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Effect of Plant Growth Regulators on Growth and Yield of Sweet Pepper

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ABSTRACT

A field experiment was carried out to study the effect of plant growth regulators on growth and yield of sweet pepper (cv Indra) in Rayagada district of Southern Odisha during September-January of 2019-20 and 2020-21. The experiment was laid out in Randomized Block Design with three replications and seven treatments. From the present study it was revealed that the maximum plant height (43.3 cm) was obtained with IAA (100 ppm) whereas maximum fruiting branches (8.20), maximum fruit weight (106.80 g) was obtained with 2,4-D (10 ppm). Maximum polar diameter (6.6 cm), shoulder diameter (5.2 cm) and single fruit weight (82.3 g) was obtained with BA (5 ppm). Maximum fruit yield (13.8 t/ha) was recorded with BA (5 ppm). Early fruit fetches higher market price than late harvested fruit and gives higher return to farmer which was obtained by application of BA (5 ppm) i.e., 28.1 days for first flowering and 60.2 days for first harvesting.

Keywords Growth, Plant growth regulator, Sweet pepper, Yield.

INTRODUCTION

Sweet pepper also known as capsicum is a major vegetable crop that was first domesticated in the American tropics. Bell pepper has a lot of health advantages as rich in Vitamin C, Vitamin A and Vitamins from the B-complex family, such as Vitamin B-1 (niacin and pyridoxine) and Vitamin B-6 (riboflavin and thiamin), are all abundant in bell peppers (Rudrappa 2016).

Plant growth regulators are organic compounds which modify the physiological process of plant. It plays an essential role in many aspects of plant growth and development, stem elongation and flower development (Chaudhary *et al.* 2006, Ouzounidou *et al.* 2010). The most important plant growth regulators are Abscisic acid, Indole-3-Acetic acid, Gibberellic acid, ethylene, jasmonic acid, salicylic acid which are responsible for rooting, flowering, fruiting, leaf

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and fruit abscission and senescence. Auxin help to increase ethylene production, which helps in fruit ripening (Santner *et al.* 2009). NAA at 50 ppm had reasonable increased the plant height, number of secondary branches (Rana and Singh 2012).

MATERIALS AND METHODS

Experimental site and land preparation : The field experiment was carried out at Majhighariani Institute of Professional Studies in Rayagada, Odisha, during the winter seasons of 2019–20 and 2020–21. The Syngenta cultivar Indra (F_1 Hybrid) was selected. Pro-trays were used to sow seeds on September 1st of 2019 and 2020. On 30 DAS, the seedlings were transplanted.

Main plot preparation : Two times the main plot was harrowed, and then a fortnight before transplanting, FYM was treated @ 20 t/ha. Following that, the plot was divided into three replications, each with seven small plots measuring 2.5 m by 2 m. The N, P and K doses provided were 175:75:150 kg/ha. Urea, DAP, and MOP were the respective supplier of nitrogen, phosphorus and potash. As a base dosage, 1/3rd of the nitrogen, the entire dose of phosphorus and the full dose of potash were applied. The remaining 2/3rd doses of nitrogen were then applied in two equal splits at 30 and 45 DAT.

Treatment : A Randomized Block Design was used to set up the experiment, with three replications and seven treatments as control (water spray), GA_3 (50 ppm), IAA (100 ppm), NAA (50 ppm), BA (5 ppm), 2, 4-D (10 ppm) and BR (10 ppm).

Observation taken

Vegetative growth : Five competitive inner rows plants were randomly selected and the vegetative parameters, such as plant height, the number of fruiting branches, the days to first flowering, and the days to 50% flowering, were recorded at intervals of 30 days for each treatment and replication.

Yield attributing and yield : From five randomly selected inner rows competitive plants in each treatment, the yield attributing characteristics such as days to first harvest, individual fruit weight and diameter, number of fruits harvested and fruit yield per plant were noted. Yet again, fruit yield per plot was measured in order to determine yield per hectare.

RESULTS AND DISCUSSION

Plant height and number of fruiting branches :

When plant growth regulators were sprayed on sweet pepper, there was a noticeable difference in the plant's height and the number of fruiting branches. The highest plant height (43.3 cm) was obtained by IAA (100 ppm) followed by BR (10 ppm) (Table 1), which is graphically represented (Fig. 1). Among the growth regulators 2,4-D (10 ppm) has achieved maximum numbers of fruiting branches (7.5) closely followed by BA (5 ppm) (Table 1). Cytokinin, auxin (IAA), brassinosteroids (BRs) are the major naturally occurring PGRs and it is effective for overall development of a plant (Santner *et al.* 2009). Polar auxin transport plays important role in growth and development and yield attributes (Tantasawat *et al.* 2015). Similarly in an experiment foliar spray of NAA at 50 ppm had reasonable increased the plant height and number of secondary branches (Rana and Singh 2012) (Mahindre *et al.* 2018). Sasse (2003) found that

Table 1. Effect of growth regulators on plant height, number of fruiting branches.

Treatments	Plant height	Number of fruiting branches	Single fruit weight (g)	Yield/ha (t)
T_1 (Control)	39.0	6.6	65.7	6.7
T_2 (GA_3 @ 50 ppm)	38.0	6.5	71.0	8.8
T_3 (IAA @ 100 ppm)	43.3	7.0	67.3	7.6
T_4 (NAA @ 50 ppm)	40.7	6.7	75.6	10.4
T_5 (BA @ 5 ppm)	37.8	7.4	82.3	13.8
T_6 (2,4-D @ 10 ppm)	41.2	7.5	73.1	10.5
T_7 (BR @ 10 ppm)	42.2	7.2	72.3	7.8
SE±(d)	**1.63**	**0.352**	**5.386**	**0.998**
CD (5%)	**3.55**	**0.767**	**11.737**	**2.175**
CV%	**4.95**	**6.168**	**9.105**	**13.042**

Table 2. Effect of growth regulators on days to first flowering, first harvesting, polar and shoulder diameter.

Treatments	Days to first flowering	Days to first harvesting	Polar diameter (cm)	Shoulder diameter (cm)
T_1 (Control)	31.9	62.1	5.8	4.9
T_2 (GA_3 @ 50 ppm)	32.8	63.0	6.0	5.0
T_3 (IAA @ 100 ppm)	32.8	63.7	5.5	4.6
T_4 (NAA @ 50 ppm)	32.4	63.3	6.1	4.8
T_5 (BA @ 5 ppm)	28.1	60.2	6.6	5.2
T_6 (2,4-D @ 10 ppm)	32.9	62.5	6.3	5.1
T_7 (BR @ 10 ppm)	31.1	61.1	6.2	5.1
SE±(d)	0.73851	23.60018	0.311	0.438
CD (5%)	1.609213	51.42478	0.679	0.954
CV%	2.851983	46.43244	6.28	10.8

brassinosteroids (BRs) as steroidal plant hormones which is essential for plant growth and development.

Days to first flowering and first harvesting

The shorter the time it takes for flowering and harvesting, the earlier the fruit can be sold at a better price. From this experiment it was resulted that BA (5PPM) took less number of days for first flowering (28.1 days) and first harvesting (60.2 days) (Table 2) followed by BR (10PPM). Auxins especially NAA had positive effect on early flowering (Kannan *et al.* 2009). Rana and Singh (2012) proved that NAA (50PPM) had reasonable decreased the days taken to first flower, days taken to 50% flower and total number of flower in a single plant. According to Santner *et al.* (2009), PGRs such as abscisic acid

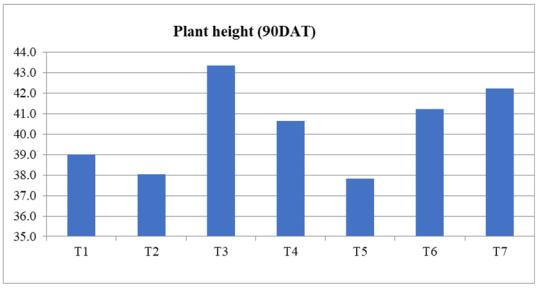

Fig. 1. Effect of growth regulators on plant height.

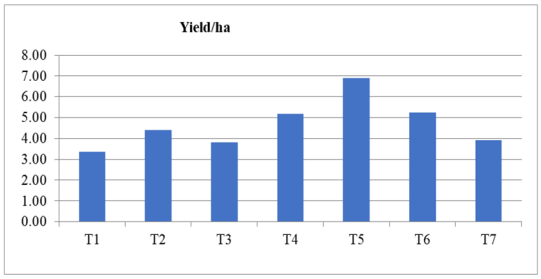

Fig. 2. Effect of growth regulators on yield per hectare.

(ABA), indole-3-aceticacid (IAA), ethylene, salicylic acid which control flowering. Bajguz (2007) found Brassinosteroids as an important plant growth regulator on flowering at nanomolar (nM) concentration.

Yield attributes and yields of sweet pepper

From this experiment it was found that BA (5PPM) had achieved highest value for single fruit weight (82.3 g) (Table 1), polar diameter (6.6 cm), shoulder diameter (5.2 cm) (Table 2) followed by 2, 4-D (10 ppm). Again BA (5 ppm) had highest numbers of fruits per plant followed by NAA (50 ppm). Based on total yield per plot BA (5 ppm) had obtained maximum yield per ha (13.8 t/ha) (Table 1) followed by 2,4-D (10 PPM). The effect of growth regulators on yield is graphically represented (Fig. 2). Similar result obtained when NAA at 50 ppm had reasonable increased number of fruits per plant, fruit breadth, fruit weight and decreased days taken to fruit set, days taken to first picking (Rana and Singh 2012). GA_3 @ 50 ppm had recorded maximum fruit length and NAA @ 50 ppm had recorded maximum number of fruits per plant (Mahindre *et al.* 2018). Again 2,4-D @ 2 ppm performed better for fruit set, total number of fruits per plant, fruit length (Chaudhary *et al.* 2006). Phytohormones like Auxins, Gibberellins, Cytokinin, Abscisic acid are present in Sea weed extract which increase the yield of vegetables, when applied exogenously (Panda *et al.* 2012). In another experiment the foliar spray of NAA at 50 ppm had reasonable increased yield per plant and yield per hectare (Rana and Singh in 2012). Similarly, Naphthalene Acetic Acid @ 40 ppm and Gibberellic Acid @ 10 ppm had produced higher fruit yield @ 28.75%, 25.70%, 13.61% and 2.30% over control, respectively (Chaudhary *et al.* 2006).

CONCLUSION

It can be concluded plant growth regulators provided as foliar application at flowering stage enhances plant growth and development which resulted increased fruit yield in sweet pepper. Among the different growth regulators IAA (100 ppm) had obtained maximum plant height whereas BA (5 ppm) recorded highest value for single fruit weight, fruit polar and shoulder diameter and yield over other treatments. Whereas, 2,4-D had superiority among other treatments for total number of fruiting branches. The less the number of days required for flowering and fruiting the fruit can reach the market early and can fetch a higher price which is directly related to higher return to the farmer. From this experiment it was concluded that BA has taken a smaller number of days for first flowering and first harvesting of fruit.

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