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Influence of NAA and GA_3 on Yield and Yield Attributing Parameters of Strawberry (*Fragaria* x *ananassa* Duch.) cv. Sabrina under Net Tunnel

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A B S T R A C T

The present investigation "Influence of NAA and GA_3 on yield and yield attributing parameters strawberry cv. Sabrina under net tunnel" was carried out at College of Agriculture, IGKV, Raipur (C.G.) during the year 2017-18. The experiment was laid out in a randomized block design with eleven treatments considering of control. Observations were recorded on different yield and yield attributing parameters like, maximum number of fruits per plant (36.86), maximum fruit length (5.78 cm), fruit width (3.40 cm), fruit weight (35.33g), fruit volume (24.17cc), fruit diameter (4.19 cm), yield (0.81kg per plant) and yield (308.40q/ha). Treatment T_3 Gibberellic acid @ 75 ppm gave the best results in terms of different yield attributing parameters, while the minimum was recorded under the treatment T_0 (RDF + water spray).

Introduction

Strawberry (*Fragaria* × *ananassa* Duch.) delicious fruit which edible part is succulent thalamus is known as one of the most attractive, nutritious, delicious and refreshing fruit of the world. It belongs to family rosaceae and the most of cultivated varieties are monoecious octaploid (2n=56) hybrid of two largely dioecious, octaploid species, *Fragaria chiloensis* Duch. and *Fragaria virginiana* Duch.. The fruit is widely appreciated for its characteristics aroma, bright red colour, delicate flavour and sweetness.

Strawberry is a temperate fruit and cultivated in plains as well as in the hills but the fruit quality is found excellent in hills. Presently in India strawberry is grown in 1000 ha area with production of 5000 million tons (Anon, 2016). The total area under strawberry in world is 242371 ha with production of 4308 million tons (Anon, 2011).

Strawberries are an excellent source of vitamin 'C' and ellagic and vitamin C is a well-known immunity booster, as well as a powerful, fast-working antioxidant. Strawberry fruits are reported to have antioxidant (lutein and zeathancins),

anticancer due to high fruit polyphenolic content, especially anthocyanins – the type of polyphenols quantitatively most important in strawberry fruits – as well as flavonoids, phenolic acids and vitamin 'C' (Meyers *et al.*, 2003; Olsson *et al.,* 2004 and Cordenunsi *et al.,* 2005).

The use of plant growth regulators has assumed an integral part of modern fruit production to improve the quality and production of fruits and it has resulted in outstanding achievements in a numbers of fruit crops with regard to improvements in yield and quality parameters (Jain and Dashora, 2011). Foliar sprays of NAA have been found to control pre-mature drop of fruit and increasing size of fruit in strawberry. The effect of growth regulators in strawberry on number of fruits, fruit yield, weight of fruit and diameter of fruit have been studied by several workers.

Gibberellic acid plays an important role in increasing the yield and yield attributing parameters of strawberry fruit.

Materials and Methods

An experiment was conducted during the year 2017-18 at the Research Farm of Centre of Excellence on Protected Cultivation and Precision Farming under net tunnel, College of Agriculture, IGKV, Raipur (C.G.). Raipur lies at 21°25' N latitude and 81° 63' E longitude at an altitude of 298.15 meter above the mean sea level and situated near the central part of Chhattisgarh. Raipur district comes under dry, sub-humid agro-climatic region. The soil of experiment field was clay loam, which is locally known as 'Dorsa' in the region. After the field preparation of experimental site tissue cultured planting materials of strawberry cv. Sabrina transplanted in uniform plots with 30cm x 30cm planting spacing. Plants were placed in the media to a depth such a way that the crown remains above from the soil surface but all roots were buried thoroughly. The soils around the plants were pressed and light irrigation was provided after the completion of planting. The experiment was laid out in Randomized Block Design (RBD) composed by 11 treatments and each replicated thrice.

The treatments consisted eleven different concentrations of plant growth regulators along with recommended dose of fertilizers viz., T_0: RDF + Control (water spray), T_1: RDF + Gibberellic acid 25 ppm, T_2: RDF + Gibberellic acid 50 ppm, T_3: RDF + Gibberellic acid 75 ppm, T_4: RDF + Gibberellic acid 100 ppm, T_5: RDF + Gibberellic acid 125 ppm, T_6: RDF + Naphthalene acetic acid 10 ppm, T_7: RDF + Naphthalene acetic acid 20 ppm, T_8: RDF + Naphthalene acetic acid 30 ppm, T_9: RDF + Naphthalene acetic acid 40 ppm, T_{10}: RDF + Naphthalene acetic acid 50 ppm. The plant growth regulators applied at 30 and 45 days after planting on strawberry cv. Sabrina. The plant growth regulators were sprayed upper surface of the plant with the help of knap sack sprayer with fine nozzle having mist droplets.

Results and Discussion

Number of fruits per plant

The maximum number of fruits per plant (36.86) was observed under the treatment T_3 (RDF + Gibberellic acid 75 ppm) which was found significantly superior from rest of the treatments. The treatments T_6, T_8 & T_9 and T_2 & T_5 having average number of fruits per plant 27.35, 27.39 & 27.36 and 32.60 & 32.34, respectively found statistically at par with each other. While the minimum number of fruits per plant (24.52) was observed under the treatment T_0 (RDF + Control). Application of GA_3 increased number of fruits per plant. Similar results were also

obtained by Saima *et al.,* (2014) and Thakur *et al.,* (2015) in strawberry (Table 1).

Fruit length (cm)

The maximum fruit length (5.78 cm) was observed under the treatment T_3 (RDF + Gibberellic acid 75 ppm), which was recorded superior among all other treatments followed by T_4 (5.03 cm). The treatments T_9 and T_6 having fruit lengths of 4.04 and 4.03 cm, respectively registered statistically at par with each other. However the minimum fruit length (3.55 cm) was observed under the treatment T_0 (RDF + Control). Similar results were supported by the results of Kumar and Tripathi (2009) and Tripathi and Shukla (2010) in strawberry.

Fruit width (cm)

The maximum fruit width (3.40 cm) was recorded under T_3 (RDF + Gibberellic acid 75 ppm) which was recorded superior and significant differences among all other treatments under present investigation and followed by T_2 & T_4, while the minimum fruit width (1.74 cm) was observed under the treatment T_0 (RDF + Control). The treatments T_2, T_4, T_5, T_1, T_{10} & T_7 and T_6, T_9, T_8, T_1, T_{10} & T_7 having respective fruit width of 2.65, 2.65, 2.54, 2.27, 2.26 & 2.38 and 1.93, 1.94, 2.03, 2.27, 2.26 & 2.38 cm were found statistically non-significant differences with each other at 5 % level of significance under present experiment. Similar results were obtained by Kumar and Tripathi (2009) and Tripathi and Shukla (2010) in strawberry.

Table.1 Influence of NAA and GA_3 on number of fruits per plant, fruit length, fruit width, fruit weight of strawberry cv. Sabrina under net tunnel

Treatments	Number of fruits per plant	Fruit length (cm)	Fruit width (cm)	Fruit weight (cm)
T_0 -RDF + Control (Water spray)	24.52^{a}	3.55^{a}	1.74^{a}	21.90^{a}
T_1 -RDF + GA_3 25 ppm	29.43^{e}	4.38^{bc}	2.27^{bc}	28.11^{bc}
T_2 -RDF + GA_3 50 ppm	32.60^{g}	4.76^{cd}	2.65^{c}	29.58^{bc}
T_3 -RDF + GA_3 75 ppm	36.86^{f}	5.78^{e}	3.40^{d}	35.33^{d}
T_4 -RDF + GA_3 100 ppm	34.36^{h}	5.03^{d}	2.65^{c}	31.40^{cd}
T_5 -RDF + GA_3 125 ppm	32.34^{g}	4.52^{bcd}	2.54^{c}	29.08^{bc}
T_6 -RDF + NAA 10 ppm	27.35^{b}	4.03^{ab}	1.93^{ab}	26.32^{b}
T_7 -RDF + NAA 20 ppm	30.23^{f}	4.40^{bc}	2.38^{bc}	28.53^{bc}
T_8 -RDF + NAA 30 ppm	27.39^{bc}	4.23^{b}	2.03^{ab}	27.23^{bc}
T_9 -RDF + NAA 40 ppm	27.36^{bc}	4.04^{ab}	1.94^{ab}	27.13^{bc}
T_{10} -RDF + NAA 50 ppm	28.43^{d}	4.28^{bc}	2.26^{bc}	27.96^{bc}
SE(m) ±	**0.11**	**0.17**	**0.16**	**1.46**
C.D. at 5%	**0.33**	**0.51**	**0.48**	**4.33**

RDF – Recommended dose of fertilizers

The superscript letters indicates that the treatment means with same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD- value comparison of treatment means

Table.2 "Influence of NAA and GA_3 on fruit volume (cc), fruit diameter (cm), yield per plant (kg), yield (q/ha) and benefit: cost ratio of strawberry cv. Sabrina under net tunnel"

Treatments	Fruit volume (cc)	Fruit diameter (cm)	Yield per plant (kg)	Yield (q/ha)	B:C ratio
T_0 -RDF + Control (Water spray)	19.92^{a}	2.79^{a}	0.57^{a}	216.03^{a}	$2.02:1^{a}$
T_1 -RDF + GA_3 25 ppm	22.06^{bcde}	3.12^{abcd}	0.64^{bcd}	256.19^{abcd}	$2.81:1^{c}$
T_2 -RDF + GA_3 50 ppm	23.32^{ef}	3.84^{de}	0.71^{e}	241.00^{abcd}	$3.44:1^{d}$
T_3 -RDF + GA_3 75 ppm	24.17^{f}	4.19^{e}	0.81^{f}	308.40^{e}	$4.02:1^{f}$
T_4 -RDF + GA_3 100 ppm	24.08^{f}	3.99^{e}	0.77^{f}	279.20^{de}	$3.77:1^{e}$
T_5 -RDF + GA_3 125 ppm	22.12^{bcde}	3.78^{cde}	0.71^{e}	239.53^{abcd}	$2.88:1^{c}$
T_6 -RDF + NAA 10 ppm	20.53^{ab}	2.88^{ab}	0.63^{bc}	223.40^{ab}	$2.48:1^{b}$
T_7 -RDF + NAA 20 ppm	22.11^{bcde}	3.61^{bcde}	0.67^{bcde}	241.13^{abcd}	$2.83:1^{c}$
T_8 -RDF + NAA 30 ppm	21.32^{abcd}	3.02^{abc}	0.63^{bc}	228.77^{abc}	$2.55:1^{b}$
T_9 -RDF + NAA 40 ppm	20.65^{abc}	3.02^{abc}	0.63^{bc}	249.49^{abcd}	$2.49:1^{b}$
T_{10} -RDF + NAA 50 ppm	21.35^{abcd}	3.09^{abcd}	0.64^{bcd}	259.17^{bcd}	$2.55:1^{b}$
SE(m) ±	**0.66**	**0.26**	**0.01**	**13.98**	**0.05**
C.D. at 5%	**1.95**	**0.76**	**0.04**	**41.52**	**0.16**

RDF – Recommended dose of fertilizers

The superscript letters indicates that the treatment means with same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD- value comparison of treatment means

Fruit weight (g)

Application of RDF + Gibberellic acid 75 ppm (T_3) produced maximum fruit weight (35.33 g), which was recorded statistically at par with T_4 having average fruit weight of 31.40 g. The treatments T_{10}, T_5, T_2, T_7, T_1, T_8 and T_9 having fruit weight of 27.96, 29.08, 29.58, 28.53, 28.11, 27.23 and 27.13 g, respectively were registered at par with each other. The minimum fruit weight (21.90 g) was noticed under the treatment T_0 (RDF + Control). The findings of present investigation are in close agreement with the view of various workers in strawberry Khokhar *et al.*, (2004) and Thakur *et al.*, (2015).

Fruit volume (cc)

The treatment T_3 (RDF + Gibberellic acid 75 ppm) registered maximum volume of fruit (24.17cc), which was non-significant difference with T_4 and T_2 having average fruit volume of 24.08 and 23.32cc, respectively. The minimum volume of fruit (19.92 cc) was noticed under the treatment T_0 (RDF + Control). The physiological basis for increase in fruit volume appears to be due to an increase in growth rate by cell division and cell enlargement. Plant growth regulators might involved in faster loading and mobilization of photo assimilates to fruits. Application of Gibberellic acid 75 ppm significantly increased the average volume of fruit. Similar observations on fruit volume were also reported by Khokhar *et al.*, (2004), Saima *et al.*, (2014) and Thakur *et al.*, (2015).

Fruit diameter (cm)

The maximum fruit diameter (4.19 cm) was recorded under T_3 (RDF + Gibberellic acid 75 ppm), which showed statistically at par with T_2 (3.99 cm), which showed statistically at par with the treatments T_4, T_2, T_5 and T_7

having respective average fruit diameter of 3.99, 3.84, 3.78 and 3.61 cm at 5% level of significance, while the minimum fruit diameter (2.79 cm) was observed under the treatment T_0 (RDF + Control). Diameter of fruits may vary due to the capacity of fruits to accumulate assimilates. Similar observations on fruit diameter due to GA_3 were also reported by Singh and Singh (2009) and Saima *et al.,* (2014) in strawberry.

Yield per plant (kg)

The highest yield kg/plant (0.81) was recorded under the treatment T_3 (RDF + Gibberellic acid 75 ppm) followed by the treatment T_4 (0.77 kg/plant). The treatments T_5, T_2 & T_7 and T_7, T_1 & T_{10} and T_7, T_1, T_{10}, T_9, T_6 & T_8 having average fruit yield of 0.71, 0.71 & 0.67 and 0.67, 0.64 & 0.64 and 0.67, 0.64, 0.64, 0.63, 0.63 & 0.63 kg/plant, respectively showed non-significant differences with each other. Similarly the treatments T_5, T_2 and T_7 having respective average fruit yield of 0.71, 0.71 and 0.67 kg/plant were recorded at par with each other. While the minimum yield per plant (0.57 kg) was recorded in control. The increase in yield might be due to the increased fruit set per plant, fruit length and fruit width as well as fruit weight. These findings are in conformity with the findings of Bhautkar (2001), Dale *et al.,* (2006), Singh and Tripathi (2010), Kumar *et al.,* (2012) and Khunte *et al.,* (2014) in strawberry (Table 2).

Yield (q/ha)

The highest yield q/ha (308.40) was recorded under the treatment T_3 (RDF + Gibberellic acid 75 ppm), which was found at par with T_4 having average fruit yield of 279.20 q/ha. However minimum yield (216.03 q/ha) was recorded under untreated plant in present investigation. The higher yield may be due to increased flowering and more fruit set, higher fruit weight and size. These findings are in conformity with the findings of Khokhar *et al.,* (2004) and Kumar *et al.,* (2012) in strawberry.

Benefit: cost ratio

The maximum Benefit: cost ratio (4.02) was recorded under the treatment T_3 (RDF + Gibberellic acid 75 ppm), followed by treatment T_4 (3.77) and T_5 (3.44). However, the minimum Benefit: cost ratio was observed under T_0 (2.02). The treatment T_3 (RDF + Gibberellic acid 75 ppm) was identified as economical and profitable for strawberry crop under the plain regions of Chhattisgarh.

In conclusion the treatment T_3 gibberellic acid @ 75 ppm gave the best results in terms of different yield attributing parameters *i.e*. number of fruits per plant, fruit length, fruit width, fruit weight, fruit volume, fruit diameter, yield per plant and yield (q/ha), while the minimum was recorded under the treatment T_0 (RDF + water spray). Hence the application of plant growth regulator (RDF + GA_3 75 ppm) is recommended for maximum fruiting and high yield in strawberry under Chhattisgarh region.

References

Anonymous. 2011. FAOSTAT-Food and Agriculture Organization of the United Nations.

Anonymous. 2016. National Horticulture Board, Department of Agriculture and Co-operation, Ministry of Agriculture, Govt. of India, Gurgaon (Haryana).

Bhautkar, M.Y. 2001. Effect of plant growth regulators on growth and yield of strawberry. J. Maharashtra Agric. Univ., 19(2): 295-296.

Cordenunsi, B.R., Genovese, M.I., do Nascimento, J.R.O., Hassimoto, N.M.A., dos Santos, R.J. and Lajolo,

F.M. 2005. Effect of temperature on the chemical composition and Anti- oxidant activity of three strawberry cultivars. Food Chem., 91, 113–121.

Dale, A., Elfving, D.C. and Chandler, C. K. 2006. Benzyladenine and gibberellic acid increases runner production in strawberries. Horti. Sci., 31(7): 1190-1194.

Jain, M.C. and Dashora, L.K. 2011. Effect of plant growth regulators on physico-chemical characters and yield of guava cv. Sardar under high density planting system. Indian J. Horti., 68: 259–261.

Khokhar, U.U., Prashad, J. and Sharma, M.K. 2004. Influence of growth regulators on growth yield and quality of strawberry cv. Chandler. Haryana J. Hortic. Sci., 33(3/4): 186-188.

Khunte, S.D., Kumar, A., Kumar, V., Singh, S. and Saravanan, S. 2014. Effect of plant growth regulators and organic manure on physico-chemical properties of strawberry (*Fragaria* × *ananassa* Duch.) cv. Chandler. Int. J. Scientific Res. and Edu., 2(7): 1424-1435.

Kumar, R., Saravanan, S., Bakshi, P. and Bandral, J. 2012. Influence of plant bio-regulators and picking time on yield and quality of strawberry (*Fragaria* × *ananassa* Duch) cv. Sweet Charlie. The Asian J. Horti., 7(1): 137-139.

Kumar, R. and Tripathi, V.K. 2009. Influence of NAA, GA_3 and boric acid on growth, yield and quality of strawberry cv. Chandler. Prog. Horti., 41(1): 113- 115.

Meyers, K.J., Watkins, C.B., Pritts, M.P. and Liu, R.H. 2003. Antioxidant and anti-proliferative activities of strawberries. J. Agric. Food Chem., 51: 6887–6892.

Olsson, M.E., Ekvall, J., Gustavsson, K.E., Nilsson, J., Pillai, D., Sjoholm, I., Svensson, U., Akesson, B. and Nyman, M.G.L. 2004. Antioxidants, low molecular weight carbohydrates and total antioxidant capacity in strawberries (*Fragaria x ananassa* Duch.): effects of cultivar, ripening, and storage. J. Agric. Food Chem., 52: 2490–2498.

Saima, Z., Sharma, A., Umar, I. and Wali, V.K. 2014. Effect of plant bio-regulators on vegetative growth, yield and quality of strawberry cv. Chandler. African J. Agric. Res., 9(22): 1694-1699.

Singh, A. and Singh, J.N. 2009. Effect of bio-regulators on growth, yield and nutrient status of strawberry cv. Sweet Charlie. Indian J. Horti., 66(2): 220-224.

Singh, V.K. and Tripathi, V.K. 2010. Efficacy of GA_3 on growth, flowering, yield and quality of strawberry cv. Chandler. Prog. Agri., 10(2): 345-348.

Thakur, S., Mehta, K. and Sekhar, R.S. 2015. Effect of GA_3 and plant growth promoting rhizobacteria on growth, yield and fruit quality of strawberry (*Fragaria* × *ananassa* Duch.) cv. Chandler. Int. J. Advanced Res., 3(11): 312 – 317.

Tripathi, V. K. and Shukla, P.K. 2010. Influence of plant bio-regulators on yield and fruit characters of Strawberry cv. Chandler. Prog. Horti., 42(2): 186-188.

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