

## EFFECT OF SOAKING THE LOCAL ORANGE GRAFTS WITH THE GROWTH REGULATOR BENZYL-ADENINE AND ON THREE ROOTSTOCKS OF CITRUS

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### ABSTRACT

The study was conducted in the Lath house of the Department of Horticulture and Landscape Gardening, College of Agriculture, University of Baghdad for the period from March to November 2013. To study the effect of soaking local orange grafts in the BA growth regulator on three rootstocks of citrus, the study included two factors: The first factor is citrus rootstocks (Sour orange, Volkameriana lemon, Cleopatra mandarin). The second factor is to soaking into the growth regulator of Benzyl- Adenine at three levels of (0, 150, 250 mg.L<sup>-1</sup>). The experiment was designed according to Randomized Complete Blocks Design (RCBD) as a factorial experiment with three replicates. The results were summarized as follows: The cultivar had a significant effect, so Volkameriana was excelled in success rate of grafts, plant height, number of leaves and branches, leaves content of chlorophyll, phosphorus and potassium. While the Cleopatra mandarin rootstock excelled by giving the highest content of carbohydrates in the leaves reached of 3.48%, while the sour orange rootstock excelled in the leaves content of nitrogen. As for the effect of soaking grafts in (BA). It was showed that the spraying treatment of with Benzyl- Adenine at a concentration of (250 mg.L<sup>-1</sup>) excelled in all studied traits (success rate of grafts, plant height, number of leaves and branches, leaves content of chlorophyll, phosphorus and potassium). As for the interaction between the rootstock and the soaking levels in the Benzyl- Adenine, while the interaction treatment between the volkameriana and soaking of the grafts in Benzyl- Adenine with a concentration of 250 mg.L<sup>-1</sup> was given the highest rate of all studied traits.

**Keywords:** Rootstock, Citrus, Benzyl- Adenine, Volkameriana.

تأثير نقع طعوم البرتقال المحلي بمنظم النمو البنزل ادنين والنامية على ثلاثة اصول من الحمضيات

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**المخلص :**

نفذت الدراسة في الظلة الخشبية التابعة لقسم البستنة وهندسة الحدائق / كلية الزراعة / جامعة بغداد / للمدة من اذار لغاية تشرين الثاني 2013 لدراسة تأثير نقع طعوم البرتقال المحلي في منظم النمو BA والمطعمة على ثلاثة اصول من الحمضيات شملت الدراسة على عاملين العامل الاول اصول الحمضيات (النارنج، الليمون فولكاماريانا، لالنكي كليوباترا مندرين) والعامل الثاني النقع بمنظم النمو البنزل ادنين في ثلاث مستويات (0, 150, 250) ملغم. لتر<sup>-1</sup> وصممت التجربة وفق تصميم القطاعات العشوائية الكاملة RCBD كتجربة عاملية وبثلاث مكررات وتلخصت النتائج بما يلي:

كان للصنف تأثيرا معنويا اذا تفوق الصنف فولكاماريانا في نسبة نجاح الطعوم وارتفاع النبات وعدد الافرع و الاوراق ومحتوى الاوراق من الكلورفيل والفسفور والبوتاسيوم. في حين تفوق الاصل لالنكي كليوباترا مندرين باعطاء اعلى محتوى من الكاربوهيدرات في الاوراق بلغ 3.48% بينما تفوق الاصل النارنج في محتوى الاوراق من N. اما تأثير نقع الطعوم بالبنزل ادنين (BA) فيلاحظ تفوق معاملة الرش بالبنزل ادنين بتركيز 250 ملغم. لتر<sup>-1</sup> في جميع الصفات المدروسة (نسبة نجاح، وارتفاع النبات، وعدد الاوراق، وعدد الافرع ونسبة الكلورفيل، والكاربوهيدرات، والنتروجين، والفسفور، والبوتاسيوم) اما فيما يخص التداخل الثنائي بين الاصل ومستويات النقع بالبنزل ادنين فقد اعطت معاملة التداخل لفولكوماريانا ونقع الطعوم بالبنزل ادنين بالتركيز 250 ملغم. لتر<sup>-1</sup> اعلى معدل لجميع الصفات المدروسة.

**الكلمات المفتاحية:** اصل، الحمضيات، البنزل ادنين، فولكاماريانا

## 1. INTRODUCTION

Orange (*Citrus sinensis* L.) is one of the most important of citrus species in the world and the Local orange is considered a common cultivar in Iraqi orchards, it is grown under palm trees or in open orchards. Orange trees are characterized by some differences in the strength of vegetative growth and abundance yield [3]. Citrus propagation is considered as one of the most important processes in increasing productivity and improving quality as it is propagated by means of grafting, which is one of the most common methods, shield budding is common in citrus (T-Grafting), where the species and the desired varieties of citrus are grafted on different rootstocks, the most important of which is the rootstocks of the sour orange (*Citrus aurantium* L.) [6]. It is a common rootstocks of most citrus species due to its resistance to root rot and phytophthora (Gummosis) disease, as well as conditions for waterlogging soil, dehydration, low temperatures and other adverse environmental conditions, and most citrus species can be grafted onto sour orange trees [17]. It is grafted after one year of its separation with the nursery when it grafts the active and strong seedlings. The lemon Volkameriana rootstock is considered of the rootstocks resistant to the rapid deterioration (Tristeza) disease and the viral scale bark disease and Rugose wood complex disease and non-bearable to the Gummosis disease and salinity, it is also compatible with most types of citrus and trees grafted on it. Its crop is abundant, its fruits are excellent and its trees are large size and strong growth [6]. As for Cleopatra mandarin (*Citrus reticulata* Blanco) rootstock is considered as root of the short and its defects are slow growth and the difficulty of separating the rhytidome for the process of grafting, it is suitable for orange and afford the salinity, but is sensitive to infection of nematodes and Gummosis disease and resistant to the rapid deterioration disease. It is good growth in the sandy and heavy land is more bear to salinity than the sour orange, and It also bears the cold [5,13]. BA is of growth regulators that are highly effective [18]. It also plays an important role in

regulating the division and differentiation of plant cells, which helps in forming well contact area after the grafting process. Therefore, this study aims to know the effect of soaking of the local orange grafts with the grow on regulator Benzyl- Adenine (BA) on the success rate of grafting and growth of seedlings of local orange on three different citrus rootstocks ( Sour orange, Volkameriana lemon, Cleopatra mandarin).

## 2. MATERIALS AND METHODS

The study was conducted in the Lath house of the Department of Horticulture and Landscape Gardening, College of Agriculture, University of Baghdad for the period from March to November 2013. To study the effect of soaking local orange grafts in the BA growth regulator and grafted them on three rootstocks of citrus ( Sour orange, Volkameriana lemon, Cleopatra mandarin). Citrus seedlings were prepared from the Agricultural Research Station of the Ministry of Agriculture in Karbala Governorate at (13/2/2013). 243 homogenous seedlings were selected for growth, with age of one and a half years for rootstocks (Sour orange, Volkameriana lemon, Cleopatra mandarin). The seedlings were transferred to the location of the study and were cultivated in plastic bags with dimensions of 7 cm diameter ×14 cm in height. The seedlings were then transferred to larger bags with a diameter of 15 cm x 20 cm of height, filled with a mixture of loamy sand soils and decomposed organic matter (2: 1). The seedlings were sprayed with Fried Pride pesticide at a concentration of 12 g.L<sup>-1</sup> after observation of leaf injury with phyllocnistis citrella. As for the irrigation of plants was as needed.

**1. Design of the experiment:** The area custom for research was divided into three plots. The plots included 27 treatments. Three seedlings were used within each experimental unit and like one single plot repeater. Each single plot was isolated from each other at a minimum distance of one meter for the orange seedlings. The experiment was conducted as a factorial experiment (3

×3) according to Randomized Complete Blocks Design (RCBD), and

**The first factor:** Type of rootstock: The grafting process of local orange buds was conducted on three rootstocks of citrus (Sour orange, Volkameriana lemon, Cleopatra mandarin).

**The second factor:** the soaking of grafts in Benzyl- Adenine (BA): Bud stocks were selected for local orange cultivar to conduct the grafting process at 10/4/2013. The Bud stocks were soaked into the BA growth regulator for 10 minutes with the following concentrations: (0, 150, 250 mg.L<sup>-1</sup>). Immediately after finished the soaking process, the grafting was carried out on the budstocks. The seedlings have been grafted in the form of (T-graft) or so-called shield budding. The grafts area was attached with provisions using special nylon ligament and left for two weeks, after which the ligaments were removed from the grafting area.

### 3. The studied traits

**1. The percentage of success grafts (%):** The success rate was recorded on the basis of the growth of grafts and the emergence of vegetative branch and adopted the following equation:

$$\frac{\text{Total number of grafted seedlings}}{\text{Number of successful grafts}} \times 100 \%$$

### 4. Characteristics of vegetative growth

#### 1. Plant height (cm):

Plant height was measured on the main stem of the seedlings from the grafting area using the measuring tape at the end of the experiment in November 2013.

#### 2. Number of main branches (branch/seedlings):

The number of branches was calculated on the main stem of the seedlings at the end of the experiment.

analyzed the results according to the Dunkin test [4].

### 2. Study factors

**3. Number of leaves:** The number of leaves was calculated at the end of the experiment.

#### 4. Chlorophyll content in leaves (mg.g<sup>-1</sup> fresh weight):

Full leaves samples were taken at the sixth and eighth nodes of the top of the branches at October 2013 to extract chlorophyll of (a and b), 0.5 g of fresh weight of these leaves was taken in tablet form and placed in dark colored containers. 20 mL of acetone was added 80% and left in the dark for 24 hours. This process was repeated, until the total extraction of chlorophyll was achieved. The final volume of the extraction solution was 50 milliliters and the chlorophyll was calculated according to method of [7]. The leachate absorption was read at wavelengths 663 and 645 nm by Spectrophotometer. The following equations were used to calculate the amount of chlorophyll (mg/g fresh weight):

$$\text{Chlorophyll a} = 9.78 (A_{663}) - 0.99(A_{645})$$

$$\text{Chlorophyll b} = 21.4(A_{645}) - 4.65(A_{663})$$

$$\text{Total Chlorophyll} = \text{Chlorophyll a} + \text{Chlorophyll b}$$

Where A 663 and A 645 represent a reading of the device at wavelengths of 663 and 645 nm, respectively.

**5. Percentage of carbohydrates in leaves (%):** The percentage of total carbohydrates in the leaves was calculated according to [9].

#### 6. Percentage of nitrogen, phosphorus and potassium in leaves (%):

It were estimated at the end of the growing season by taking 0.5 g of digested leaves by using concentrated sulfuric acid and concentrated perchloruric acid by adding 5 mL of H<sub>2</sub>SO<sub>4</sub> and 5 mL of HClO<sub>3</sub> to the sample in accordance with method of [12], and obtain colorless extractions ready for mineral estimation, and nitrogen was estimated using

Microkjeldahl [8]. Total phosphorus was estimated using Ammonium Molybdate and spectrophotometer and wavelength 882 nm according to method [15]. Potassium was estimated by Flamephotometer according to method [22].

### 3. RESULTS

#### 1. The percentage of success grafts (%):

The results of Table (1) showed significant differences between the rootstocks in the percentage of success grafts, giving the Volkamariana rootstock the highest success rate of 86.48%, followed by a significant difference of the rootstock of Sour orange which gave a success rate reached of 82.09%, while the Cleopatra mandarin rootstock gave the lowest success rate of 70.67%. As for the

concentrations of Benzyl- Adenine , we note from the results of the same table there were significant differences if the concentration gave 250 mg.L<sup>-1</sup> the highest success rate of 84.66%, as for the concentrations of Benzyl- Adenine , we note from the results of the same table there were significant differences where the concentration gave 250 mg.L<sup>-1</sup> the highest success rate of 84.66%. While the comparison treatment gave the lowest percentage of 73.41%. As for the interaction between the rootstock and the Benzyl- Adenine , it was noted the superiority of Volkamariana rootstock at 250 mg.L<sup>-1</sup> Benzyl- Adenine where given the highest success rate reached of 89.18%, while the rootstock was given to the cleopatra mandarin rootstock in the control treatment the lowest ratio of 61.47%.

**Table 1:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine in the success rate of the grafts.

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	75.10 g	83.77 d	83.77 d	82.09 B
Volkameriana lemon	83.66 e	86.62 c	86.62 c	86.48 A
Cleopatra mandarin	61.47 i	73.17 h	73.17 h	70.67 C
Rate of BA mg.L <sup>-1</sup>	73.41 C	81.19 B	81.19 B	

#### 2. Plant height (cm)

The results of Table (2) show significant differences between the rootstocks for the plant height, the rootstocks of Volkamariana gave the highest rate of plant height of 144.06 cm, and then followed by a significant difference in the rootstock of the sour orange which gave an average of 136.26 cm while the cleopatra mandarin rootstock gave the lowest rate of 59.58 cm. As for the concentrations of Benzyl- Adenine , we noted from the results of the table that there were significant differences as the concentration of 250 mg.L<sup>-1</sup> gave the

highest rate of plant height of 120.41 cm followed by a significant difference of concentration of 150 mg.L<sup>-1</sup> which gave an average height reached of 113.49 cm. While the control treatment gave the lowest rate of 103.80 cm. As for the interaction between the rootstocks and the Benzyl- Adenine , was noted the superiority of Volkamariana rootstock at 250 mg.L<sup>-1</sup> Benzyl- Adenine where gave the highest rate of plant height reached of 152.21 cm, while the cleopatra mandarin rootstock of the comparison treatment gave the lowest rate of 54.70 cm.

**Table 2:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the plant height trait (cm)

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	125.08 e	138.22 d	145.19 b	136.26 B
Volkameriana lemon	137.94 d	142.04 c	152.21 a	144.06 A
Cleopatra mandarin	54.70 h	60.20 g	63.85 f	59.58 C
Rate of BA mg.L <sup>-1</sup>	103.80 C	113.49 B	120.41 A	

### 3. Number of branches:

The results of Table (3) indicate significant differences between the rootstocks for the number of branches, where the rootstocks of Volkamariana gave the highest rate of number of branches of 9.26, and then followed by a significant difference in the rootstock of the sour orange, which gave an average of 8.31, while the cleopatra mandarin rootstock gave the lowest rate of 5.52. As for the concentrations of Benzyl- Adenine , we noted from the results of the table that there were significant differences where the concentration

of 250 mg.L<sup>-1</sup> gave the highest number of branches of 9.15, followed by a significant difference of concentration of 150 mg.L<sup>-1</sup> where gave an average number of branches reached of 6.14. While the control treatment gave the lowest rate of 6.14. As for the interaction between the rootstocks and the Benzyl- Adenine , was noted the superiority of Volkamariana rootstock at 250 mg.L<sup>-1</sup> Benzyl- Adenine where gave the highest rate of the number of branches reached of 11.30, while the cleopatra mandarin rootstock of the comparison treatment gave the lowest rate of 4.56.

**Table 3:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the number of branches

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	6.76 f	8.46 d	9.72 b	8.31 b
Volkameriana lemon	7.11 e	9.37 c	11.30 a	9.26 a
Cleopatra mandarin	4.56 i	5.55 h	6.44 g	5.52 c
Rate of BA mg.L <sup>-1</sup>	6.14 c	7.79 b	9.15 a	

### 4. Number of leaves

The results of Table (4) show that there were a significant differences between the rootstocks for the number of leaves, where the rootstocks of Volkamariana gave the highest rate number of leaves 214.52, and then followed by a significant difference in the rootstock of the sour orange, where gave an average number of leaves 192.19, while the Cleopatra mandarin rootstock gave the lowest number of leaves 127.27. As for the concentrations of Benzyl- Adenine , we noted from the results of the table that there were significant differences where the concentration of 250 mg.L<sup>-1</sup> gave

the highest number of leaves 211.70, followed by a significant difference of concentration of 150 mg.L<sup>-1</sup> where gave an average number of leaves reached of 180.66. While the control treatment gave the lowest rate of 142.06. As for the interaction between the rootstocks and the Benzyl- Adenine , was noted the superiority of Volkamariana rootstock at 250 mg.L<sup>-1</sup> Benzyl- Adenine where gave the highest rate of the number of leaves reached of 261.47, while the cleopatra mandarin rootstock of the comparison treatment gave the lowest rate of 105.18.

**Table 4:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the number of leaves

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	156.19 f	195.92 d	224.46 b	192.19 c
Volkameriana lemon	164.51 e	217.58 c	261.47 a	214.52 a
Cleopatra mandarin	105.18 i	128.48 h	149.16 g	127.70 c
Rate of BA mg.L <sup>-1</sup>	142.06 c	180.66 b	211.70 a	

### 5. Chlorophyll content in leaves

The results of Table (5) show that there were a significant differences between the rootstocks for the Chlorophyll content in leaves, where the rootstocks of Volkamariana gave the highest rate of Chlorophyll content in leaves 12.04, and then followed by a significant difference in the rootstock of the sour orange, where gave an average of Chlorophyll content in leaves 11.22, while the cleopatra mandarin rootstock gave the lowest Chlorophyll content in leaves of 10.53. As for the concentrations of Benzyl- Adenine , we noted from the results of the table that there were significant differences

where the concentration of 250 mg.L<sup>-1</sup> gave the highest Chlorophyll content in leaves of 13.84, followed by a significant difference of concentration of 150 mg.L<sup>-1</sup> where gave an average Chlorophyll content in leaves reached of 11.85. While the control treatment gave the lowest rate of 8.10. As for the interaction between the rootstocks and the Benzyl-Adenine , was noted the superiority of Volkamariana rootstock at 250 mg.L<sup>-1</sup> Benzyl-Adenine where gave the highest rate of the Chlorophyll content in leaves reached of 14.81, while the cleopatra mandarin rootstock of the comparison treatment gave the lowest rate of 7.16.

**Table 5:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the Chlorophyll content in leaves

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	8.16 h	11.55 f	13.94 b	11.22 b
Volkameriana lemon	8.97 g	12.34 d	14.81 a	12.04 a
Cleopatra mandarin	7.16 i	11.67 e	12.76 c	10.53 c
Rate of BA mg.L <sup>-1</sup>	8.10 c	11.85 b	13.84 a	

### 6. Percentage of carbohydrates in leaves

The results of Table (6) showed significant differences between the rootstocks to the carbohydrates content in leaves as the Cleopatra mandarin rootstock gave the highest carbohydrates content in leaves reached of 3.48%, and then followed by the rootstock of Volkameriana by a significant difference as it gave the carbohydrates content in leaves amounted to 3.40% while the sour orange rootstock gave the lowest rate of 3.31%. As for the concentrations of Benzyl- Adenine , we noted from the results of the table that there were significant differences where the concentration of 250 mg.L<sup>-1</sup> gave the highest

carbohydrates content in leaves of 3.69%, followed by a significant difference of concentration of 150 mg.L<sup>-1</sup> where gave an average carbohydrates content in leaves reached of 3.43%. While the control treatment gave the lowest rate of carbohydrates content in leaves of 3.07%. As for the interaction between the rootstocks and the Benzyl-Adenine , was noted the superiority of Volkamariana rootstock at 250 mg.L<sup>-1</sup> Benzyl-Adenine where gave the highest rate of the carbohydrates content in leaves reached of 3.82%, while the cleopatra mandarin rootstock of the comparison treatment gave the lowest rate of 3.44%.

**Table 6:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the carbohydrates content in leaves

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	2.85 g	3.45 d	3.65 b	3.31 c
Volkameriana lemon	2.93 f	3.45 d	3.82 a	3.40 b
Cleopatra mandarin	3.44 d	3.40 e	3.59 c	3.48 a
Rate of BA mg.L <sup>-1</sup>	3.07 c	3.43 b	3.69 a	

### 7. Nitrogen content in leaves

The results of Table (7) showed significant differences between the rootstocks to the nitrogen content in leaves as the sour orange rootstock gave the highest nitrogen content in leaves reached of 1.52%, and then followed by the rootstock of Volkameriana by a significant difference as it gave the nitrogen content in leaves amounted to 1.47% while the cleopatra mandarin rootstock gave the lowest rate of 1.36%. As for the concentrations of Benzyl-Adenine , we noted from the results of the table that there were significant differences

where the concentration of 250 mg.L<sup>-1</sup> gave the highest nitrogen content in leaves of 1.6%, followed by a significant difference of concentration of 150 mg.L<sup>-1</sup> where gave an average nitrogen content in leaves reached of 1.44%. While the control treatment gave the lowest rate of nitrogen content in leaves of 1.31%. As for the interaction, it is noted that all the rootstocks excelled with the treatment of soaking the concentration of 250 mg.L<sup>-1</sup> in increasing the nitrogen content in leaves, while it reduced in the cleopatra mandarin rootstocks with compared to 1.14%.

**Table 7:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the nitrogen content in leaves

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	1.44 c	1.50 b	1.62 a	1.52 a
Volkameriana lemon	1.35 d	1.44 c	1.62 a	1.47 b
Cleopatra mandarin	1.14 e	1.37 d	1.57 a	1.36 c
Rate of BA mg.L <sup>-1</sup>	1.31 c	1.44 b	1.60 a	

### 8. Phosphorus content in leaves

The results of Table (8) show that there were a significant differences between the rootstocks for the phosphorus content in leaves, where the rootstocks of Volkamariana gave the highest rate of phosphorus content in leaves 0.33%, and then followed by a significant difference in the rootstock of the sour orange, where gave an average of phosphorus content in leaves 0.31%, while the cleopatra mandarin rootstock gave the lowest phosphorus content in leaves of 0.29%. As for the concentrations of Benzyl- Adenine , we noted from the results of the table that there were significant differences where the concentration of 250

mg.L<sup>-1</sup> gave the highest phosphorus content in leaves of 0.39%, followed by a significant difference of concentration of 150 mg.L<sup>-1</sup> where gave an average phosphorus content in leaves reached of 0.32%. While the control treatment gave the lowest rate of 0.22%. As for the interaction between the rootstock and Benzyl- Adenine , it is noted the superiority of the two rootstock of Volkameriana and sour orange with Benzyl- Adenine at the concentration of 250 mg.L<sup>-1</sup> of the phosphorus content in leaves of 0.40% for both. While decreased in the control treatment to lowest rate reached of 0.19% for the cleopatra mandarin.

**Table 8:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the phosphorus content in leaves

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
Sour orange	0.21 f	0.32 c	0.40 a	0.31 b
Volkameriana lemon	0.25 e	0.35 b	0.40 a	0.33 a
Cleopatra mandarin	0.19 g	0.29 d	0.38 b	0.29 c
Rate of BA mg.L <sup>-1</sup>	0.22 c	0.32 b	0.39 a	

### 9. Potassium content in leaves

The results of Table (8) show that there were a significant differences between the rootstocks for the phosphorus content in leaves, where the rootstocks of Volkamariana gave the highest rate of potassium content in leaves reached of 1.34%, and then followed by a significant difference in the rootstock of the sour orange and cleopatra mandarin of (31.1 and 1.32 %), respectively. As for the concentrations of Benzyl- Adenine , we noted from the results of the table that there were significant differences, where the concentration of 250 mg.L<sup>-1</sup> gave the highest potassium content in leaves of 1.42%, followed by a significant difference of

concentration of 150 mg.L<sup>-1</sup> where gave an average potassium content in leaves reached of 1.31%. While the control treatment gave the lowest rate of 1.23%. As for the interaction between the rootstock and Benzyl- Adenine , it is noted the superiority of the rootstock of Volkameriana with Benzyl- Adenine at the concentration of 250 mg.L<sup>-1</sup> of the potassium content in leaves of 1.43% which differed significantly from the rootstock for the Cleopatra mandarin and the Benzyl- Adenine at a concentration of 250 mg.L<sup>-1</sup>, where the potassium ratio was 1.42%, while in the interaction treatment to the rootstock of the Cleopatra mandarin, it gave the lowest rate of 1.23%.

**Table 9:** Effect of the rootstock and soak the local orange grafts with Benzyl- Adenine for the potassium content in leaves

Rootstock	BA mg.L <sup>-1</sup>			Effect of rootstock
	0	150	250	
<b>Sour orange</b>	1.23 f	1.30 e	1.40 c	1.31 b
<b>Volkameriana lemon</b>	1.23 f	1.34 d	1.43 a	1.34 a
<b>Cleopatra mandarin</b>	1.22 f	1.30 e	1.42 b	1.32 b
<b>Rate of BA mg.L<sup>-1</sup></b>	1.23 c	1.31 b	1.42 a	

### 4. DISCUSSION

The difference between species in the success rate of grafts and the number of branches and leaves is due to the genetic differences between the species that affect the physiological condition of the tree, which leads to a difference in the quantity and speed of the callus formation necessary for the connection between grafts and rootstocks [16]. The reason for the low success rate of the grafts for Cleopatra mandarin rootstock is due to the difficulty of separating the rhytidome and slow of growth, which cause slow of formation the callus which is necessary for the connection these results were agreed with [6, 3]. As for the effect of BA in the success rate of grafts compared to non-use it, may be due to the role of BA in stimulating the division of cells and promote division and addition to some areas of wound in the tissues of the plant. The [10] showed the role of cytokines in encourage division even the differentiated cells in plant tissues such as phloem and cortex as well as the campium cells, which

encourages the formation of a good connection area. This is consistent with [19] when soaking orange grafts in Benzyl- Adenine and grafting on the rootstock of the sour orange, which caused an increase in the success rate. Data of vegetative growth shows the role of BA in the improvement of all vegetation traits and with increasing concentration, improvement is increasing, the improvement of plant height may have been attributed to the catalytic effect of the Benzyl- Adenine in the early opening of the buds, which increased the length of growth, which was positively reflected in plant height, these differences in the height of seedlings can also be attributed to the catalytic effect of BA in cell division as indicated [10]. Treatment with BA increases the rate of cell division in the treated tissue and encourages division of differentiated cells such as cortex and phloem, which helps in forming a good connection area. This result is consistent with [1]. As for the role of BA in increasing the number of branches which attributed to his role in breaking the total



sovereignty (Due to the opening of static buds), And encouraged the growth of side buds, which increased the number of branches [21], This result was consistent with the results of [1]. And that the increase in the number of branches as shown in Table (3) was reflected positively in the increase in the number of leaves. It is also noticed that there is a difference in the chlorophyll content in leaves as shown in Table (5) in the leaves of the local orange seedlings on the three rootstocks. This may be due to the strength of the vegetative growth of the rootstocks, which is reflected in good vegetative growth, which leads to an increase in the content of the content of chlorophyll, and carbohydrates in leaves, which constitute a high proportion of dry matter [14], which was reflected positively in increasing the strength of vegetative growth of seedlings, which need to absorb a lot of mineral elements of the soil, including potassium, phosphorus and nitrogen, as indicated in tables (7,8,9).

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