

IMPACT OF PLANT GROWTH REGULATOR ON ROOT DEVELOPMENT OF DRAGON FRUIT CUTTING [*HYLOCEREUS COSTARICENSIS* (WEB.) BRITTON AND ROSE]

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Abstract: An experiment was conducted to know the influence of growth regulators IBA, NAA and their combination on rooting of stem cuttings in Dragon fruit [*Hylocereus undatus* (Haworth) Britton & Rose] under low cost polyhouse at Horticulture Research Farm, Department of Horticulture, BBAU a central university luck now, during the year October 2020 to April 2021. The experiment was laid out by following Complete Randomized Design with twelve treatments replicated thrice. The stem cuttings of Dragon fruit treated with different plant growth regulators result reveals that, the length of the longest root (10cm), fresh weight and dry weight of root (18g and 0.18 g, respectively), total number of roots per cuttings (8.00), root diameter (2.00 mm) were found in T₉ IBA @3000ppm+ NAA@100ppm) at 60 day after treatment followed by T₁₁ (8.66cm,16g,0.16g, 7 number, 1.86 mm) treated with IBA @ 2000ppm +NAA@200 ppm). while and the lowest of all these were found in control (without PGR) T₁ (6cm, 13g,0.12gm ,6 number, 1.00 mm) was recorded.

Keywords: Dragon fruit, Rooting, Stem cutting, IBA, NAA, PGR

INTRODUCTION

Dragon fruit is a perennial climbing cactus, belongs to the family Cactaceae. It is one of the newly introduced exotic fruit crop in India. The origin is tropical and subtropical forest regions of Mexico and Central South America (Mirzahi and Nerd, 1996). It is commonly called as Pitaya, Strawberry pear, Night blooming cereus, Queen of night, Honorable queen, Cereus triangularis, Jesus in the cradle and Belle of the night (Martin et al., 1987). It has received worldwide recognition, as an ornamental plant and as a fruit crop. Dragon fruit also possess medicinal properties; especially the red-fleshed varieties are rich in anti-oxidants. Regular consumption of fresh dragon fruit greatly controls the asthma, cough, cholesterol, high blood pressure, helps with stomach disorders, good for heart health, helps in preventing cancer, prevents congenital glaucoma, boosts immune power, reduces arthritis pain, good for pregnant women, prevents renal bone disease, good for bone health, repairs body cells, helps in improving appetite, good for eye health, boosts brain health, flowers are used in Aromatherapy. The vegetative propagation in Dragon fruit is utmost desirable in order to propagate true-to-type plants. Hence, vegetative methods of propagation viz., stem cuttings is done which is inexpensive, rapid, simple and does not require the particular techniques as in case of other methods. The reports on an investigation on the propagation of

Dragon fruit from cuttings and use of growth regulators for better root growth are scanty. Therefore, the study was undertaken on the propagation of Dragon fruit using different growth regulators for rapid multiplication.

MATERIALS AND METHODS

The experiment was carried out in a low cost polyhouse at Horticulture Research Farm, Department of Horticulture, BBAU a central university luck now, during the year 2020 -21. The experiment was laid out in a complete randomized design with 12 treatments replicated thrice consisting of growth regulators IBA, NAA and their different combinations (T₁- Control (without PGR) T₂- IBA 1000 ppm, T₃-IBA 2000 ppm, T₄- IBA 3000 ppm, T₅- NAA 100 ppm, T₆ NAA 200 ppm, T₇- IBA @ 1000 ppm+NAA@100 ppm, T₈- IBA 2000 ppm+NAA 100 ppm, T₉- IBA 3000 ppm+NAA 100 ppm, T₁₀- IBA 1000 ppm + NAA 200 ppm, T₁₁- IBA 2000 ppm + NAA 200 ppm and T₁₂- IBA 3000 ppm+NAA 200ppm). Cuttings were collected from two year old shoots with 6-7 nodes each. ~ 1596 ~ Journal of Pharmacognosy and Phytochemistry Length of the cuttings used for planting was ranging from 25 ± 2 cm . The cuttings were treated with fungicide (2% Bavistin) solution and dried in shade, cool place then cuttings were dipped in different concentration solution of IBA according to planned treatment combination for 5 second and later, they

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are allowed to dry for 15 minutes under shade and planted in poly bags containing rooting media, keeping indentation margin up side and planted in poly bags. After planting cuttings were examined and the following observation were recorded on, the length of the longest root, fresh weight and dry weight of root , total number of roots per cuttings , root diameter , was recorded.

RESULTS AND DISCUSSION

Effect of growth regulators on length (cm) of the root in stem of cuttings.

The data of length of root in stem of cutting at 60 days after treatment has been presented in Table 1. and fig 1. The maximum length of root cutting (10.00 cm) of stem was counted in treatment T₉ (IBA @ 3000 ppm + NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (8.66cm). While minimum length of root of the cutting (6.00 cm) was recorded in treatment T₁ (Control) followed by treatment T₂ (7.00 cm). At 90 days after treatment maximum length of root cutting (15.00 cm) of stem was counted in treatment T₉(IBA @ 3000 ppm + NAA @

100 ppm). but it is statistically similar to treatment T₁₁ (14 .00cm). While minimum length of root cutting (10.00 cm) was recorded in treatment T₁ (Control) followed by treatment T₂ (11.33cm). At 120 days after treatment maximum length of root cutting (20.00 cm) of stem was counted in treatment T₉ (IBA @ 3000 ppm+ NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (18.66cm). While minimum length of root cutting (15.00cm) was recorded in treatment T₁ (Control) followed by treatment T₂ (16 .33cm). These results were consequences with the findings of Dhurve *et al.*,(2018),Seran and Thiresh (2015),Ayesha and Thippesha (2018) and they recorded average root length from maximum 23.07 cm to minimum 4.27 cm. It might be due to effect of auxin because rooting was favored by a high C/N ratio and presence of higher percentage of starch, sucrose, reducing sugars. The auxin treatment markedly enhanced starch depletion and the same was correlated with enhanced rooting and triggering elongation process (Alexander, 1938; Mitchell *et al.*, 1940 and Bausor, 1942).

Table 1. Effect of PGRs on length (cm) of root at 60, 90 and 120 DAT

Treatment	Length(cm)of root		
	60 DAT	90DAT	120DAT
T ₁ Control (without PGR)	6.00	10.00	15.00
T ₂ IBA @ 1000 ppm	7.00	11.33	16.33
T ₃ IBA @ 2000 ppm	7.66	11.66	17.33
T ₄ IBA @ 3000 ppm	7.33	12.00	17.00
T ₅ NAA@100 ppm	8.00	13.66	18.00
T ₆ NAA@200 ppm	8.33	12.00	18.33
T ₇ IBA @ 1000 ppm+NAA@100 ppm	7.33	13.00	18.66
T ₈ IBA @ 2000 ppm+NAA@100 ppm	7.66	13.66	17.66
T ₉ IBA @ 3000 ppm+NAA@100 ppm	10.00	15.00	20.00
T ₁₀ IBA @ 1000 ppm+NAA@200 ppm	7.66	15.33	16.66
T ₁₁ IBA @ 2000 ppm+NAA@200 ppm	8.66	14.00	18.66
T ₁₂ IBA @ 3000 ppm+NAA@200 ppm	7.00	12.33	17.66
S _{Em} (±)	0.385	0.385	0.215
CD(P=0.05 %)	1.130	1.130	0.632

Effect of growth regulators on fresh weight (g) of root of cutting

The data accumulated on the fresh weight of root due to influence of various level of plant growth regulators have been displayed in Table 2 and in figure.2. critical analysis of data revealed that various treatment significantly enhances the fresh weight of root at 60 days after treatment maximum fresh weight of root (18.00g) of stem was counted in treatment T₉ (IBA @ 3000 ppm + NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (16 g). While minimum fresh weight of root (13 g) was recorded in treatment T₁ (Control) followed by treatment T₂ (14 g).At 90 days after

treatment maximum fresh weight of root (24.66 g) of stem was counted in treatment T₉. but it is statistically similar to treatment T₁₁ (23 g). While minimum fresh weight of root (17 g) was recorded in treatment T₁ (Control) followed by treatment T₂ (18 g). At 120 days after treatment maximum fresh weight of root (35.33 g) of stem was counted in treatment T₉. but it is statistically similar to treatment T₁₁ (33.33 g). While minimum fresh weight of root (26.00 g) was recorded in treatment T₁ (Control) followed by treatment T₂ (26.66g). Results obtained in present investigation were similar to the findings of Ahmad *et al.* (2016) and Dhurve *et al.*, (2017). Fresh weight of root showing statistically significant

result because of different concentration of IBA. Auxin might increase amount of stored carbohydrates in roots which is directly influence the fresh weight of root.

Table 2. Effect of PGRs on fresh weight (g) root at 60,90 and 120 DAT

Treatment	Fresh weight(g) of root		
	60 DAT	90DAT	120DAT
T ₁ Control (without PGR)	13.00	17.00	26.00
T ₂ IBA @ 1000 ppm	14.00	17.66	26.66
T ₃ IBA @ 2000 ppm	14.66	17.33	27.33
T ₄ IBA @ 3000 ppm	15.33	18.33	28.33
T ₅ NAA@100 ppm	15.66	19.33	29.33
T ₆ NAA@200 ppm	15.66	20.66	30.33
T ₇ IBA@1000ppm+NAA@100 ppm	15.00	21.00	30.66
T ₈ IBA@2000ppm + NAA@100 ppm	15.66	22.33	31.63
T ₉ IBA@3003ppm+NAA@100 ppm	18.00	24.66	35.33
T ₁₀ IBA @ 1000 ppm+NAA@200 ppm	17.00	21.33	29.66
T ₁₁ IBA @2000 ppm+NAA@200 ppm	16.66	23.33	33.33
T ₁₂ IBA @ 3000 ppm+NAA@200 ppm	17.00	21.66	31.00
SEm(±)	0.577	0.347	0.304
CD(P=0.05 %)	1.695	1.019	0.893

Effect of growth regulators on dry weight (g) of root in stem of cuttings

The data accumulated on the dry weight of root due to influence of various level of plant growth regulators have been displayed in table 3. and figure 3. critical analysis of data revealed that various treatment significantly enhances the dry weight of root at 60 days after treatment maximum dry weight of root (0.18 g) of stem was counted in treatment T₉ (IBA @ 3000 ppm + NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (0.17 g). While minimum dry weight of root (0.12 g) was recorded in treatment T₁ (Control) followed by treatment T₂ (0.13 g).At 90 days after treatment maximum dry weight of

root (0.250) of stem was counted in treatment T₉ (IBA @ 3000 ppm + NAA @ 100 ppm).but it is statistically similar to treatment T₁₁ (0.24 g). While minimum dry weight of root (0.18 g) was recorded in treatment T₁ (Control) followed by treatment T₂ (0.19 g)At 120 days after treatment maximum dry weight of root (0.32 g) of stem was counted in treatment T₉ (IBA @ 3000 ppm + NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (0.31 g). While minimum dry weight of root (0.25 g) was recorded in treatment T₁ (Control) followed by treatment T₂ (0.26 g). Ahmad *et al.*, (2016) and Dhruve *et al.*, (2017) also reported high dry matter by IBA application.

Table 3. Effect of PGRs on dry weight (g) ofroot at 60, 90 and 120 DAT

Treatment	Dry weight(g) of root		
	60 DAT	90DAT	120DAT
T ₁ Control (without PGR)	0.12	0.18	0.25
T ₂ IBA @ 1000 ppm	0.13	0.19	0.26
T ₃ IBA @ 2000 ppm	0.13	0.20	0.26
T ₄ IBA @ 3000 ppm	0.14	0.21	0.27
T ₅ NAA@100 ppm	0.13	0.21	0.28
T ₆ NAA@200 ppm	0.13	0.22	0.29
T ₇ IBA @ 1000 ppm+NAA@100 ppm	0.15	0.23	0.27
T ₈ IBA @2000 ppm+NAA@100 ppm	0.16	0.23	0.27
T ₉ IBA @3000 ppm+NAA@100 ppm	0.18	0.25	0.32
T ₁₀ IBA @ 1000 ppm+NAA@200 ppm	0.15	0.21	0.28
T ₁₁ IBA @ 2000 ppm+NAA@200 ppm	0.16	0.23	0.31
T ₁₂ IBA @3000 ppm+NAA@200 ppm	0.15	0.22	0.28
SEm(±)	0.003	0.005	0.006
CD(P=0.05 %)	0.010	0.015	0.017

Effect of growth regulators on total number of roots in stem of cuttings

The data accumulated on the total number of root due to influence of various level of plant growth regulators have been displayed in Table 4. and figure 4. critical analysis of data revealed that various treatment significantly enhances the total number of roots at 60 days after treatment maximum number of root (8.00) of stem was counted in treatment T₉ (IBA @ 3000 ppm + NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (7). While minimum number of root (6.00) was recorded in treatment T₁ (Control) followed by treatment T₂ (6.00). At 90 days after treatment maximum number of root (15) of stem was counted in treatment T₉. it is statistically similar to treatment T₁₁ (14). While

minimum number of root (10.00) was recorded in treatment T₁ (Control) followed by treatment T₂ (10.66). At 120 days after treatment maximum number of root (22.00) of stem was counted in treatment T₉. but it is statistically similar to treatment T₁₁ (21.00). While minimum number of root (16.00) was recorded in treatment T₁ (Control) followed by treatment T₂ (16.66). The results obtained in present investigation were in conformity with the earlier findings of following researchers viz. Seran and Thiresh (2015), Ahmad *et al.*, (2016) Dhruve *et al.*, (2017) who also recorded average number of roots per cutting from 7.0 cm to 19.3 cm. Application of the different concentration of IBA positively influenced number of initiated roots per cutting as it influence the initiation of roots in cutting.

Table 4. Effect of PGRs on total number of roots at 60, 90 and 120 DAT

Treatment	Total Number of roots		
	60 DAT	90DAT	120DAT
T ₁ Control (without PGR)	6.00	10.00	16.00
T ₂ IBA @ 1000 ppm	6.33	10.66	16.66
T ₃ IBA @ 2000 ppm	6.66	11.66	18.33
T ₄ IBA @ 3000 ppm	6.66	12.66	18.66
T ₅ NAA@100 ppm	7.00	12.00	19.66
T ₆ NAA@200 ppm	6.33	12.66	19.33
T ₇ IBA @ 1000 ppm+NAA@100 ppm	7.33	12.00	19.00
T ₈ IBA @ 2000 ppm+NAA@100 ppm	6.00	13.00	17.66
T ₉ IBA @ 3000 ppm+NAA@100 ppm	8.00	15.00	22.00
T ₁₀ IBA @ 1000 ppm+NAA@200 ppm	6.33	11.33	19.33
T ₁₁ IBA @ 2000 ppm+NAA@200 ppm	7.00	14.00	21.00
T ₁₂ IBA @ 3000 ppm+NAA@200 ppm	6.33	12.33	17.66
S _{Em} (±)	0.304	0.408	0.289
CD(P=0.05 %)	0.893	1.999	0.848

Effect of growth regulators on root diameter (mm) in stem of cuttings

The data accumulated on the root diameter due to influence of various level of plant growth regulators have been displayed in Table 5. and figure.5. critical analysis of data revealed that various treatment significantly enhances the root diameter at 60 days after treatment maximum root diameter (2 mm) of stem was counted in treatment T₉ (IBA @ 3000 ppm+ NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (1.9 mm). While minimum root diameter (1 mm) was recorded in treatment T₁ (Control) followed by treatment T₂ (1.2 mm). At 90 days after treatment maximum root diameter (4 mm) of stem was counted in treatment T₉ (IBA @

3000 ppm+ NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (3.6 mm). While minimum root diameter (2 mm) was recorded in treatment T₁ (Control) followed by treatment T₂ (2.2 mm). At 120 days after treatment maximum root diameter (5.00 mm) of stem was counted in treatment T₉ (IBA @ 3000 ppm + NAA @ 100 ppm). but it is statistically similar to treatment T₁₁ (4.83 mm). While minimum root diameter (4.00 mm) was recorded in treatment T₁ (Control) followed by treatment T₂ (4.13mm). Ahmad *et al.* (2016) also recorded average diameter of root (0.9 mm to 1.5 mm). as similar to present result. This is due to IBA, which acted as a root promoting hormone, its influence root primordia and length of root with number root.

Table 5. Effect of PGRs on root diameter (mm) at 60,90 and 120 DAT.

Treatment	Root diameter (mm)		
	60 DAT	90 DAT	120DAT
T ₁ Control (without PGR)	1.00	2.00	4.00
T ₂ IBA @ 1000 ppm	1.20	2.63	4.13
T ₃ IBA @ 2000 ppm	1.33	2.56	4.50

T₄ IBA @ 3000 ppm	1.50	2.70	4.16
T₅ NAA@100 ppm	1.46	2.63	4.73
T₆ NAA@200 ppm	1.56	3.20	4.63
T₇ IBA @ 1000 ppm+NAA@100 ppm	1.26	2.86	4.13
T₈ IBA @2000 ppm+NAA@100 ppm	1.46	3.06	4.16
T₉ IBA @ 3000 ppm+NAA@100 ppm	2.00	4.00	5.00
T₁₀ IBA @ 1000 ppm+NAA@200 ppm	1.66	3.03	4.13
T₁₁ IBA @ 2000 ppm+NAA@200 ppm	1.86	3.40	4.83
T₁₂ IBA @ 3000 ppm+NAA@200 ppm	1.50	2.33	4.20
SEm(±)	0.086	0.285	0.135
CD(P=0.05 %)	0.253	0.838	0.398

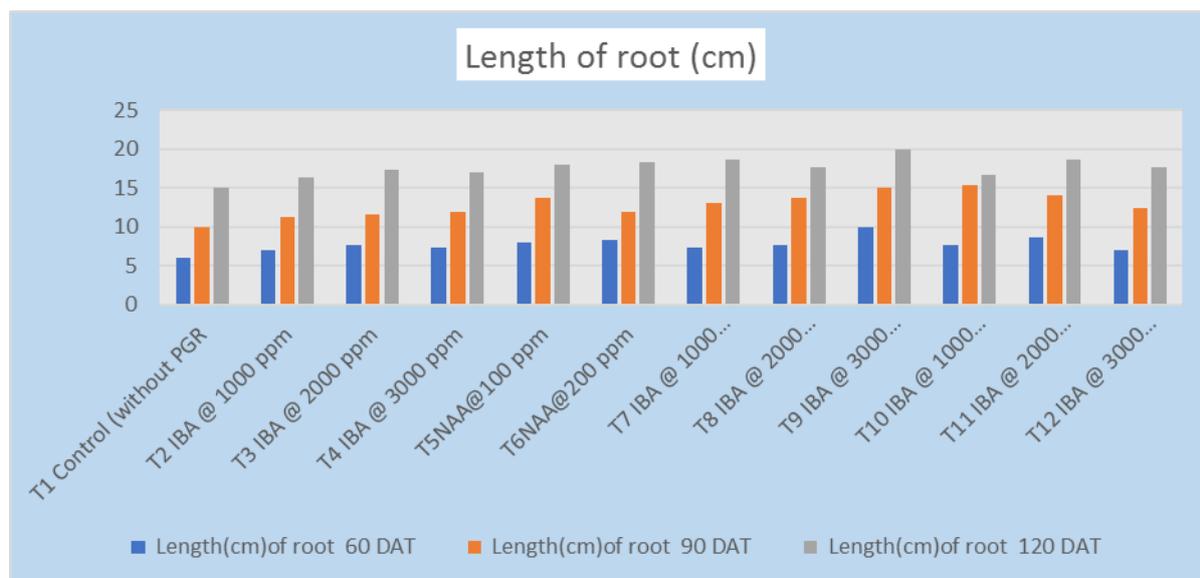


Fig. 1. Effect of PGRs on length (cm) of root at 60, 90 and 120 DAT.

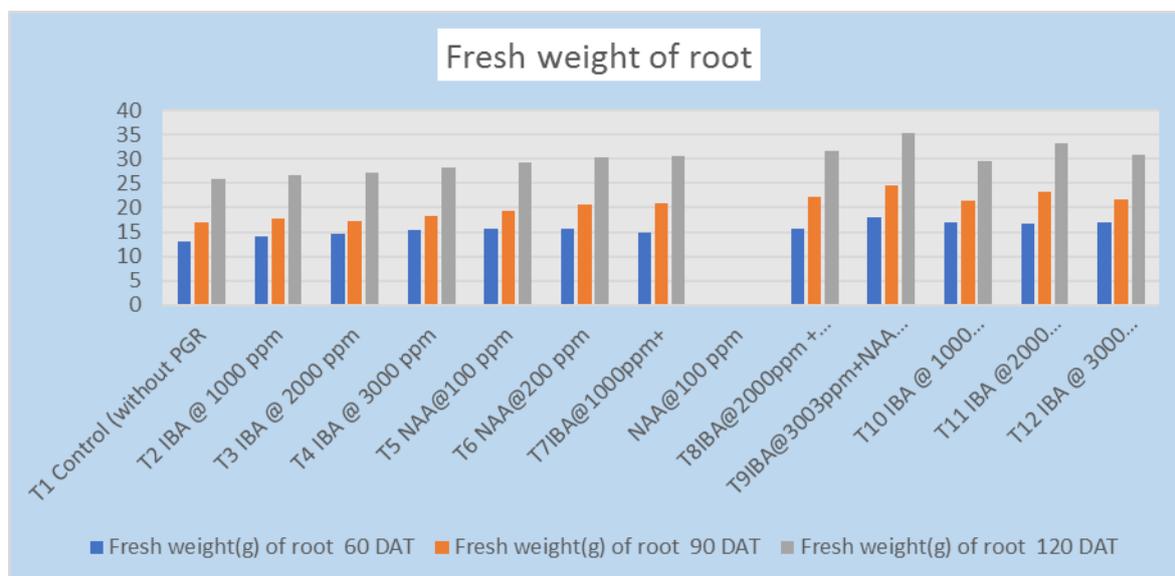


Fig. 2. Effect of PGRs on fresh weight (g) root at 60,90 and 120 DAT.

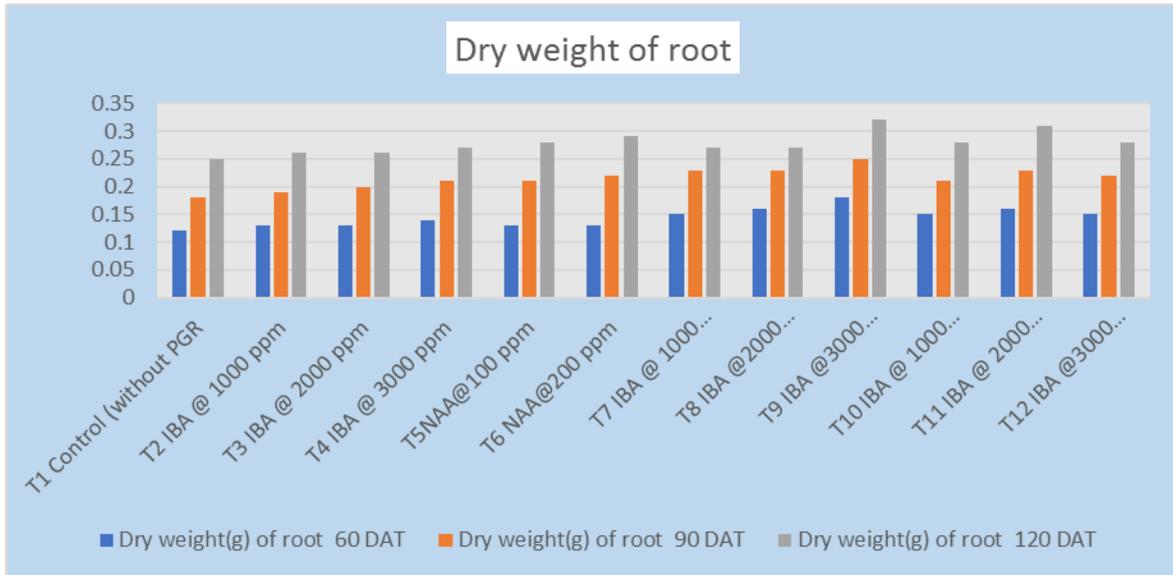


Fig. 3. Effect of PGRs on dry weight (g) of root at 60, 90 and 120 DAT.

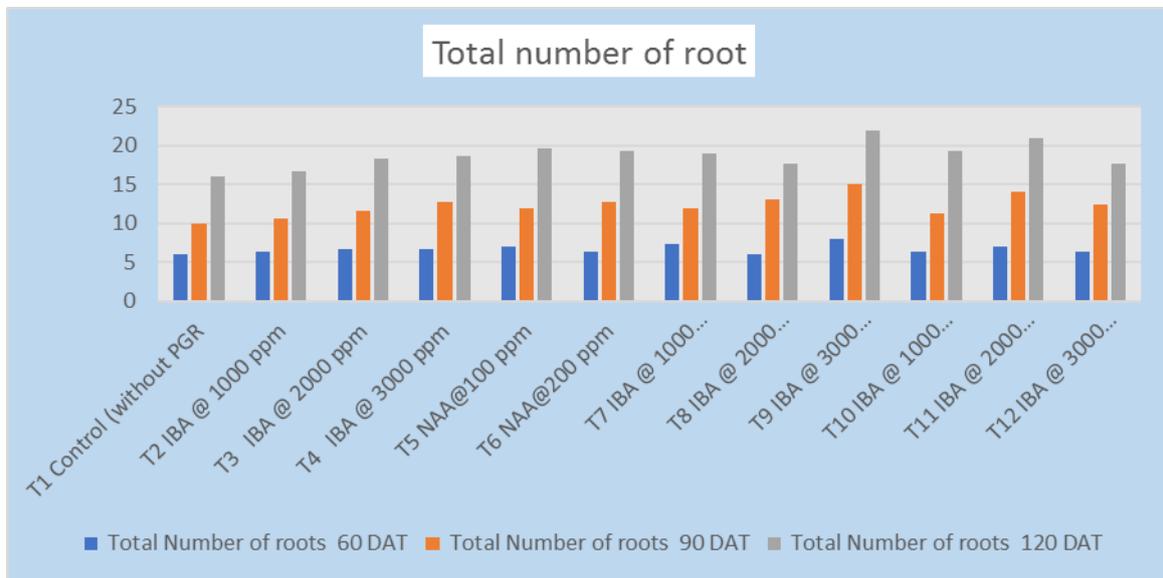


Fig. 4. Effect of PGRs on total number of roots at 60,90 and 120 DAT.

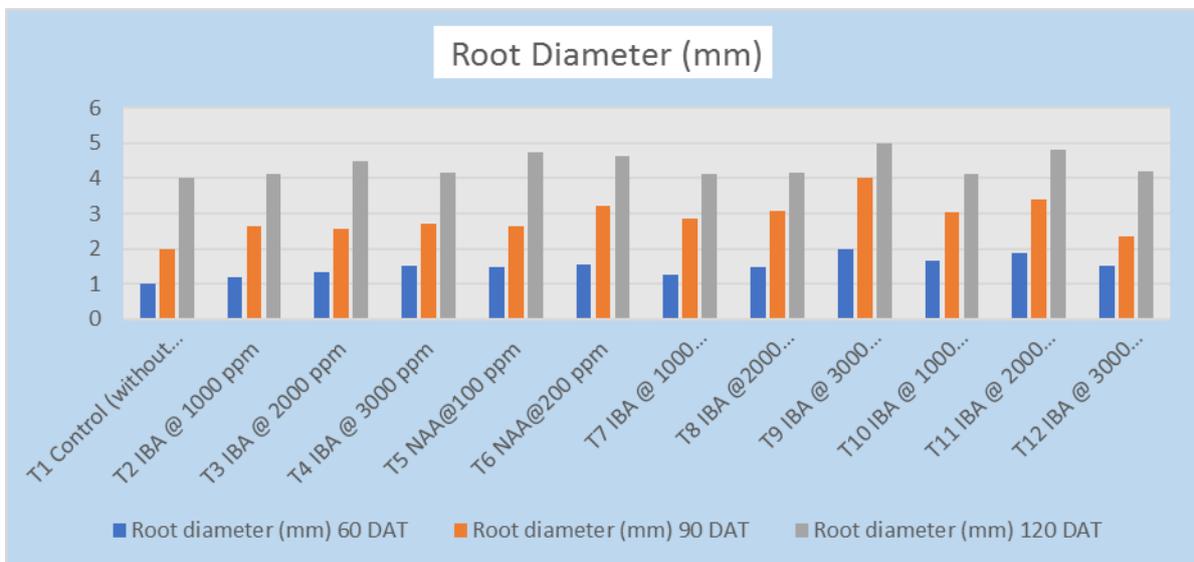


Fig 5. Effect of PGRs on root diameter (mm) at 60,90 and 120 DAT.

CONCLUSION

The study revealed that application of different plant growth regulators has great potential to induce rooting in stem cuttings of dragon fruit. Among all the treatments T₉ IBA @ 3000 ppm+NAA@100 ppm, gave best results with respect to root parameter followed by T₁₁ IBA @ 2000 ppm+NAA@200 ppm. Based on the findings of current investigation it is recommended that vegetative method of propagation through stem cuttings in dragon fruit is reliable for nursery plant production as it is quick and easy method of vegetative propagation.

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