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Influence of PGRs and Poultry Manure on Physico-Chemical Parameters of Strawberry (*Fragaria x ananassa* Duch.) cv. Chandler

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A B S T R A C T

A field experiment was conducted during the winter season at the experimental field of the Department of Horticulture, Allahabad School of Agriculture, SHIATS, Allahabad (U.P.) entitled "Influence of PGRs and Poultry Manure on physico-chemical parameters of Strawberry (*Fragaria x ananassa*Duch.) *cv.* Chandler." PGRs namely NAA (100, 150 and 200 ppm), GA_3 (100, 150 and 200 ppm), Triacontanol (100, 150 and 200 ppm) and CCC (400, 800 and 1200 ppm) were applied as foliar spray and poultry manure (2.50, 5.50 and 8.50 tones ha^{-1}) was mixed in soil during field preparation. The results revealed that treatment T_3 showed the maximum fruit weight (16.84g), fruit length diameter ratio (1.58) and specific gravity (1.34). Maximum p^H value (3.90) and total soluble solid (10.19^0brix) were reported with the treatment T_{12}. The maximum juice content (90.12%) of fruit was recorded with treatment T_{10}. However the maximum acidity of fruit juice (0.87 %) was observed under treatment T_9.

Introduction

The common cultivated strawberry (*Fragaria x ananassa* Duch.) is considered as a man made hybrid crop evolved by crossing between *F. virginiana* and *F. chilonensis. F.* species and belongs to rosaceae family with basic chromosome number X=7. Genus *Fragaria* includes atleast 17 other species (diploid, tetraploid, hexaploid and octoploid). The cultivated strawberry is an octoploid (2n=8x=56). Strawberry is the most delicious and refreshing soft fruits of the world. It is an aggregate fruit and non-climateric fruit which develops by simultaneous ripening of the number of separate berries of a single flower (Fig. 3), adhering as the common unit on the common receptacle, botanically called as

"etaerio of achenes". Strawberry can be grown in wide climatic conditions, ranging from temperate to tropical climate.

Growth and development of strawberry is highly sensitive to variations in air and soil temperature. An optimum growing season temperature of 15^0C has been reported for most of the strawberry cultivars and species have found range between 20 to 26^0C, the ambient temperature for proper growth (Larson *et al.,* 1994). 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. 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. 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, erosion and maintain the soil ecosystem. Vegetative growth of plant was increased by organic manures treated strawberry (Ngodup and Saravanan, 2010). 3.03 % N, 2.63 % P_2O_5 and 1.4 % K_2O nutrient composition of poultry manures (Katyayan, 2008). Poultry manure was fruit yield increased with 50% NPK combination and ascorbic acid also increased (Subhjith and Prasad, 2010).

The fruit quality is very good in hills as compared to plains. Similarly, the colour and flavor development is not proper in plains. 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. Plant growth retardants generally have great effects on cells elongation, where inhibition of GA_3 synthesis rapidly causes reduction in stem elongation and leaf expansion (Tanimoto, 1983). GA_3 at 100 ppm concentration produced tallest plants (20.39 cm) with higher number of leaves (18.09) and number of flowers (16.23). Further this treatment extended the duration of flowering (72.66 days) and resulted in higher yield (112.95 g.) per plant with maximum length (3.09 cm) and weight (8.02 g.) of berries. The maximum berry breadth 1.93cm was recorded in strawberry plants with CCC at 1000 ppm followed by GA_3 at 100 ppm (1.91cm) (Tripathi and Shukla, 2006). Triacontanol treated plants increased number of root which causes plants to take up more nutrients from soil and increased production per plants (Blarke and Lenz, 1983). The highest number of fruits (23.31), yield per hectare (27.90 tones), length diameter (1.50) and B: C ratio was recorded with triacontanol treated strawberry (Kumar *et al.,* 2011). The highest grass return, net return and B: C ratio was recorded with CCC treated strawberry (Kumar *et al.,* 2012). The highest number of leaves per plant and leaf area was found with triacontanol and anthocyanin content was increased with CCC treated plant (Thakur *et al.,* 1991) .The highest fruit diameter, weight, volume, acidity per cent (as citric acid equivalent) and the lowest sugar: acid ratio with 400 ppm NAA treated strawberry plant (Techawongstein, 1989).

Materials and Methods

The present investigation was carried out under Allahabad agro-climatic conditions 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. (Fig. 1)

The soil ploughed 2-4 times by cultivator, harrowed, leveled and the weeds were rooted out from experimental field. Runners of

strawberry cv. Chandler transplanted in uniform plots during evening with 45cm x 30cm planting spacing. Thirteenth treatment combinations were randomized in three replications.

The various combination of poultry manure (tone/ha) and different Plant growth regulators were as: T_1 – (control), T_2–(Poultry Manure 2.50 tonnes + NAA 100 ppm), T_3–(Poultry Manure 2.50 tonnes + Triacontanol 100 ppm), T_4 – (Poultry Manure 2.50 tonnes + Cycocel 400 ppm), T_5 – (Poultry Manure 2.50 tonnes + GA_3 100 ppm), T_6 –(Poultry Manure 5.50 tonnes + NAA 150 ppm), T_7–(Poultry Manure 5.50 tonnes + Triacontanol 150 ppm), T_8 – (Poultry Manure 5.50 tonnes + Cycocel 800 ppm), T_9– (Poultry Manure 5.50 tonnes + GA_3 150 ppm), T_{10} – (Poultry Manure 8.50 tonnes + NAA200 ppm) T_{11}– (Poultry Manure 8.50 tonnes + Triancontanol200 ppm), T_{12}– (Poultry Manure 8.50 tonnes + CCC1200 ppm) and T_{13} – (Poultry Manure 8.50 tonnes + GA_3 200 ppm) (Fig. 3).

Poultry manure broadcasted according to various treatment combinations during layout of experimental plots twenty days before transplanting. GA_3 and triacontanol dissolve powder in a small volume of alcohol. 5-10 ml. Alcohol solvents listed above.

GA_3 solution was slight heated to improve solubility. Measure 1000 ml (1.0 litre) of good quality water and was added liquid hand dish washing soap at 1-5 drops. It was best to shake before each spraying.

Aim for coating the upper surface of the plant leaves thoroughly, Spay enough to allow drip down from the leaves, stems and shoots also. The observations were recorded on Qualitative characters in terms length diameter ratio, Fruit weight (fruit/g), specific gravity, pH of fruit juice, acidity of fruit juice, ascorbic acid, juice content of fruit, TSS of fruit (Fig. 2).

Results and Discussion

The various treatments showed significant effect on length diameter ratio of fruits. The maximum length diameter ratio of fruit (1.58) was observed with treatment T_3. The minimum length diameter ratio of fruit (1.36) was observed with treatment T_1. These results were in close conformity with the findings of Kumar *et al.,* (2011). The maximum weight of each fruit (16.84 g) was observed with treatment T_3 (2.50 tones poultry manure + 100 ppm triacontanol) followed by (16.46 g) with treatment T_7 (5.50 tones poultry manure + 150 ppm triacontanol).

The maximum specific gravity (1.34) was observed with treatment T_3. The minimum specific gravity (1.14) was recorded in treatment T_5. Similar results were also reported by Kumar *et al.,* (2011). The present data shown in table 1 and it was found that effect of plant growth regulators and organic manure on pH of the fruit juice was significant. The maximum pH of the fruit juice (3.90) was observed with treatment T_{12} followed by treatment T_4. The minimum pH of the fruit juice (3.34) was observed with treatment T_3. These results were in close conformity with the findings of Kumar *et al.,* (2011). The maximum acidity of fruit juice (0.87%) was observed with treatment T_9. The minimum acidity of fruit juice (0.74%) was observed with treatment T_5. Similar findings were also reported by Singh and Singh (1979) and Kumar *et al.,* (2012). The various treatments showed significant effect on ascorbic acid of fruits. The maximum ascorbic acid (58.71 mg/100 g pulp) was observed with treatment T_4. The minimum ascorbic acid of fruit (50.51 mg) was observed under treatment T_1. Similar findings were also reported by Singh and Phogat, (1983).The maximum juice content of fruit (90.12%) was observed with treatment T_{10}. Similar finding were also reported by Kumar *et at.,* (2012) (Fig. 4–10).

Table.1 Influence of PGRs and Poultry Manure on physico-chemical parameters of Strawberry

Treatment	plant height (cm)	Plant Spread (cm)	Total no of fruits per plant	Fruit yield per plant (g)	Length : diameter ratio (cm)	Specific gravity	pH value	Acidity (%)	TSS (^{0}Brix)	ascorbic acid (mg/100 g)	Juice content (%)
T_1	13.08	20.25	11.47	146.80	1.36	1.16	3.37	0.77	8.26	50.51	84.20
T_2	14.03	22.54	15.67	227.90	1.51	1.20	3.66	0.78	9.16	52.63	88.74
T_3	14.05	21.51	17.93	301.94	1.58	1.34	3.34	0.79	9.21	54.07	85.70
T_4	12.82	20.08	17.40	270.22	1.47	1.20	3.86	0.81	9.34	58.71	89.69
T_5	21.35	23.85	15.27	207.43	1.43	1.14	3.68	0.74	8.92	54.79	85.56
T_6	15.63	21.86	15.13	226.79	1.52	1.24	3.74	0.75	9.52	51.45	87.60
T_7	16.03	23.89	20.07	330.18	1.56	1.30	3.79	0.83	8.76	53.81	87.22
T_8	12.15	19.76	19.33	317.84	1.53	1.23	3.65	0.79	9.70	56.95	86.78
T_9	24.41	24.81	14.47	181.22	1.40	1.18	3.45	0.87	9.52	55.13	86.33
T_{10}	15.09	24.19	16.20	224.96	1.41	1.17	3.50	0.82	8.99	53.23	90.12
T_{11}	15.98	21.93	19.50	305.57	1.49	1.21	3.69	0.76	9.11	52.34	85.31
T_{12}	11.31	19.37	18.20	293.07	1.46	1.22	3.90	0.75	10.19	57.33	88.10
T_{13}	27.57	26.41	13.53	163.35	1.42	1.19	3.55	0.80	7.86	56.18	83.71
f-test	S	S	S	S	S	S	S	NS	S	S	S
CD at 0.05	1.47	2.59	2.89	28.18	0.06	0.11	0.34	0.11	0.76	1.15	1.48

Fig.1 Experimental plots

Fig.2 Harvested fruits from the experimental plots

Fig.3 During ripening of fruits in plant

Fig.4 Influence of PGRs and poultry manure on length: diameter ratio of fruit of Strawberry

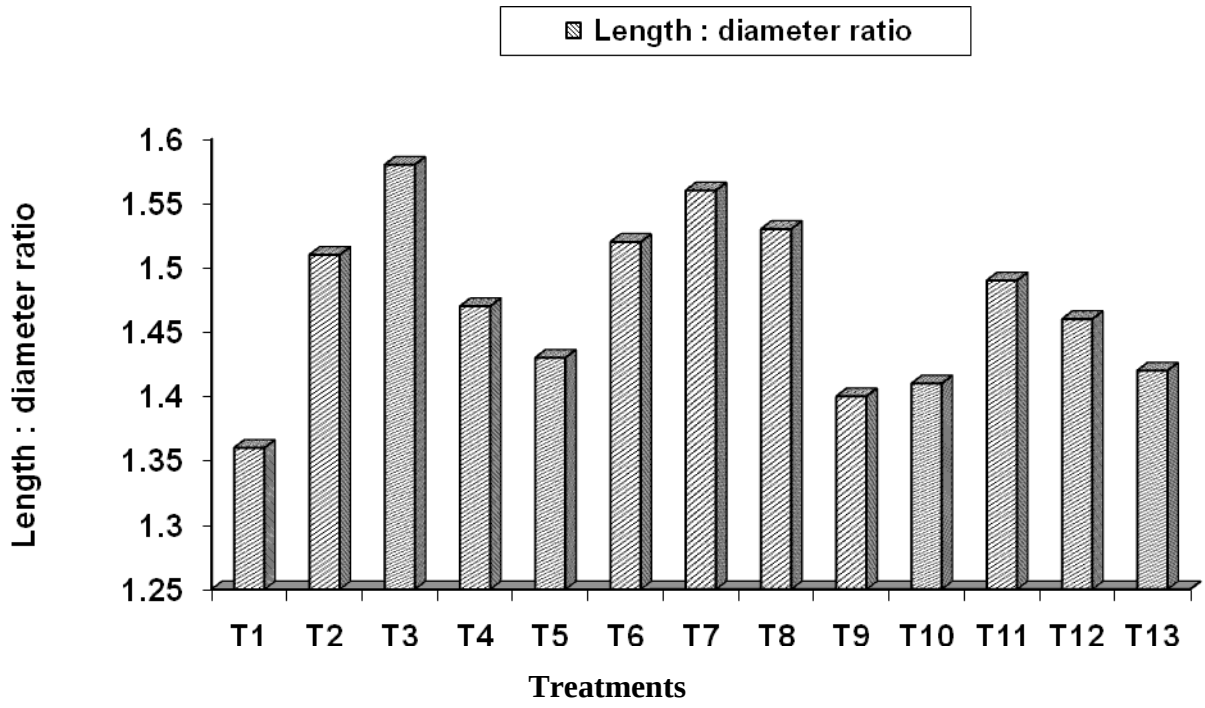


Fig.5 Influence of PGRs and poultry manure on specific gravity of fruit of Strawberry

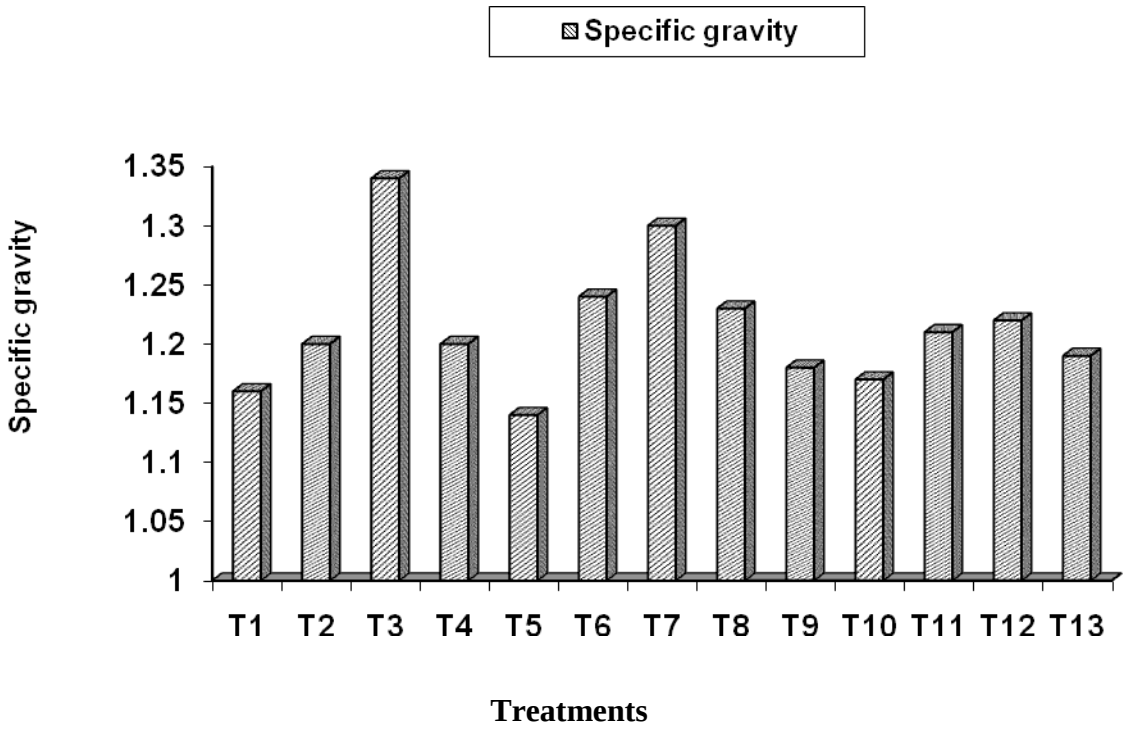


Fig.6 Influence of PGRs and poultry manure on pH of fruit juice of Strawberry

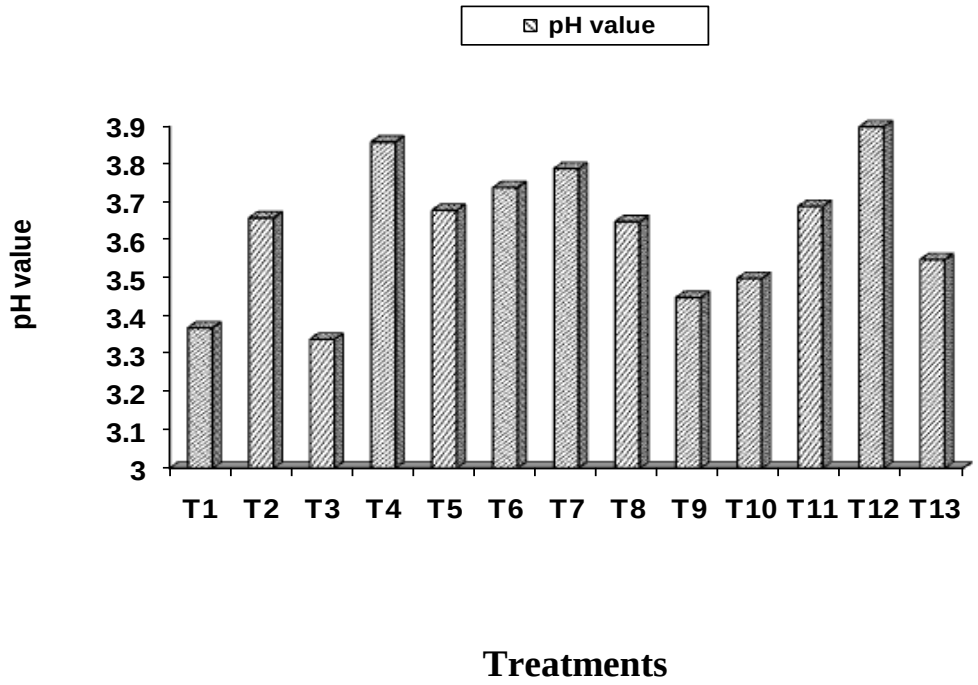


Fig.7 Influence of PGRs and poultry manure on acidity of fruit juice (%) of Strawberry

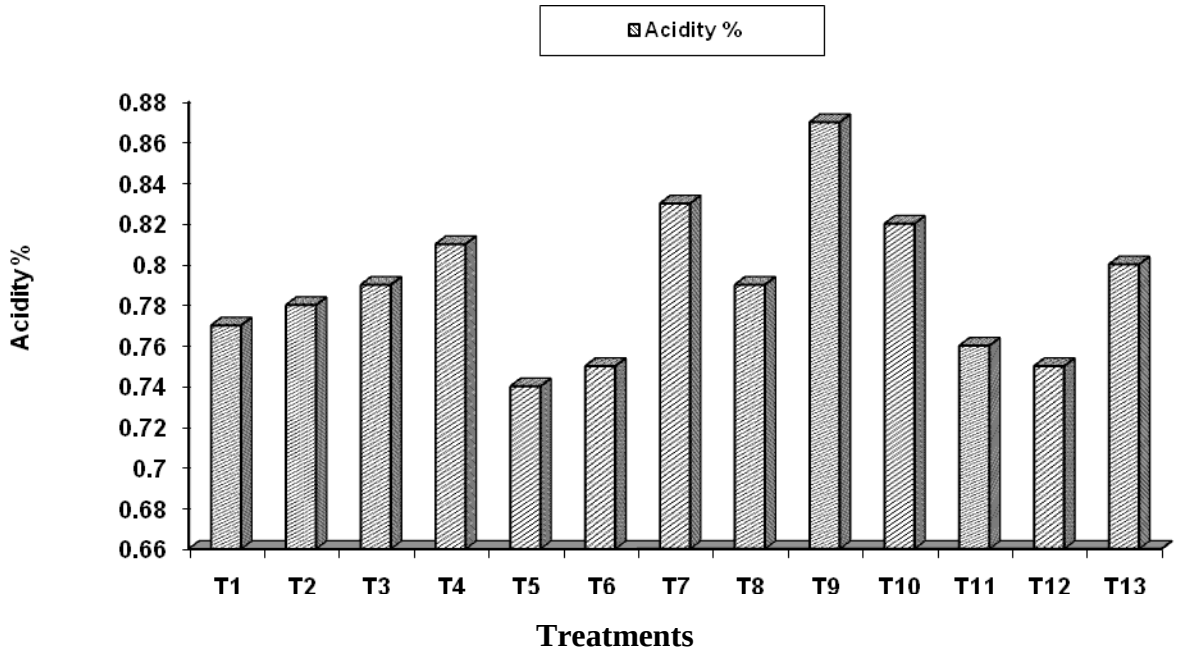


Fig.8 Influence of PGRs and poultry manure on total soluble solids (^{o}Brix) of Strawberry

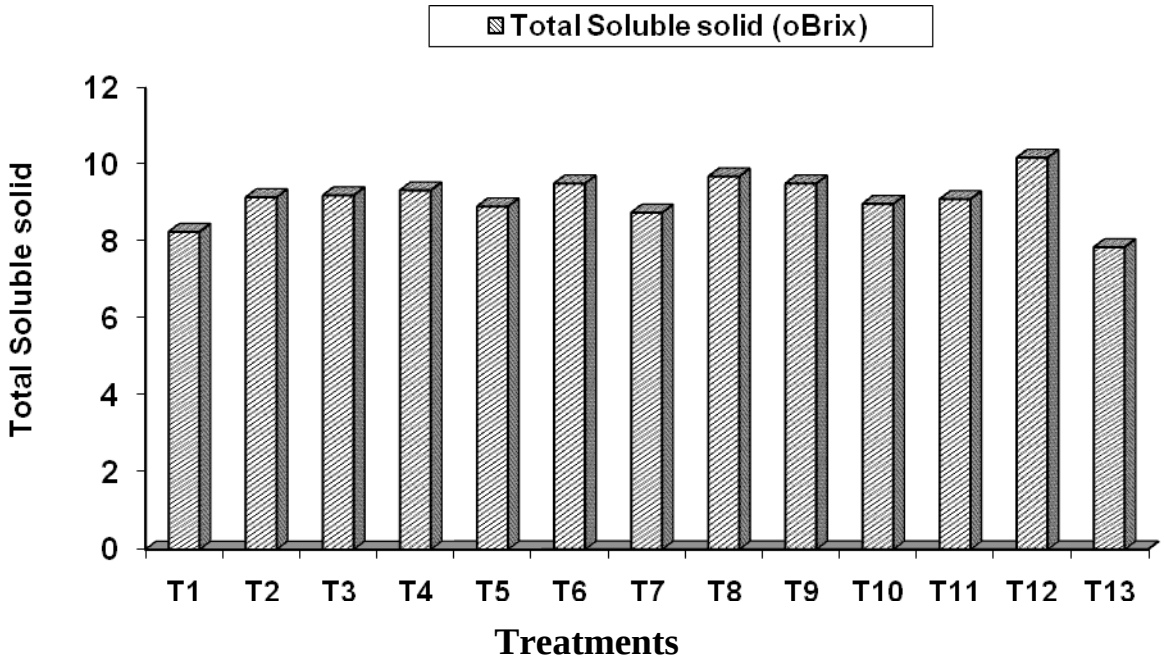


Fig.9 Influence of PGRs and poultry manure on ascorbic acid of fruits (mg/100 g pulp) of Strawberry

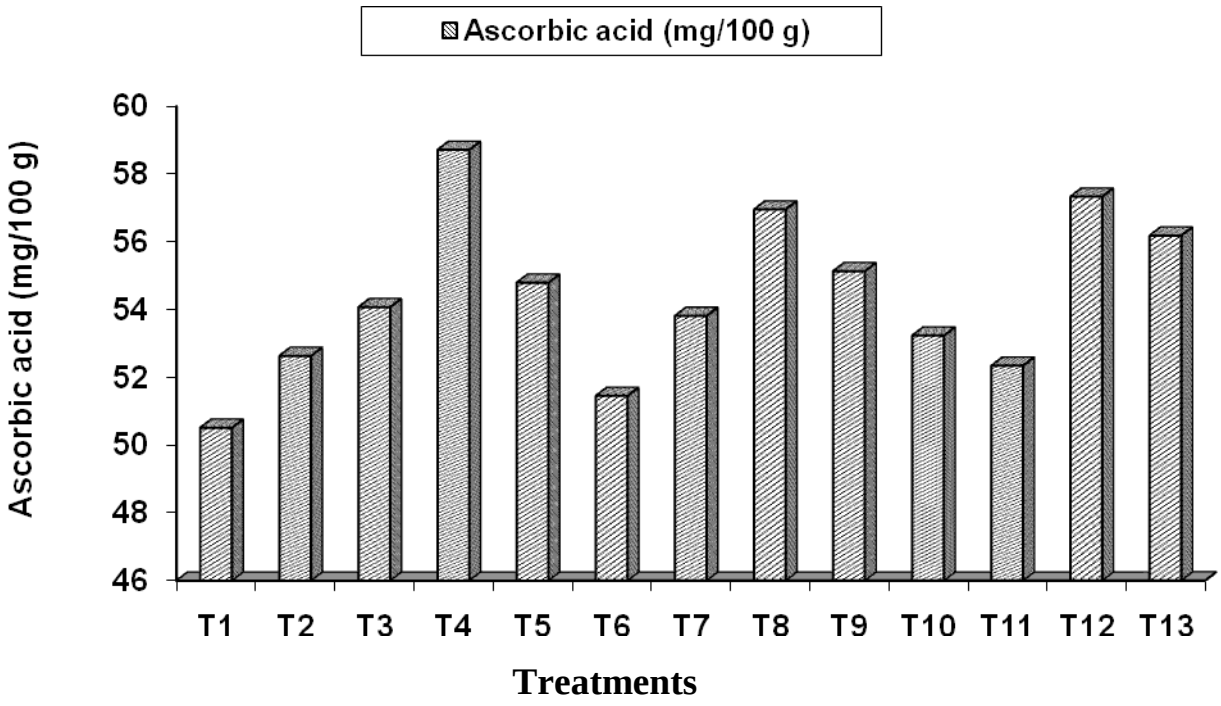
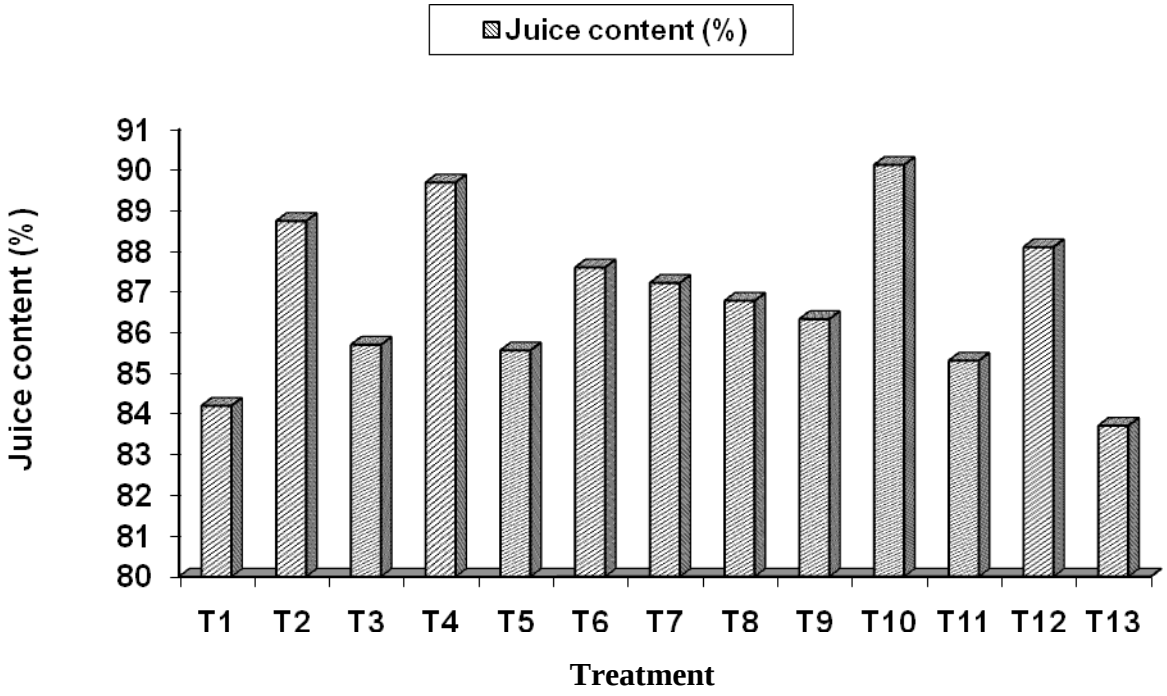


Fig.10 Influence of PGRs and poultry manure on Juice content of fruit (%) of Strawberry



The maximum TSS of fruit (10.19) was noticed with treatment T_{12} (8.50 tones poultry manure + 1200 ppm CCC) while the minimum TSS of fruit (7.86) was observed with treatment T_{13} (8.50 tones poultry manure + 200 ppm GA_3). Similar results were also reported by Kumar *et al.,* (2012) and Kumar *et al.,* (2011).

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 maximum plant height, plant spread and petiole length, maximum number of leaves per plant was recorded with poultry manure and GA_3 treated plants. The highest fruit yield per plant, specific gravity, length diameter ratio was recorded poultry manure and triacontanol treated plants. The highest vitamin C and TSS was recorded poultry manure and CCC treated plants. The application of poultry manure, GA_3, CCC and triacontanon is recommended for better physico-chemical parameters. Hence, overall use of plant growth regulators (PGR's) and poultry manure not only increases plant growth and yield but also results in the improvement in fruit quality of strawberry.

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