

Original Research Article

<https://doi.org/10.20546/ijcmas.2019.807.149>

## Effectiveness of Plant Growth Regulators on Vegetative Growth of Strawberry cv. Camarosa

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### ABSTRACT

The field experiment was carried out at the permanent experimental field of horticulture garden, Bihar Agricultural College, Sabour, Bhagalpur during 2018-2019 for the Effectiveness of plant growth regulators on vegetative growth of strawberry cv. Camarosa. The experiment was laid out in Randomized Block Design with three replications having nine treatments such as: T<sub>1</sub> (GA<sub>3</sub> @ 100 ppm), T<sub>2</sub> (GA<sub>3</sub> @ 150 ppm), T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm), T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm), T<sub>5</sub> (NAA @ 100 ppm), T<sub>6</sub> (NAA @ 100 ppm), T<sub>7</sub> (NAA @ 100 ppm), T<sub>8</sub> (NAA @ 100 ppm) and T<sub>9</sub> (control) at 30, 60, 90 and 120 days after transplanting. Among the various concentration of plant growth regulators imposed that 250 ppm of GA<sub>3</sub> proved to best with respect to plant height (28.54 cm.), plant spread (39.00 cm.), crown diameter (42.68 mm), petiole length (12.53 cm), no. of leaves per plant (25.60), number of runner per plant (15.73), runner length (23.27 cm) and leaf area index (36.52 cm<sup>2</sup>). Hence, on the basis of overall findings of the present investigation stated that the increasing concentration of plant growth regulators which increase the vegetative growth of strawberry in cv. Camarosa.

#### Keywords

Growth regulators, Camarosa, Naphthalene acetic acid (NAA) and Gibberellic acid (GA<sub>3</sub>)

#### Article Info

##### Accepted:

10 June 2019

##### Available Online:

10 July 2019

### Introduction

The cultivated strawberry (*Fragaria x ananassa* Duch.; family Rosaceae) is a natural hybrid, derived from two North American species, Scarlet (*Fragaria virginiana* Duch.) and Chilean (*Fragaria chiloensis* Duch.). This is an octaploid (2n=8x=56) developed in

France during the 17<sup>th</sup> Century (Martinelli, 1992). It is one of the most fascinating delicious fruits due to its characteristic aroma, bright red in colour, juicy texture and nutritious fruits due to excellent source of vitamin C, manganese, potassium as well as rich source of antioxidants which are consumed in large quantities, either fresh or in

prepared foods, such as preserved fruit juice, pies, ice creams and milkshakes etc. among the soft fruits of the world (Kher *et al.*, 2010). The strawberry is a typical short day and temperate climate fruit crops which are presently cultivated in many countries of world from the arctic to the tropics due to wider climatic as well as soil adaptation (Biswas *et al.*, 2008) and also cultivated in nontraditional regions and different parts of India including sub-tropics and tropics region (Sharma and Sharma, 2004; Suga *et al.*, 2013). In India, it is commercially grown in J & K, Maharashtra, Karnataka and Madhya Pradesh etc. Recently, strawberry's cultivation in northern India especially in Haryana, Punjab, Himachal Pradesh and parts of Uttar Pradesh is picking up fast due to availability of market in Delhi and another city. Strawberry being a vegetatively propagated plant and its commercial propagation through Runners. Runner is slender, prostrate branch with long internodes, creeping at the ground surface, rooting at the node and growing into a new plant.

The plant growth regulators like naphthalene acetic acid (NAA) and gibberellic acid (GA<sub>3</sub>) have been found important to alter the growth, yield and quality parameters of strawberry fruit which enhances the plant resistance to biotic and abiotic stresses (Erdogan *et al.*, 2016). GA<sub>3</sub> progressively increases the plant height, canopy spread, leaf area, number of leaves, petiole length and induces stem elongation when applied exogenously to strawberry plants (Chovatia and Makhmale, 2017). Strawberry farmers are partially dependent upon the time and quantity of runner production of the plants. Early runner production which is prudent in both the cases, such as: runner's production and higher yield. The planting season, spacing and certain agro-techniques, like- application of nutrients, bio regulators, deblossoming, etc. are reported to exert significant influences on runner

formation in strawberry. The quality and quantity of strawberry's runner plants can be regulated and optimized by adopting appropriate techniques. In the view of the potential commercial value of strawberry, Keeping the above facts in view, the present investigation was under taken to study the "Effectiveness of plant growth regulators on vegetative growth of strawberry cv. Camarosa."

## **Materials and Methods**

The present investigation was carried out at the permanent research farm of Horticulture Garden, Bihar Agricultural College, Sabour, Bhagalpur (87°02'42" E, 25°15'40" N) at an altitude of 46 m above mean sea level in the heart of vast Indo-Gangatic plains of north India. The climate of this place is sub-tropical in nature which characterized by dry summer, moderate rainfall and cold winter. January and February are usually the coldest months whereas the mean temperature normally falls as low as 10.4°C. The experiment was laid out in Randomized Block Design with three replications with spacing 40 cm x 30 cm having nine treatments such as: T<sub>1</sub> (GA<sub>3</sub> @ 100 ppm), T<sub>2</sub> (GA<sub>3</sub> @ 150 ppm), T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm), T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm), T<sub>5</sub> (NAA @ 100 ppm), T<sub>6</sub> (NAA @ 100 ppm), T<sub>7</sub> (NAA @ 100 ppm), T<sub>8</sub> (NAA @ 100 ppm) and T<sub>9</sub> (control) at 30, 60, 90 and 120 days after transplanting. The statistical analysis was carried out using ANOVA with Opstat software.

## **Results and Discussion**

### **Plant height (cm)**

The height of strawberry cv. Camarosa showed statistically significant variation with foliar spray of plant growth regulators and the height of tagged plants was measured with the help of a measuring scale from the ground

level to the tip of the primary leaves of the plant and the average results were calculated on the basis of three plants in centimeters. The mean data pertaining to plant height in strawberry cv. Camarosa have been presented in Table 1 the scrutiny of the data revealed that the maximum plant height (28.54 cm) was recorded with foliar application of T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm) followed by plant height (27.67 cm.) with foliar application of T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) and the minimum plant height (15.28 cm) was obtained in T<sub>9</sub> (control) which was statistically on equal footing with plant height (16.00 cm.) with foliar application of T<sub>5</sub> (NAA @ 100 ppm). The height of the plants during present investigation due to application of GA<sub>3</sub> @ 250 ppm which increase the cell elongation and cell division (Rademabher, 2000). The above results are confined with work of Dwivedi (1987), Mohammed *et al.*, (1990), Thakur *et al.*, (2017).

#### **Plant spread (cm.)**

From the Table 1, the perusal data regarding to plant spread, the maximum width of the plant as measured from leaf tip to leaf tip at the maturity level of time. The maximum plant spread (39 cm) was found with foliar application of GA<sub>3</sub> @ 250 ppm followed by plant spread (35.87 cm.) with foliar application of GA<sub>3</sub> @ 200 ppm. While as, the minimum plant spread (25.07 cm.) was found with T<sub>9</sub> (control) followed by plant spread (26.00 cm.) with foliar application of T<sub>5</sub> (NAA @ 100 ppm). Due to application of plant growth regulators, which led to compatible environment in root zone which prevent the weed population. The sufficient soil moisture as well as abundant nutrients are available which regulated the growth of strawberry plant by causing cell elongation and cell division which increase length of petiole by application of GA<sub>3</sub> and NAA. These results are in agreement with Palei *et al.*, (2016) and Kumar *et al.*, (2012b).

#### **Crown diameter (mm.)**

The data concerning to crown diameter for different concentration of plant growth regulators have been presented in Table 1. The maximum crown diameter (42.68 mm.) was found with foliar application of GA<sub>3</sub> @ 250 ppm followed by crown diameter (40.25 mm.) with foliar application of T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm). But the minimum crown diameter was found in (20.40 mm.) in T<sub>9</sub> (control) followed by crown diameter (30.13 mm.) with foliar application of NAA @ 100 ppm. The crown diameter is the main fickle that has been used to determine the capability of the plants if the crown diameter length than 8.0 mm then it has been considered as a good vigor indicator plants as well as faster initial growth in strawberry cultivation (Hochmuth *et al.*, 2001). The results are confined with work of Dale *et al.*, (2006).

#### **Petiole length (cm.)**

The petiole is the stalk that supports a leaf in a plant which attaches with stem. Finding related with different concentration of plant growth regulators which has been presented in Table 1. The maximum length of petiole (12.53 cm.) was recorded with foliar application of T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm) but the minimum petiole length (8.87 cm) for T<sub>9</sub> (control) followed by petiole length (9.93 cm.) with foliar application of T<sub>5</sub> (NAA @ 100 ppm). The results agree with the observation of Palei *et al.*, (2016).

#### **Number of leaves per plant**

The data concerning to number of leaves per plant have been given in Table 1. The maximum number of leaves (25.60) was found with foliar application of T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm) followed by number of leaves (22.80) with foliar application of T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm).

**Table.1** Effect of plant growth regulators on vegetative growth of strawberry cv. Camarosa

Treatments	Plant height (cm)	Plant spread(cm)	Crown diameter (mm)	Petiole length (cm)	No. of leaves per plant	No. of runner per plant	Runner length(cm)	Leaf area Index (cm <sup>2</sup> )
T <sub>1</sub>	22.40	31.67	30.00	9.93	19.00	12.60	20.93	27.07
T <sub>2</sub>	26.30	34.07	39.93	10.63	21.53	13.60	21.27	29.00
T <sub>3</sub>	27.67	35.87	40.25	11.60	22.80	14.27	22.36	33.62
T <sub>4</sub>	<b>28.54</b>	<b>39.00</b>	<b>42.68</b>	<b>12.53</b>	<b>25.60</b>	<b>15.73</b>	<b>23.27</b>	<b>36.52</b>
T <sub>5</sub>	16.00	26.00	30.13	9.80	15.07	6.00	16.87	14.00
T <sub>6</sub>	17.00	27.00	30.33	10.93	16.93	7.47	17.97	16.07
T <sub>7</sub>	17.53	28.07	30.53	11.47	18.67	9.20	18.8	18.56
T <sub>8</sub>	18.67	29.00	30.60	12.00	21.00	10.20	19.83	20.35
T <sub>9</sub>	15.28	25.07	20.40	8.87	19.00	5.67	15.03	15.00
<b>Mean</b>	<b>21.76</b>	<b>30.64</b>	<b>32.76</b>	<b>10.86</b>	<b>19.96</b>	<b>10.53</b>	<b>19.59</b>	<b>23.35</b>
<b>C.V</b>	5.55	6.92	7.37	6.41	5.24	5.98	5.51	5.70
<b>C.D @ 5%</b>	2.04	3.70	4.21	1.21	1.82	1.09	1.88	2.32
<b>Lowest Range</b>	15.28	25.07	20.40	8.87	15.07	5.67	15.03	14.00
<b>Highest Range</b>	28.54	39.00	30.33	12.53	25.60	15.73	23.27	36.52

While as, the minimum number of leaves (15.07) was found with foliar application of T<sub>5</sub> (NAA @ 100 ppm) followed by number of leaves (16.93) with application of T<sub>6</sub> (NAA @ 150 ppm). The number of leaves per plant which was highly significant with increasing concentration of plant growth regulators. The results are agreement with work of Lolaei *et al.*, (2013), Vishal *et al.*, (2016) and Kaur and Mirza (2018).

#### Number of Runners per plant

Finding related with number of runner per plant have been presented in Table 1. The maximum number of runner per plant (15.73) was found in T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm) followed by number of runner per plant (14.27) in T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) but the minimum runner per plant (5.67) was found in T<sub>9</sub> (control) followed by number of runner per plant (6.00) in T<sub>5</sub> (NAA @ 100ppm). The commercially propagation of strawberry by runners and it is

the propagating materials for the cultivation of strawberry. The number of runners was increasing with high dose of GA<sub>3</sub>. Our results are confined with work of Lolaei *et al.*, (2013) and Chovatia and Makhmale (2017).

#### Runner length

The data with respect to runner length under different treatments have been mentioned in Table 1. The maximum runner length (23.27 cm.) was found in T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm) followed by runner length (22.36 cm.) in T<sub>3</sub> (GA<sub>3</sub>@ 200 ppm) but the minimum runner length (15.03 cm) was found in T<sub>9</sub> (control).

The runner length was increased with high concentration of plant growth regulators with favourable climatic factors which enhance the length of runner in strawberry. Our results were confined with Mohammed *et al.*, (1990), Dwivedi *et al.*, (2002) and Chovatia and Makhmale (2017).

## Leaf area index

The data concerning with the leaf area of different treatments have been given in Table 1. The maximum leaf area index (36.52 cm<sup>2</sup>) was found in T<sub>4</sub> (GA<sub>3</sub> @ 250 ppm) followed by leaf area (33.62 cm<sup>2</sup>) in T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) but the minimum leaf area (14.00 cm<sup>2</sup>) was found in T<sub>5</sub> (NAA @ 100ppm). The higher leaf area in these treatments might be attributed due to more available metabolites and their allocation to the above ground parts of the plants through roots. The application of gibberellic acid has the potential to control growth and flowering by reduced leaf area and induces earliness in strawberry. These findings are in line with Sharma and Singh (2009), Kumar and Manimegalai (2008) and Kaur and Mirza (2018).

From the results obtained during the present investigation with different treatments of different plant growth regulators on vegetative growth of strawberry cv. Camarosa, it can be concluded that plants treated with GA<sub>3</sub> 250 ppm which significantly increased the plant height (cm.), plant spread (cm.), crown diameter (mm), petiole length (cm.), number of leaves per plant, number of runner per plant, runner length (cm.) and leaf area index.

## Acknowledgements

The authors are thankful to Chairman, Department of Horticulture, Bihar Agricultural College, Bihar Agricultural University, Sabour, India for providing all the required infrastructure and facilities for the present work.

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#### **How to cite this article:**

Vikash Kumar, Sanjay Sahay, Hidayatullah Mir, Feza Ahmad and Kumari Rashmi. 2019. Effectiveness of Plant Growth Regulators on Vegetative Growth of Strawberry cv. Camarosa. *Int.J.Curr.Microbiol.App.Sci*. 8(07): 1259-1264. doi: <https://doi.org/10.20546/ijcmas.2019.807.149>