

SHORT COMMUNICATION

Role of PGRs and Organic Manure on Quantitative and Qualitative Characters of Strawberry cv. Chandler

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ABSTRACT

Strawberry (*Fragaria x ananassa* Duch.) is one of the most delicious and refreshing soft fruits. Plant growth regulators (PGR's) and poultry manure has been commonly used in modifying various physiological processes with advantage in plant growth, flowering, fruit yield and other attributes in strawberry crop. The plant growth parameters like plant height, plant spread and petiole length increased with application of poultry manure and GA₃. The minimum plant height, plant spread and petiole length, minimum number of leaves per plant and minimum days taken to first flower was observed with poultry manure and CCC treated plant. The maximum weight of fruit, maximum length diameter ratio of fruits, maximum specific gravity, maximum fruit yield per plant, fruit yield per plot and fruit yield per ha. was recorded with poultry manure and triacontanol treated plants. The maximum juice content of fruit (90.12%) was observed with poultry manure and NAA treated plants.

Keywords CCC, GA₃, NAA, Organic Manure, Strawberry and Triacontanol.

Strawberry (*Fragaria x ananassa* Duch.) is the most widely distributed fruit crop owing to its genotypic diversity, highly heterozygous nature and environmental adaptation (Larson *et al.*, 1994 and Childers *et al.*, 1995). It is also nutritious and beneficial for anemic patients. Strawberry consumption can reduce the risk of cancer by 50% due to high level of vitamin - C (30 - 100 mg/100 g) foliate and photochemical compound such as the ellagic acid present in the fruit. Besides this, it is also a fairly good source of vitamin - A (60 IU/100 g) Kumar *et al.* (2011). The common cultivated strawberry is considered as a hybrid between *F. virginiana* and *F. chilonensis*. *F.* species belongs to rosaceae family with basic chromosome number X=7. Genus *Fragaria* includes at least 17 other species (diploid, tetraploid, hexaploid and octoploid). The cultivated strawberry is an octoploid (2n=8x=56).

In India it is grown in Dehradun, Nainital (Uttarakhand), Solan, Kullu and Palampur (H.P.), Srinagar (J&K) and hills of Darjeeling (W.B.). Now its cultivation is gaining popularity in the tropical and sub-tropical areas of Gurgaon (Haryana), Muzaffer Nagar, Saharanpur and Meerut (U.P.), Jalandhar, Patiala, Ludhiana and Gurdaspur (Punjab) and Pune (Maharashtra).

The fresh ripe fruit of strawberry are rich source of vitamins, minerals and among vitamins it is fairly good source of vitamin A and vitamin C. It has high pectin, available in the form of calcium pectate, which serves as an

excellent ingredient for jelly making. Besides it also has abundance of minerals, like potassium, calcium and phosphorus. In strawberry the ellagic acid (naturally occurring plant phenol) has been found to inhibit cancer disease. The regular consumption of strawberry fruits also controls asthma.

Most strawberry cultivars produce hermaphrodite flowers and are self-fertile. However, some also produce male or staminate, imperfect and female or pistillate flowers. Hermaphrodite flowers are self-fertile and pistillate flowers requires cross pollination for fruit production. The inflorescence is really a modified stem and at each node of the inflorescence a bract replaces the leaf while the bud in the axil of the bract develops into a branch of the inflorescence. Strawberry is an aggregate fruit and non-climateric fruit which develops by simultaneous ripening of the number of separate berries of a single flower, adhering as the common unit on the common receptacle, botanically called as "etaerio of achenes". Strawberry is usually propagated through runners. Now a day, large scale propagation by tissue culture has been used widely in strawberry industry.

Growth and development of strawberry is highly sensitive to variations in air and soil temperature. An optimum growing season temperature of 15°C has been reported for most of the strawberry cultivars and species (Larson *et al.*, 1994) have found range between 20 and 26°C, the ambient temperature for proper growth. Plants grow very fast in plains and its starts bearing within three months of planting and in hills, it takes 9-12 months to come to bearing. However, the fruit quality is very good in hills as compared to plains. Similarly, the colour and flavor development is not proper in plains.

Organic manures in soil have been associated with increases in water-holding capacity, cation-exchange capacity, aeration and root depth as well as decrease in soil crusting and erosion. Poultry manure, Compost, Farm yard manure and vermi-compost have been utilized in agriculture as a significant source of organic manure. Manures supply plant nutrients including micronutrients, provide food for soil micro-organisms and buffering action in soil reaction. 3.03 % N, 2.63 % P₂O₅ and 1.4 % K₂O nutrient composition of poultry manure. Continuous and indiscriminate use of chemical fertilizers has caused serious damage to the soil ecosystem and physico-chemical characteristics so there is need to use the organic manure in place chemical fertilizers to maintain the soil ecosystem. Plant growth regulators are also used in order to control vegetative growth (Latimer, 1991).

Roll of Plant Growth Regulators in Strawberry

Gibberallic acid (GA₃)

Anwar and Hanen (1990) reported that plant height, number of leaves and number of suckers were highest with 100 ppm GA₃ strawberry cv. Murree Ozguven and Kaska (1991) reported that early and profuse flowering, better yield along with quality of fruit was recorded with 50 ppm GA₃ in strawberry cv. Chandler. Sharma and Singh (1990) reported that plant height, plant spread, number of fruits/plant, individual fruit weight, TSS and acidity were increased for GA₃ treated strawberry plants. Dwivediet *al.* (1996) reported that the maximum number of leaf and petiole length per plant was obtained under long day condition + 50 ppm GA₃ in strawberry cv. SengaSengana. Pipattanawong *et al.* (1996) reported highest petiole length with GA₃ treated strawberry plants. Parousii *et al.* (2000) reported that the GA₃ at 200 ppm increased the petiole length and leaf area in strawberry. Khokharet *al.* (2004) reported that GA₃ at 75 ppm produced the tallest plants, the highest leaf area, number of leaves per plant, cumulative fruit yield, fruit weight and fruit volume while fruit anthocyanin content was highest with GA₃ at 50 ppm in strawberry cv. Chandler. Tripathi and Shukla (2006) reported that GA₃ at 100 ppm concentration produced tallest plants (20.39 cm) with higher number of leaves (18.09), number of flowers (16.23) and weight (8.02 g.) of berries in strawberry cv. Chandler. Sharma and Singh (2009) reported that fruit size decreased, and fruit number increased but there was no remarkable effect on fruit quality parameters in strawberry. Kumar *et al.* (2012) reported that GA₃ at 90 ppm gave best result in terms of vegetative growth, runner production, ascorbic acid and acidity. Kumar *et al.* (2013) reported that highest juice content of fruits (86.70/86.46%), TSS (7.56/7.43°Brix), sugar content (4.33/4.26%), pH of fruit (3.87/3.86) were recorded in 50 ppm GA₃ treated strawberry cv. Belrubi. The plant growth parameters like plant height, plant spread and petiole length increased with application of poultry manure and GA₃ at all successive stage of plant growth. The treatment combination treatment T₁₃ (8.50 tones poultry manure + 200 ppm GA₃) showed the maximum plant height (27.57 cm), plant spread (26.41 cm) and petiole length (13.87 cm).

Chloro Choline Chloride (CCC):

Cocel is a growth retardant and gave best yield characters. Thakur *et al.* (1991) reported that crown height, leaf number and leaf area were reduced while fruit anthocyanin content were increased with 1000 ppm CCC treated strawberry plants cv. Teoga. Pankov (1992) reported that CCC increased fruit yield by 1.6 and 1.9 t/ha respectively in strawberry mother plants cv. Yasna and SengaSengana. Tripathi and Shukla (2007) examined that maximum berry width was recorded with 1000 ppm CCC treated strawberry cv. Chandler. Kumar and Saravanan (2010) reported that highest length diameter ratio of fruits (2.10) with treatment T₁₀ (GA₃ 75 ppm + CCC 500 ppm). Kumar *et al.* (2012) reported that 900 ppm CCC showed higher juice content, pH value, total soluble solid, ascorbic acid and total sugar in strawberry fruits. Dwivediet *al.* (1996) reported that the maximum days taken to produce first flower from day after transplant with 1000 ppm cycocel treated

strawberry plants under long day condition. Kumar *et al.* (2012) reported that the highest values for fruit yield 330.7 g/plant and 20.15 t/ha and cost benefit ratio (1:2.70) were recorded with the use of 500 ppm cycocel in strawberry fruit cv. Sweet Charlie. The minimum plant height, plant spread, petiole length and minimum number of leaves per plant was observed with treatment T₁₂ (8.50 tones poultry manure + 1200 ppm CCC). Minimum days taken to first flower (55.77 DAT) was observed with the treatment T₈ (5.50 tones poultry manure + 800 ppm CCC) followed by T₁₂ (8.50 tones poultry manure + 1200 ppm CCC) 56.22 days.

Naphthalene Acetic Acid (NAA):

Mir *et al.* (2004) observed that plant height, plant spread, number of leaves per plant, petiole length, leaf area index, days to first flowering and days to fruit bud development, fruit yield per plant, yield per hectare were highest with NAA at 0, 10, 15, 20, 25, 30 and 35 ppm treated strawberry cv. Sweet Charlie and highest yield per plant (362.5 g) along with improved fruit quality recorded with NAA @ 15 ppm. Asreyet *al.* (2004) reported that the pre-harvest treatment with NAA 25 ppm showed the higher vitamin C (49.30 mg/100 g pulp) content during storage in strawberry cv. Chandler. Villarreal *et al.* (2009) reported that the treatment with naphthalene acetic acid (NAA) delayed ripening and anthocyanin accumulation of strawberry fruits. The maximum juice content of fruit (90.12%) was observed with treatment T₁₀ (8.50 tones poultry manure + 200 ppm NAA).

Triacantanol:

Thakur *et al.* (1991) reported that highest number of leaves per plant (7.2) and leaf area (149.4 cm) were obtained with 50 ppm triacantanol treated strawberry cv. Teoga. Kumar *et al.* (2011) the results revealed that highest number of fruits (23.31), yield per hectare (27.90 tones), length diameter (1.50) and cost benefit ratio (1:3.1) were recorded with triacantanol 5 ppm treated strawberry plants cv. Sweet Charlie. Blarke and Lenz (1983) reported that Triacantanol treated strawberry plants increased number of root which causes plants to take up more nutrients from soil and increased production per plants. The maximum weight of fruit, maximum length diameter ratio of fruits, maximum specific gravity was recorded with poultry manure + 100 ppm triacantanol treated plant and the maximum fruit yield per plot (3301.83 g) and fruit yield per ha. was recorded with treatment T₇ (5.50 tones poultry manure + 150 ppm triacantanol).

Roll of organic manures in strawberry

Poultry manure:

3.03 % N, 2.63 % P₂O₅ and 1.4 % K₂O nutrient composition of poultry manures. Turemis (2002) reported that the fruit yield was 490.2 g/plant with wheat straw + poultry manure while with poultry manure fruit yield was 436.6 g/plant of strawberry cv. Dorit (216). Singh *et al.* (2006) reported that strawberry cv. SengaSengana plants showed the highest values for plant height (23.39 cm), plant spread (24.21 cm), runners per plant (13.03) and yield (238.95 g/plant) as well as the earliest blooming (10.33 days) along with better quality with treatment combination poultry

manure + *Azotobacter* + wood ash + phosphate solubilizing bacteria + oil cake in. Umar Iqbal *et al.* (2008) reported that the maximum plant height 20.29 cm, plant spread 27.65 cm and leaf area 69.05 cm² with the application of 50 per cent nitrogen through poultry manure and remaining quantity in the form of urea in combination with *Azotobacter* treated strawberry *cv.* Senga Sengana. Ngodup and Sarvanan (2010) reported that strawberry plant showed highest plant height, plant spread, petiole length, no. of leaves, fruit per plant and the highest yield was obtained from T₇ (vermicompost @ 2tonnes /ha + poultry manure @ 2tonnes /ha). Subhajith and Prasad (2010) results revealed that the application of 50% NPK+ 50% poultry manure of recommended dose noticed 15.31 tones yield per hectare and 0.81 % acidity and 50.80 mg/100 g ascorbic acid in strawberry. Ayesha *et al.* (2011) reported that improvement in the fruit weight of strawberry was observed (10.0 g) with T₃; Soil+ Silt+ Poultry Manure (1: 1: 1). Nowsheen *et al.* (2012) reported that maximum plant growth and fruit yield (132.75q/ha) of strawberry obtained with treatment Poultry manure + *Azotobacter*+Wood ash+ PSB+ Oil Cake (T₂).

CONCLUSION

The present investigation at the Experimental Field of the Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed to-be University), Allahabad U.P. It was concluded that the highest vegetative growth of plant was recorded with treatment T₁₃ (8.50 tones poultry manure and 200 ppm GA₃). Poultry manure and triacontanol treated plants has given highest results in terms fruit yield per plant, fruit yield per plot and fruit yield per hectare. The maximum juice content of fruit (90.12%) was observed with treatment T₁₀ (8.50 tones poultry manure + 200 ppm NAA). The maximum ascorbic acid (58.71 mg/100 g pulp) was observed with treatment T₄ (2.50 tones poultry manure + 400 CCC). The best benefit cost ratio was recorded with the treatment T₇ (5.50 tones poultry manure + 150 ppm triacontanol). The application of poultry manure, GA₃ and triacontanol is recommended for better growth and yield in strawberry under Allahabad region.

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