Effect of Some Different Growth Regulators and Bio-Compound on Rooting of Softwood Cutting of Guava under Low Tunnel

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ABSTRACT

This study was carried out during (2020/2021) seasons on softwood cuttings of mature trees of guava cv. Montakab El-Sabahia conducted at the El-Sabahia Experimental Horticulture Research Institute in Alexandria Governorate, Egypt. The softwood cuttings were prepared on two separate dates: the last week of April and July. The basal ends of the cuttings (3–4 cm) were dipped for 5 minutes in solutions of Indole-3-butyric acid (IBA) at 2000 and 3000 ppm, NAA at 500 and 1000 ppm, and bio solution before planting each year.

The more favorable results were obtained by the cuttings t that collected on the first date (last week of April). Among the treatments, treating cuttings by 3000 ppm IBA achieved high results in terms of percentage of rooted cuttings (30.7%), number of roots per cutting (5.5), root fresh weight per cutting (4.5 g), and survival percentage of rooted cuttings (47.3%). However, the highest length of roots (7.1 cm) was observed at 1000 ppm NAA treatment.

Keywords: Vegetative- Propagation-Survival- Cuttings.

INTRODUCTION

Guava, a fruit originating in tropical America and noted for its delightful aroma and low-maintenance cultivation, is now cultivated across a diverse range of tropical and subtropical regions globally Thaipong and Boonprakob (2005). This adaptability extends to various rainfall conditions, including dry climates, and a wide spectrum of soil types Salazar et al. (2009). Notably, guava is the most significant crop species within the Myrtaceae family Rai et al. (2007).

Commercial cultivation of guava encompasses countries such as India, Pakistan, South Africa, Florida, Hawaii, Brazil, Colombia, Cuba, Venezuela, New Zealand, Philippines Yadava (1996), Vietnam Le et al. (1998) and Thailand Tate (2000). This availability throughout the year, coupled with affordability and resistance to transport and post-harvest handling, contributes to its widespread appeal among consumers Thaipong and Boonprakob (2005).

Despite the abundance of seeds available, guava propagation rarely utilizes seeds due to the inconsistent characteristics of seedlings. The offspring exhibit significant variation in fruit size and quantity, making them unsuitable for commercial production. Consequently, therefore vegetative propagation techniques must be used to select plants with promising characteristics like high performance and resistance to pests and diseases Tong et al. (1991).

When compared to other vegetative propagation techniques, air layering makes guava viable. It is a simple, low-cost, and easily accessible strategy for growers and producers. In a short period of time, her plants are uniform, bigger, and in good health Gonzalez et al. (2001). Guava trees can be nursery propagated for final field planting by grafting, budding, stem cuttings with succulent green stems, or root cuttings. Vegetative propagation is often employed to guarantee that plants are true-to-type and yield fruit as soon as possible.

Guava vegetative propagation can quickly produce commercially viable plants, keep genetic variation from segregating, and maintain the quality of the fruit Giri et al. (2004) and Singh et al. (2004). Cutting-based propagation has several benefits, such as the capacity to generate plants of the same kind of tree and commercially valuable trees in a single growing season Tavares (1994). Rooting is unquestionably the most advanced and comprehensive vegetative propagation method Manica et al. (2000) and Awan et al. (2012). IBA promotes root formation in guava, even in difficult cases. By enhancing the number of successfully rooted cuttings, the quantity and quality of roots produced, and creating more uniform growth and root development Bacarin et al. (1994).

Indole-3-butyric acid (IBA) and a-naphthalene acetic acid (NAA) were two artificial substances that were more effective for rooting than naturally occurring or artificial IAA. Wilcoxon and Zimmerman (1935) that IBA and NAA are still the most efficient rooting auxins today, micro cuttings produced from tissue culture and stem cuttings. The necessity of auxin for the adventitious root initiation process on stems has been repeatedly shown. In fact, studies have demonstrated that auxin, whether endogenous or administered, is necessary for the division of the early cells of the root Gaspar and Hofinger (1988) and Strömquist and Hansen (1980). It has been discovered that IBA occurs naturally.

MATERIALS AND METHODS

The current study was conducted during 2020 and 2021 seasons at El-Sabahia Station, Alexandria, Governorate, Egypt. Current-season growth, approximately 12 cm long with four nodes and leaves, was used to make softwood cuttings. The leaves were halved to stop transpiration, and the two to three lowest leaves were removed. The cuttings were prepared at two collecting dates (last week of April and July). Weighing 2 and 3g of indole-3-butyric acid (IBA) and dissolving it in 50 ml of 96 ^{co}. alcohol in a beaker yielded a hydroalcoholic solution. After thoroughly dissolving the IBA, the volume was lowered to 1000 ml with distilled water, yielding IBA concentrations of 2000 and 3000 ppm, respectively. The same process was followed for the remaining dosages, as described by Hartman and Kester (1960). The way prior was used to prepare NAA at 500 and 1000 ppm. A mixture of micro-organisms such as Yeasts (*Schizosaccharonyces pompe* and *Zygosaccharomyces spp*) and bacteria *Gluconacetobacter diazotrophicus*, *Acetobacter xylinum* and *Lactobacilus spp*) was prepared at concentration (5 ml/ L -10 ml/L) Aly and Ahmed (2018). Before planting, the basal ends of cuttings (3–4 cm) were soaked for 5 minutes in IBA, NAA, or a mixture of them and bio- solution. The treated cuttings were planted at a depth of 6–8 cm in black polyethylene bags 30cm in diameter. The bags contained a mixture of vermiculite and sand at ratio of 1:1 (v/v). The experiment was carried out in a low tunnel with dimensions of 3 x 2 x 0.5 m in length, breadth, and height, respectively.

Treatments:

Treatments were arranged as follow:

T1: (IBA) at concentration 2000 "ppm".
T2: IBA at concentration 3000 ppm.
T3: NAA at concentration 500 ppm.
T4: NAA at concentration 1000 ppm.
T5: Combined application of IBA at 2000 ppm + (NAA) at 500 ppm.
T6: Combined application of IBA at 3000 ppm + (NAA) at 1000 ppm.
T7: bio-inoculants spp (5 ml/L -10 ml / L)
Control cutting treated with water.

Assessed average growth measurements of Cuttings; at 90 days after planting:

1. Cuttings survival percentage.
2. Rooting percentage.
3. Root number per cutting.
4. Root length per cutting.

5. Root fresh weight per cutting.

The experiment was set up in a full random block design (RCBD) with three replications, each having three cuts. Data were statistically analyzed for ANOVA according to Steel and Torrie (1982) and the differences were tested by L.S.D. 5% level.

RESULTS AND DISCUSSIONS

Effect of Time of Taking Guava Cuttings:

Rooting and survival (%) number, length, and fresh weight of the cuttings were all significantly impacted by the timing of planting the cuttings (last week of April and July) as shown in (**Tables, 1 & 2**). These results are comparable to those published by Sinha et al., (1962) Sharma (1975) and Rathore et al. (1984). When comparing the values of rooting, survival (%), number, length, and fresh weight of the roots to the second date (last week of July), the first collection date (last week of April) gave the highest results. The current findings corroborated those of Arafat et al. (2020), who found that, guava cuttings taken in May had greater rooting and survival percentages, as well as longer, more roots and dry weights than cuttings obtained in July. The growth and rooting potential of stem cuttings can be influenced by the climate. The most frequent variables are rooting medium moisture content, temperature, humidity, and light Hartman et al. (1997), Evans (1992) and Singh (2018).

Table (1). Effect of the collecting date of softwood guava cuttings on rooting during the last week of April in (2020/2021) seasons.

Treatment	Rooting percentage %		Root number		Root length (cm)		Root weight (gm)		Survival percentage (%)	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
(T1)	21.00	24.30	4.60	5.90	3.10	5.40	2.30	4.60	43.40	45.10
(T2)	27.00	31.20	5.30	6.60	3.50	5.80	4.80	7.10	46.10	48. 30
(T3)	13.00	16.10	3.00	4.30	3.90	6.20	3.30	5.60	20.30	22. 30
(T4)	17.00	19.50	3.40	4.70	5.90	7.90	2.50	4.80	24.20	26. 40
(T5)	14.00	17.40	3.70	5.00	3.40	6.40	2.70	5.00	35.60	37.10
(T6)	22.00	26.30	4.60	5.90	4.40	6.70	2.80	5.10	37.10	39. 50
(T7)	10.00	14.30	2.70	4.00	2.40	3.70	1.50	3.80	9.10	11.30
LSD	1.50	2.40	0.13	0.11	0.36	0.32	0.21	0.22	2.20	2.50

T1: (IBA) at concentration 2000 "ppm"; T2: IBA at concentration 3000 ppm; T3: NAA at concentration 500 ppm; T4: NAA at concentration 1000 ppm; T5: Combined application of IBA at 2000 ppm + (NAA) at 500 ppm; T6: Combined application of IBA at 3000 ppm + (NAA) at 1000 ppm; T7: bio-inoculants spp (5 ml/L -10 ml / L).

Table (2). Effect of the collecting date of softwood guava cuttings on rooting during the last week of July in (2020/2021) seasons.

Treatment	Rooting percentage %		Root number		Root length (cm)		Root weight (gm)		Survival percentage (%)	
	2020	2021	2020	2021	2020	2021	2021	2021	2021	2021
(T1)	18.80	22.20	2.40	3.70	2.50	3.50	2.70	2.90	41.28	43.00
(T2)	24.30	29.10	3.10	4.40	3.10	4.10	3.60	4.90	43.90	46.30
(T3)	10.60	14.00	0.80	2.10	3.30	4.70	1.10	2.40	18.80	20.20
(T4)	14.80	17.40	1.20	2.50	4.20	5.30	1.50	3.40	22.00	23.90
(T5)	11.10	15.30	1.50	2.80	2.70	5.70	1.30	2.80	33.40	35.00
(T6)	19.80	24.20	2.40	3.70	3.70	6.20	1. 20	2.60	35.00	37.00
(T7)	7.60	12.10	1.40	1.70	1.20	2.20	2.10	1.60	7.00	9.20
LSD	1.20	2.60	0.11	0.12	0.34	0.24	0.11	0.15	2.40	2.30

T1: (IBA) at concentration 2000 "ppm"; T2: IBA at concentration 3000 ppm; T3: NAA at concentration 500 ppm; T4: NAA at concentration 1000 ppm; T5: Combined application of IBA at 2000 ppm + (NAA) at 500 ppm; T6: Combined application of IBA at 3000 ppm + (NAA) at 1000 ppm; T7: bio-inoculants spp (5 ml/L -10 ml / L).

Effect of growth regulator and bio-inoculants:

Data in **Table (3)** showed that, the long roots are found in The softwood cuttings that treated with 1000 ppm NAA (5.1- 7.1 cm in 2020/2021) respectively, followed by the combination of 3000 ppm IBA and 1000 ppm NAA (3.7-6.2 cm). The lowest root lengths obtain by the cuttings that treated with 2000 ppm IBA (2.5-3.5) in the first and second season. The results are in consonance with those of Noor et al. (2004) who noted that, the long roots are found in cuttings of softwood treated with NAA and paclobutrazol. This outcome is consistent with that of Lanphear and Meahl (1963) who noted that, in the presence of favorable endogenous and environmental conditions, growth regulators aid in mimicking the roots in cuttings. The highest fresh weight was showed in IBA at 3000 ppm (4.5g) while the least roots weight was observed in 500 ppm NAA (1.2-3.5g). That result is in harmony with that reported by Arafat et al. (2020) and Wahab et al. (2001). They discovered that IAA at 5000 ppm and IBA at 4000 ppm had the greatest mean root weights (16.25 and 16.62g). Whereas IAA at 1000, 2000 ppm, and IBA at 2000 ppm had the lowest mean root weights of 6.71, 5.91, and 6.11 g.

The data in (**Table 3**) find out the highest survival percentage of cuttings (45.2-47.3%) was observed in the cuttings that treated with IBA at 3000ppm, while cuttings receiving 500 ppm NAA showed the lowest survival rates (19.5-21.2%). Similarly, treated the cutting with IBA demonstrated a higher survival rate due to the increment in root number and overall rooting percentage. This trend aligns with Abdullah et al. (2006) who reported 60% rooting and 70.9% survival in a non-mist propagator when applying 4000 ppm IBA. Similarly, Arafat et al. (2020) documented a greater number of roots in guava tip cuttings treated with 4000 ppm IBA, while no rooting occurred in water-treated cuttings.

Bio-inoculants boost rooting and survival percentages of cuttings, as well as root length, fresh weight, and number. The resulted in (**Table, 3**) showed that Bio-inoculants showed rooting percentage (8.8-13.2 %), root number (2.1-2.8), root length (1.8-2.9 cm), root fresh weight (1.06-27 g), and survival percentage (8.1- 10.2%) in soft wood guava cuttings, were measured. The current findings agree with those of Harman et al. (2004), Thankamani et al. (2005), and Sundhari et al. (2002). Murthy et al. (2010) discovered that different bio-inoculants resulted in substantial changes in several rooting properties of vanilla stem cuttings when compared to the control. The least number of days for rooting, the highest number of roots per cutting (50%), the length of the root (25.21%), the thickness of the longest root (63.33%), the fresh weight (251.94%), and the dry weight of the root (113.33%) were all reported by Trichoderma harzianum.

Table (3). Effect of growth regulators and bio-inoculants on Of Guava soft wood cuttings during (2020/2021) seasons.

Treatment	Rooting percentage (%)		Root number		Root length (cm)		Root weight (gm)		Survival percentage (%)	
	2020	2021	2020	2021	2020	2021	2021	2021	2021	2021
(T1)	20.90	25.20	3.50	4.60	2.80	4.40	3.70	3.70	42.30	44. 20
(T2)	25.60	30. 70	4.20	5.50	3.30	4.90	4.20	4.50	45.20	47.30
(T3)	15.90	18.40	1.90	3.20	3.60	5.30	1.20	3.50	19.50	21.20
(T4)	11.80	15.00	2.30	3.60	5.10	7.10	1.40	6.00	23.10	24.90
(T5)	12.50	16.30	2.60	3.90	3.20	6.20	1.60	3.90	34.50	36. 70
(T6)	19.90	23.20	3.50	4.80	4.30	5.70	1.70	4.00	36.00	38. 50
(T7)	8.80	13.20	2.10	2.80	1.80	2.90	1.06	2.70	8.10	10.20
LSD	1.90	2.20	0.11	0.12	0.31	0.23	0.11	0.14	2.40	2.60

T1: (IBA) at concentration 2000 "ppm"; T2: IBA at concentration 3000 ppm; T3: NAA at concentration 500 ppm; T4: NAA at concentration 1000 ppm; T5: Combined application of IBA at 2000 ppm + (NAA) at 500 ppm; T6: C ombined application of IBA at 3000 ppm + (NAA) at 1000 ppm; T7: bio-inoculants spp (5 ml/L -10 ml / L) .

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تأثير بعض منظمات النمو المختلفة والمركب الحيوى على تجذيرعقل الجوافة الغضة تحت الأنفاق

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قسم بحوث الزيتون وفاكهة المناطق شبه الجافة معهد بحوث البساتين مركز البحوث الزارعية –الجيزة ،مصر

أجريت هذه الدراسة خلال موسمى 2021/2020 على العقل الغضة لاشجار الجوافة الناضجة صنف منتخب الصبحية بمحطة بحوث الصبحية بمحافظة الاسكندرية - جمهورية مصر العربية. تم تجهيز العقل فى موعدين (الأسبوع الأخير من شهر ابريل والأسبوع الأخير من شهر يوليو). تم غمس الأطراف القاعدية للعقل (4-3 سم) لمدة 5 دقائق فى حمض اندول بيوترك تركيز 2000 و3000 جزء فى المليون وحمض النفثالين تركيز 500 - 1000 جزء فى المليون وخليط بينهم والمركب الحيوى.

أظهرت النتائج أن الموعد الأول لأخذ العقل فى الأسبوع الأخير من شهر أبريل أعطى افضل نتائج التجذير، سجلت المعاملة الثانية "T2" حمض الاندول بيوترك تركيز 3000 جزء فى المليون أفضل النتائج فى نسبة تجذير العقل 30.7%، عدد الجذور 5.5، الوزن الطازج للجذور 4.5 جرام، ونسبة البقاء على قيد الحياة للعقل 47.3% بينما اعلى طول للجذور 7.1 سم للمعاملة بحمض النفثالين (1000 جزء فى المليون).