includes the use of plant growth regulators.

## Materials and Methods

An experiment entitled "Effect of Different Level of Gibberllic Acid, Naphthalene Acetic Acid and Cycocel on Growth and Yield of Bitter Gourd (*Momordica charantia* L.) CV. Kashi Mayuri", was carried out in the agro-climatic conditions of Prayagraj in the Central Research Farm Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences during 2021. The region is located on the right bank of the Yamuna, 6 kilometres south of Prayagraj city, on the rewa road. It is located at 25°57' North latitude, 81°51' East longitude, and is 98 metres above sea level (MSL).

According to Table 1, Randomized Block Design (RBD) with three replications is used to test nine different GA3, NAA and CCC combinations with control. After weighing, the growth regulators were dissolved in a tiny amount of 95% absolute alcohol. Each growth regulator's stock solution was first produced by diluting it with distilled water. Further dilutions of the measured volume of stock solution with distilled water were used to create the desired concentration solution. Spraying was done per the treatment for each plant, using an equal volume of solution for each. A compressed air hand sprayer was used to spray in the evening. The control plant was sprayed with distilled water. Statistical analysis of variance was performed on the data collected throughout the experiment. The significance of the treatments was determined using the 'F' test at a level of significance of 5%

**Table 1:** Details of treatments details

| Treatments | Treatment dosages |
|---|---|
| T0 | Control |
| T1 | GA3 @ 40 ppm l-1 |
| T2 | GA3 @ 60 ppm l-1 |
| T3 | GA3 @ 80 ppm l-1 |
| T4 | NAA @ 50 ppm l-1 |
| T5 | NAA @ 100 ppm l-1 |
| T6 | NAA@ 150 ppm l-1 |
| T7 | CCC @ 100 ppm l-1 |
| T8 | CCC @ 200 ppm l-1 |
| T9 | CCC @ 300 ppm l-1 |

## Results and Discussion

### Flowering parameters

From the data mentioned in table 2. the minimum days to first female flower emergence (24.87 days) per plant was recorded in T6 NAA @ 150 ppm l-1 which was followed by T5 NAA @ 100 ppm l-1 (29.63). Whereas, the maximum days to first female flower emergence (36.88 days) was recorded in T0 Control. The minimum days to first male flower emergence (35.08 days) per plant was recorded T5 NAA @ 100 ppm l-1 respectively. Whereas, the maximum days to first male flower emergence (43.66 days) was recorded in T0 Control.

These results indicated that application of cycocel delayed flowering in bitter gourd. Application of NAA stimulated the number of both pistillate and staminate flowers. This might be due to increase in the mobilization of auxin substances in plants and also in reduction of sugar thereby bringing a change in membrane permeability. This colloborates the result of Dixit *et al*. (2001) [10]. Choudhury and Singh (1977) [11], and Bisaria (1974) reported that NAA 100 ppm decreased the male flowers and increased the female flowers in cucumber. Mangave *et al*. (2016) [6] obtained minimum number of male flowers and maximum number of female flowers/plant with the application of 75 ppm NAA. The narrower sex ratio by the spraying of NAA is possibly due to the fact that this substance is reported to increase functional male organs and compatibility besides the embryo abortion in plants (Gill *et al*., 2012) [12].

**Table 2:** Effect of different level of PGR on Flower parameters of bitter gourd c.v. Kashi Mayuri

| Treatment Symbols | Treatment Combinations | Days to first female flower emergence | days to first male flower emergence |
|---|---|---|---|
| T0 | Control | 36.40 | 42.23 |
| T1 | GA3 @ 40 ppm | 33.40 | 40.93 |
| T2 | GA3 @ 60 ppm | 34.02 | 39.33 |
| T3 | GA3 @ 80 ppm | 35.10 | 41.23 |
| T4 | NAA @ 50 ppm | 30.27 | 38.60 |
| T5 | NAA @ 100 ppm | 29.63 | 35.80 |
| T6 | NAA @ 150 ppm | 24.87 | 37.40 |
| T7 | CCC @ 100 ppm | 35.30 | 41.27 |
| T8 | CCC @ 200 ppm | 34.90 | 41.93 |
| T9 | CCC @ 300 ppm | 35.67 | 41.67 |
| S. E. (m) | | 1.14 | 0.92 |
| CD at 5% | | 3.29 | 2.66 |
| F Test | | S | S |

### Growth and Yield parameters

The maximum fruit weight (105.89), fruit length (16.30), fruit diameter (7.60) was shown in T2 GA3 @ 60 ppm l-1 followed by T3 GA3 @ 80 ppm l-1 (85.15), (14.34), (7.33) respectively and minimum was shown in T0 control. The possible reason for increase in length and diameter of fruits after the application of growth regulators may be attributed to higher respiration and photosynthesis in treated plants as compared to control. This may be due to greater accumulation of carbohydrates, owing to photosynthesis, which resulted into increased weight and size of fruits. These results are in conformity with reports on MH by Dubey (3) in sponge gourd and Arora *et al*. (1987) in ridge gourd with ethrel. The growth characters like length of fruit and width of fruit obtained with the application of GA3 @ 40 ppm in cv. Tia. (Dostogir *et al*., 2006) [13]. Similar result obtain with ethrel 50 ppm in cv. Pusa hybrid 1. (Nagamani *et al*., 2008) [14]. Whereas maximum number of fruits per plant (38.67) and Fruits yield (35.25 t ha -1) was shown in T2 GA3@ 60 ppm l-

1 and minimum was shown in T0 control. The increase in fruit yield of treated plants may be attributed to the reason that plants remain physiologically more active to build up sufficient food stock for developing flowers and fruits ultimately leading to higher fruit yield. Similar results were reported by Pandya and Dixit in bottle gourd and Arora *et al*. in ridge gourd. Marbhal *et al*. (2005) [15] reported that the maximum fruit yield was observed by spraying of NAA (50 ppm) which was higher than control. Dostogir Hossain *et al*. (2006) [13] reported that the application of GA3 at 25 ppm recorded maximum number fruits per plants (15.8).

**Table 3:** Effect of different level of PGR on Growth and Yield parameters of bitter gourd c.v. Kashi Mayuri

| Treatment Symbols | Treatment Combinations | Fresh fruit weight (g) | Length of fruits (cm) | Diameter of fruits (cm) | Number of fruits per plant | Fruits yield -1 (t ha) |
|---|---|---|---|---|---|---|
| T0 | Control | 54.10 | 12.07 | 4.57 | 28.27 | 13.90 |
| T1 | GA3 @ 40 ppm | 81.87 | 14.09 | 7.23 | 37.00 | 27.31 |
| T2 | GA3 @ 60 ppm | 105.89 | 16.30 | 7.60 | 38.67 | 35.25 |
| T3 | GA3 @ 80 ppm | 85.15 | 14.74 | 7.33 | 37.20 | 28.17 |
| T4 | NAA @ 50 ppm | 63.21 | 13.40 | 5.43 | 30.00 | 17.29 |
| T5 | NAA @ 100 ppm | 68.63 | 13.89 | 5.60 | 31.33 | 18.57 |
| T6 | NAA @ 150 ppm | 68.91 | 13.24 | 5.27 | 33.23 | 20.99 |
| T7 | CCC @ 100 ppm | 77.67 | 12.96 | 4.67 | 32.97 | 23.50 |
| T8 | CCC @ 200 ppm | 73.45 | 13.27 | 4.80 | 36.20 | 23.26 |
| T9 | CCC @ 300 ppm | 73.77 | 13.02 | 5.43 | 36.60 | 23.38 |
| S. E. (m) | | 1.00 | 0.52 | 0.09 | 0.60 | 0.49 |
| CD at 5% | | 2.88 | 1.51 | 0.25 | 1.74 | 1.40 |
| F Test | | S | S | S | S | S |

## Conclusion

From the above discussion it is concluded that among the different suitable doses of GA3, NAA and CCC, treatment T5 NAA @ 100 ppm l-1 and T6 NAA @ 150 ppm l-1 shows minimum days to first male flower emergence and first female flower emergence. Whereas, maximum fruit weight, fruit length, fruit diameter and maximum number of fruits per plant, fruit yield (t ha) was significantly shown in treatment T2 GA3@ 60 ppm l-1. Overall, treatment T2 GA3 @ 60 ppm l-1 showed better result in the terms of fruit growth and yield of Bittergourd C.V Kashi Mayuri.

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