The Pharma Innovation Journal 2022; 11(5): 2337-2341

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 2337-2341
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www.thepharmajournal.com
Received: 08-01-2022
Accepted: 20-04-2022

Rishabh Mishra
Research Scholar, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India

UB Deshmukh
Assistant Professor, Department of Fruit science, Pt. Kishori Lal Shukla College of Horticulture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India.

SP Sharma
Assistant Professor, Department of Fruit science, Pt. Kishori Lal Shukla College of Horticulture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India.

Shivaji Limje
Assistant Professor, Department of Agri. Extension, Pt. Kishori Lal Shukla College of Horticulture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India

Dikeshwar Nishad
Assistant Professor, Department of Agriculture Statistics and social Science, Pt. Shiv Kumar Shastri College of Agriculture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India.

Diksha Mahar
Research Scholar, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India

Jitendra Sahu
Research Scholar, Department of Vegetable Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India.

Corresponding Author:
Rishabh Mishra
Research Scholar, Department of Fruit Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station Rajnandgaon, IGKV, Raipur Chhattisgarh, India

Effect of plant growth regulators and its concentration for air layers of guava

Rishabh Mishra, UB Deshmukh, SP Sharma, Shivaji Limje, Dikeshwar Nishad, Diksha Mahar and Jitendra Sahu

Abstract
A field experiment was conducted at the Horticulture Farm Bharregaon under Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon (C.G.), during *Rabi* season of 2020-21, to evaluate the "Effect of plant growth regulators on air layering in guava (*Psidium guajava* L.)*"*. Totally 11 different treatments and 03 replication consisting of different growth regulators have been tried. Among the effect of different practices, the application enhanced the root parameters like callus formation (mm), success in rooting percentage, number of secondary roots/ air-layers, length of secondary roots/ air-layers (cm), diameters of secondary roots/ air-layers (mm), fresh weight of roots /air –layers (g) and dry weight of roots/ air-layer (g) were significantly superior in the treatment T_4 (Indole 3 butyric acid- 10000 ppm) and least performance in the treatment T_0 (Dipped in distilled water). There for it may be concluded that treatment T_4 (Indole 3 butyric acid- 10000 ppm) may be prefer for growth regulators on air layering in guava.

Keywords: Plant, regulators, concentration, air, guava, *Psidium guajava* L.

Introduction
The Guava (*Psidium guajava* L.) is one of the hardy fruit crops being cultivated throughout Maharashtra and Karnataka state. It is native of tropical America and belongs to the family Myrtaceae and is widely distributed throughout the tropical and sub-tropical regions of the world. The guava fruit is important commercially in India, Pakistan, South Africa, Florida, Hawaii, Brazil, Colombia, Cuba, Venezuela, New Zealand. It is a Tropical fruit which is available throughout the year with moderate price, postharvest handling and high preference by consumers due to its delightful taste and flavor (Anon; 2010) [1].

Guava is fourth most important fruit in area and production after mango, banana and citrus in India. Guava shares 3.3 percent of area and 3.3 per cent of production of total fruit crop grown all over India. Guava is 5th in productivity among different fruit crops grown in India. It is being cultivated in India on 2.04 lakh hectares area with an annual production of 36.67 lakh tonnes (Anon., 2019) [2]. Chhattisgarh in area and production while in productivity (15.9 t/ha) of guava (Anon., 2019) [2].

Air layering reported to have yielded good results. Air layering with the help of growth substances stimulating root primordial in air layers of fruit plants (Tyagi and Patel, 2004) [11]. However, the percentage of establishment and survival of rooted layers in open conditions is very poor and is not achieving up to an expectation of the demand at cheaper rate with high establishment and survival percentage. The rooting ability of air layered shoots is decided by several factors that vary with the crops, cultivar and biochemical constituents of the clone (*viz*., carbohydrates, nitrogen, sugars, starch, phenols, auxins levels etc.) and the climatic conditions prevelling in the season (*viz*., temperature, relative humidity, rain fall etc.) of layering. All these factors should be at optimum level to attain better rooting of a guava layers. The method is quite rapid and is relatively simple. Limbs of l/2 inch or more in diameter are girdled by removing a strip of bark about one and one-half times the width4of the limb. The girdled area is bound with a ball of moistened sphagnum several inches in diameter and four to five inches long, which is then wrapped with a sheet of a heavy grade of translucent rubber plastic film (Vitalon) and tied securely at each end with rubber bands or string (Ruehle, 1948) [10]. Although guava cuttings are hard to root, they have been practiced by different scientists through the application of various root promoting hormones. Numerous natural and synthetic auxins such as Indoleacetic acid (IAA), Indole Butyric Acid (IBA), Naphthalene Acetic Acid (NAA), 2,4-dichloro-phenoxyacetic acid (2,4-D)and paclobutrazol (Mukhtar *et al*., 1998; Debnath and Maiti,1990) [6, 3].

These root-induced hormone chemicals are utilized for several purposes in horticulture and agriculture such as formation of adventitious roots from stem cuttings, micro-propagation of plant species, fruit setting etc.

Auxins are formed in abundance in growing regions such as terminal and lateral buds, elongating internodes and the young embryo in its developing stage inside the seed. There are numerous natural and synthetic auxins: Indole Acetic Acid (IAA), Indole Butyric Acid (IBA), Naphthalene Acetic Acid (NAA) and 2,4-diclorophenoxyacetic acid (2,4-D). Synthetic auxins are utilized for several purposes in horticulture and agriculture such as the formation of adventitious roots from stem cuttings of various plants, micro propagation of plant species, setting of fruit etc. Layering success can be improved by a combination of auxin treatments, IAA and NAA. A single auxinalone is seldom sufficient for some fruit trees to root. NAA and IBA mixtures not only6improve rooting but also accelerate the production of fibrous root in the nursery (Ram *et al*. 1991) [8]. Enough work is available on these aspects in many fruit crops. However, an important fruit like guava requires specific investigation on scientific lines to solve the various problems related to raising plants to meet out the increasing demand of fruit growers.

Materials and Methods

A field experiment was conducted at Instructional Farm, under Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon, (C.G.). Rajnandgaon comes under the geographical area of western part of Chhattisgarh with latitude 21.10° N, and longitude 81.03° E and an altitude of 330.70 meters above the mean sea level. Rajnandgaon is located in west central agro climatic Zone of Chhattisgarh with tropical wet and dry climate which has extreme winter and moderate summer. This region generally receives monsoon during June-October with mean annual precipitation of 1274 mm. The maximum temperature at Rajnandgaon goes upto 47 °C in summer season while minimum temperature falls down upto 13 °C in winter season.

The experiment consisted of 11 treatments *viz*. T_0: Control, $T_{1:}$ Indole 3 butyric acid, $T_{2:}$ Indole 3 butyric acid, T_3: Indole 3 butyric acid, T_4: Indole 3 butyric acid, T_5: Indole acetic acid, T_6: Indole acetic acid, T_7: Indole acetic acid, T_8: Gibberellic acid, T_9: Gibberellic acid and $T_{10:}$ Gibberellic acid which was arranged in Randomized Block Design with three replications. A 100 ml of 2500 ppm IBA solution was prepared by dissolving 0.25 g IBA in approximately 25 ml absolute alcohol (95%) then it was diluted with double distilled water to make 100 ml solution. Similarly 5000 ppm, 7500 ppm and 10000 ppm IBA solution was prepared. A 100 ml of 2000 ppm IAA solution was prepared by dissolving 0.2 g IAA in approximately 25 ml absolute alcohol (95%) then it was diluted with double distilled water to make 100 ml solution. Similarly 2500 ppm and 3000 ppm IAA solution was prepared. A 100 ml of 200 ppm gibberellic acid solution was prepared by dissolving 0.02 g gibberellic acid in approximately 25 ml absolute alcohol (95%) then it was diluted with double distilled water to make 100 ml solution. Similarly 300 ppm, and 400 ppm gibberellic acid solution was prepared. Irrigation and weeding: watering and weeding was attended regularly and polybags were kept clean at 7 days intervals so that there was no competition for moisture and material.

Results and Discussion

Root Characters

Number of secondary roots/ air-layers, Length of secondary roots/ air-layers (cm) and Diameters of secondary roots/ air-layers (mm)

The data on various root characters *viz*. number secondary roots/ air-layers, length secondary roots/ air-layers (cm) and diameter secondary roots/ air-layers (mm) as influenced by the air layers practices were recorded and presented in Table 1 and figure 1, 2, 3. The data revealed that the number of secondary roots/ air-layers in relation to different formulations of growth regulator treatment was found to be significant. Among the different treatment T4, (Indole 3 butyric acid -10000 ppm) recorded significantly highest number of secondary roots/ air-layers of (16.49) followed by T3, (Indole 3 butyric acid -7500 ppm) (15.64) and T2, (Indole 3 butyric acid -5000 ppm) (14.35). The lowest performance of number of secondary roots/ air-layers were recorded in the treatment T0 (Control- Dipped in distilled water) of (8.23). Compared to treatment where the growth regulator was applied another treatment.

This might be due to secondary hormones are known to play a vital role in the process of restorative regenerations and availability of favorable conditions in a months earlier enhancement of number of secondary rooting. The similar result was found by Kunal (2005) [4].

The data revealed that the length of secondary roots/ air-layers in relation to different formulations of growth regulator treatment was found to be significant. Among the different treatment T4, (Indole 3 butyric acid -10000 ppm) recorded significantly highest length of secondary roots/ air-layers) of (2.40 cm) followed by T3, (Indole 3 butyric acid -7500 ppm) (2.23 cm) and T2, (Indole 3 butyric acid -5000 ppm) (2.05 cm). The lowest performance of length of secondary roots/ air-layers were recorded in the treatment T0 (Control- Dipped in distilled water) of (0.62 cm). Compared to treatment where the growth regulator was applied another treatment.

Length of secondary roots may be due to the effect of growth regulators IBA on the metabolites translocation and carbohydrates metabolism which may be involved in the role of hormones on root length. These findings are in line with those of Tyagi and Patel (2004) [11].

The data revealed that the diameters of secondary roots/ air-layers in relation to different formulations of growth regulator treatment was found to be significant. Among the different treatment T4, (Indole 3 butyric acid -10000 ppm) recorded significantly highest diameters of secondary roots/ air-layers of (2.10 mm) followed by T3, (Indole 3 butyric acid -7500 ppm) (1.92 mm) and T2, (Indole 3 butyric acid -5000 ppm) (1.86 mm). The lowest performance of diameters of secondary roots/ air-layers were recorded in the treatment T0 (Control- Dipped in distilled water) of (0.63 mm). Compared to treatment where the growth regulator was applied another treatment.

This is might be due to auxin are known to be helpful in rooting and auxin to adenine high ratio to promotes the Diameters of secondary roots. The similar result was found by Patel *et al.* (2011) [7].

Fresh weight of roots /air –layers (g) and Dry weight of roots/ air-layer (g)

The data on various yield attributes *viz*. fresh weight of roots

/air –layers (g) and dry weight of roots /air –layers (g) as influenced by the air layers practices were recorded and presented in Table 1 and figure 4, 5. The data revealed that the fresh weight of roots /air –layers (g) in relation to different formulations of growth regulator treatment was found to be significant. Among the different treatment T4, (Indole 3 butyric acid -10000 ppm) recorded significantly highest fresh weight of roots /air –layers (g) of (3.74 g) followed by T3, (Indole 3 butyric acid -7500 ppm) (3.00 g) and T2 (Indole 3 butyric acid -5000 ppm) (3.23 g). The lowest performance of fresh weight of roots /air –layers (g) were recorded in the treatment T0 (Control- Dipped in distilled water) of (1.13 g). Compared to treatment where the growth regulator was applied another treatment.

Due to initiate more number of adventitious roots as well as longest roots per cutting which helps in early establishment of cuttings and an increase in root fresh weight per cutting. The similer result was found by Mankar *et al.* (2009) [5].

The data revealed that the dry weight of roots/ air-layer (g) in relation to different formulations of growth regulator treatment was found to be significant. Among the different treatment T4, (Indole 3 butyric acid -10000 ppm) recorded significantly highest dry weight of roots/ air-layer (g) of (0.74 g) followed by T3, (Indole 3 butyric acid -7500 ppm) (0.71 g) and T2, (Indole 3 butyric acid -5000 ppm) (0.69 g). The lowest performance of dry weight of roots/ air-layer (g) were recorded in the treatment T0 (Control- Dipped in distilled water) of (0.47 g). Compared to treatment where the growth regulator was applied another treatment.

The auxins increased root length and fresh weight of roots, resulting in increased dry weight of roots this might be due to the fact that, auxin stimulates the initiation of lateral and adventitious roots because of their effect on cell division. The similar result was found by Ramteke *et al.* (2016) [8].

Table 1: Number of secondary roots/ air-layers, Length of secondary roots/ air-layers (cm) and Diameters of secondary roots/ air-layers (mm)

Tr. No.	Treatment Details	Concentration (ppm)	Number of secondary roots/ air-layers	Length of secondary roots/ air-layers (cm)	Diameters of secondary roots/ air-layers (mm)
T_0	Control	Dipped in distilled water	8.23	0.62	0.63
T_1	Indole 3 butyric acid	2500ppm	11.14	1.78	1.53
T_2	Indole 3 butyric acid	5000ppm	14.35	2.05	1.86
T_3	Indole 3 butyric acid	7500ppm	15.64	2.23	1.92
T_4	Indole 3 butyric acid	10000ppm	16.49	2.40	2.10
T_5	Indole acetic acid	2000ppm	11.68	1.62	1.47
T_6	Indole acetic acid	2500ppm	12.06	1.64	1.63
T_7	Indole acetic acid	3000ppm	13.45	1.91	1.80
T_8	Gibberellic acid	200ppm	10.69	1.61	1.10
T_9	Gibberellic acid	300ppm	10.88	1.49	1.42
T_{10}	Gibberellic acid	400ppm	11.09	1.55	1.48
S.Em (±)			0.90	0.04	0.18
CD (5%) =			2.71	0.13	0.55
CV =			10.50	4.38	6.82

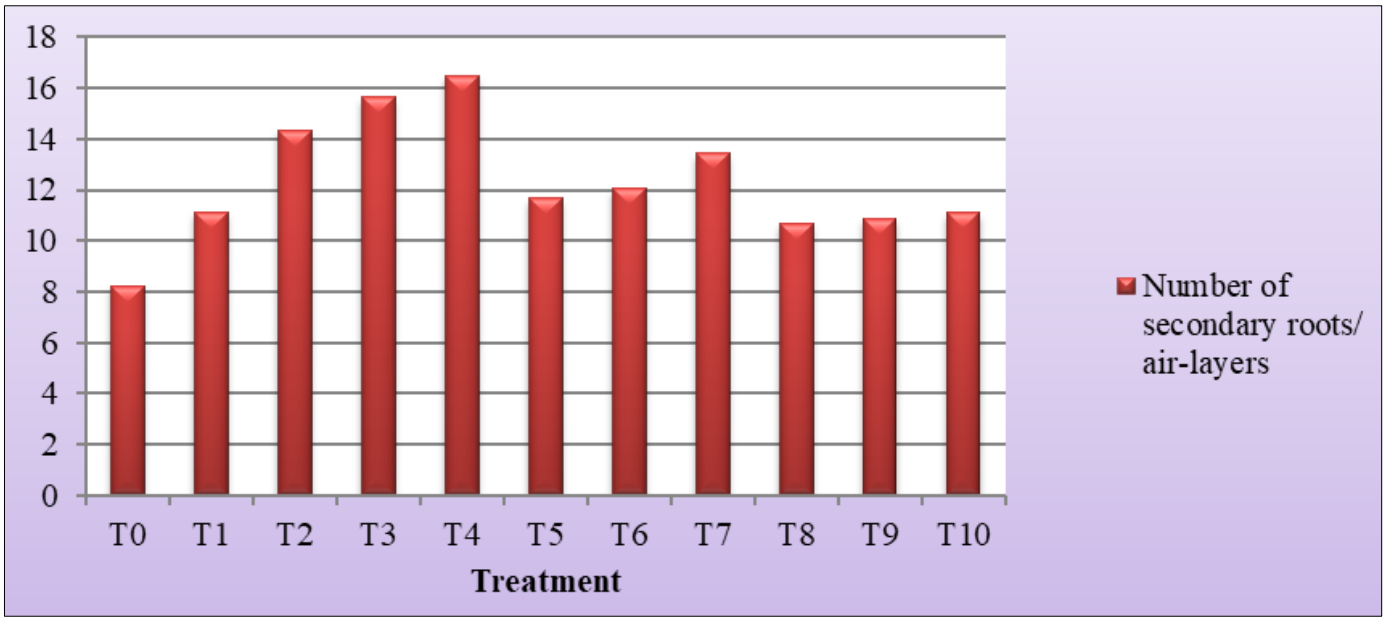

Fig 1: Number of secondary roots/ air-layers

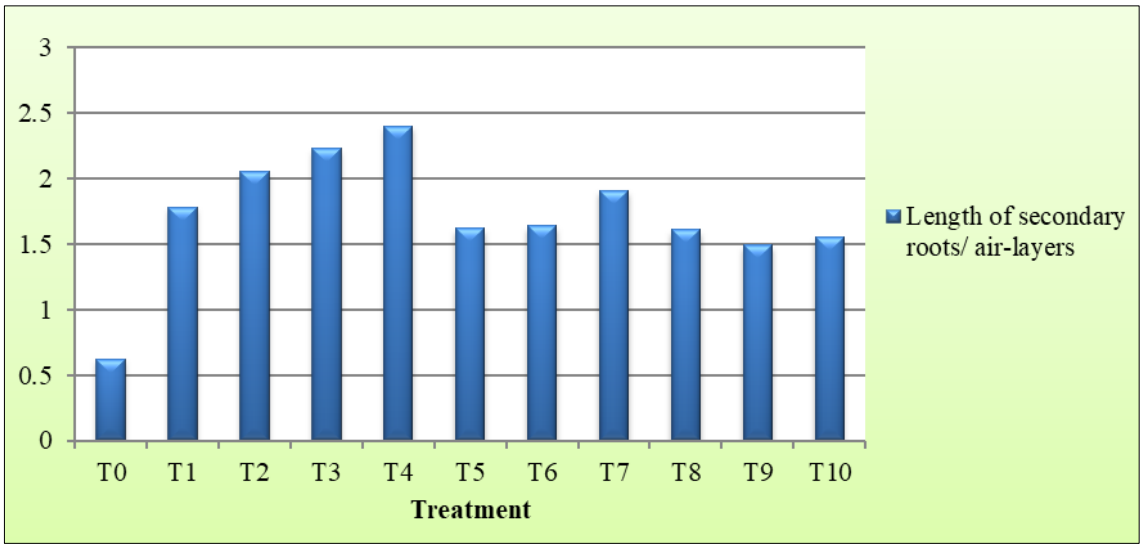

Fig 2: Length of secondary roots/ air-layers (cm)

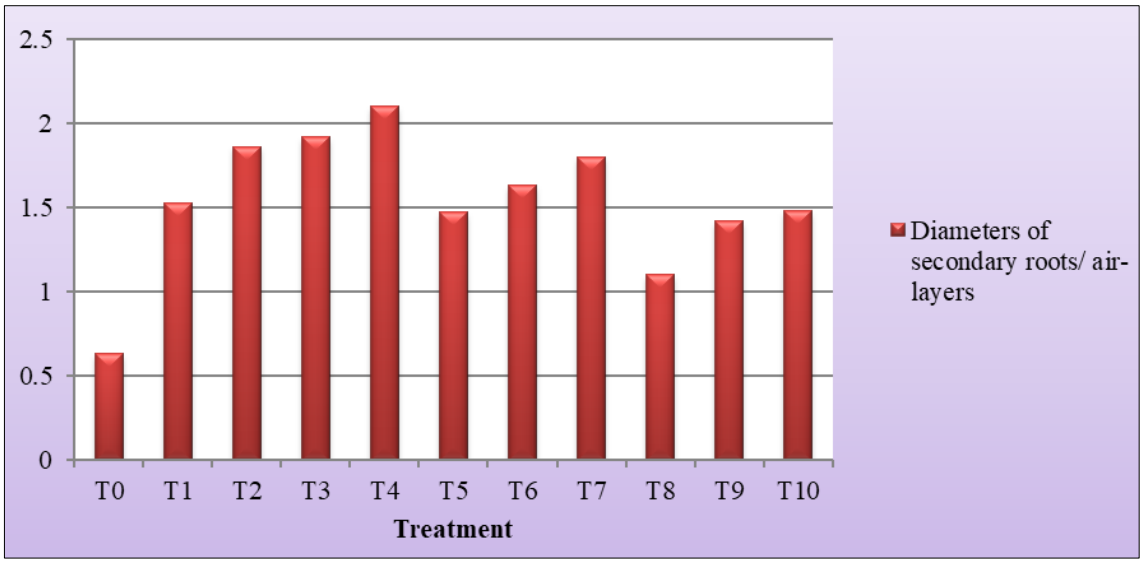

Fig 3: Diameters of secondary roots/ air-layers

Table 2: Fresh weight of roots /air –layers (g) and Dry weight of roots/ air-layer (g)

Tr. No.	Treatment Details	Concentration (ppm)	Fresh weight of roots/air-layers (g)	Dry weight of roots/air-layer (g)
T_0	Control	Dipped in distilled water	1.13	0.47
T_1	Indole 3 butyric acid	2500ppm	2.71	0.65
T_2	Indole 3 butyric acid	5000ppm	3.23	0.69
T_3	Indole 3 butyric acid	7500ppm	3.00	0.71
T_4	Indole 3 butyric acid	10000ppm	3.74	0.74
T_5	Indole acetic acid	2000ppm	2.59	0.67
T_6	Indole acetic acid	2500ppm	2.62	0.66
T_7	Indole acetic acid	3000ppm	2.89	0.67
T_8	Gibberellic acid	200ppm	2.38	0.61
T_9	Gibberellic acid	300ppm	2.45	0.62
T_{10}	Gibberellic acid	400ppm	2.65	0.64
S.Em (±)			0.14	0.03
CD (5%) =			0.42	0.12
CV =			9.12	10.52

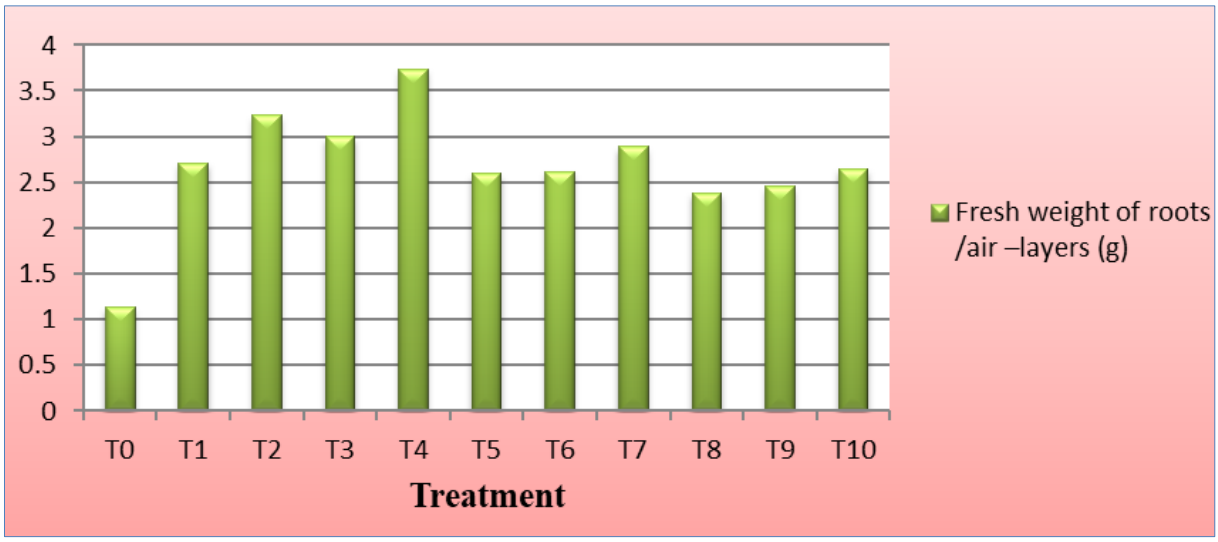

Fig 4: Fresh weight of roots /air –layers (g)

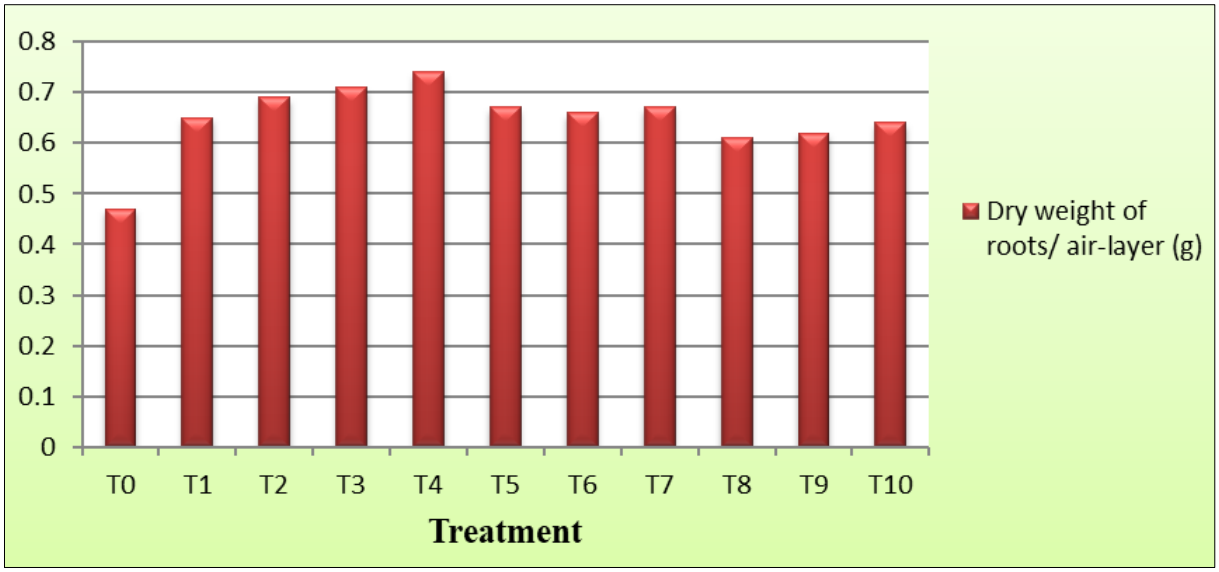

Fig 5: Dry weight of roots/ air-layer (g)

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