Response of Cutting of Two Olive Cultivars to the Planting Date and Different Chemical Treatments

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Abstract

A factorial experiment was conducted according to The Randomized Complete Block Design (RCBD) in a private nursery in the north of Babil Governorate / Sadat district of India to know the effect of the cultivars(Manzanillo and Bashiqa) with a symbol (A1, A2) and three dates for planting cuttings (15 T2, 15 K1, 15 K2) and a symbol for them (T1, T2, T3) and some chemical treatments which are the control treatment (distilled water), growth regulator IBA (4000 $mg.L^{-1}$), ascorbic acid (AsA) (750 $mg.L^{-1}$), sucrose (60 $g.L^{-1}$) 1) 100% honey, Licorice root extract (6 $g.L^{-1}$), combination (IBA + licorice root extract + ascorbic acid), combination (honey + ascorbic acid + licorice root extract) and their symbol (C0, C1, C2, C3, C4, C5, C6, C7) respectively in the rooting and growth of the olive cuttings, and after the end of the experiment, the results were as follows: Manzanillo cultivar, first date, and treatment (A1T2C6) were excelled in most of the studied traits.

Key Words: Response, Mind, Olive, Cultivars, Planting Date.

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Introduction

Olea europaea L. (Olive) is one of the subtropical fruits that are sustainable and perennial for hundreds of years. It belongs to the olive family Oleaceae, which contains about 30 genera, including the genus Olea, which includes 35 species, including olive, which is the only type with economic importance, where it gives fruits suitable for human use in pickling and oil extraction (Lanza, 2011). Olive oil, which is one of the best types of vegetable oils in the diet of diabetics, can be used as it helps to represent fats in the liver, as well as added to some mixtures to treat burns, especially first-degree burns (Rahmani et al., 2014). The vegetative propagation of commercial olive cultivars is the best method for producing seedlings using cuttings of various types. The semi-woody stem cuttings are one of the most common types of cuttings used in the propagation of different olive varieties on a commercial scale due to the possibility of processing them in large numbers and producing them economically (Farahani et al., 2011)and that some olive varieties are easy to root, and others are difficult to root, and that the ability to root the cuttings and its success is affected by several factors, including the date of taking the cuttings, temperature and relative humidity. This method is one of the best methods of economically propagating olives, and the resulting trees are characterized by being more robust, fruitful and faster growing. The low rooting rate of the cuttings is one of the main obstacles facing this method (Murat, 2016). To improve the rooting rate, the bases of the cuttings are treated with rooting promoters, as studies have confirmed that treating the bases of the olive cuttings with substances that encourage rooting, such as auxins and some phenolic compounds, gave the highest rooting rate.

The success rate of rooting cuttings varies according to the dates of processing them from the mother trees, due to the difference in their content of internal hormones, nutrients, growth stimulants and factors auxiliary to rooting (Hijri et al., 2002).

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Materials and Methods

The factorial experiment was conducted according to The completely randomized design (CRD) in a private nursery in Sadat Al-Hindiya district, north of Babylon province, latitude 32.68516 and length 44.33301 during the growing season -2020-2021. To study the effect of three planting dates (November 15, December 15, January 15) and which are symbolized by (T1, T2, T3) respectively and eight chemical treatments which are the control treatment (distilled water), the growth regulator IBA (4000 mg..L^{-1}). Ascorbic acid (AsA) (750 mg.L^{-1}), sucrose (60 g..L^{-1}), honey 100%, licorice root extract (6 g..L^{-1}), combination (IBA + licorice root extract + ascorbic acid), combination (honey + ascorbic acid + licorice root extract) and which are symbolized by (C0, C1, C2, C3, C4, C5, C6, C7), respectively, in the growth of the cuttings of two olive cultivars, namely (Menzinello and Bashiqa) and which are symbolized by (A1, A2) respectively.

Preparation of Solutions

1. The comparison treatment (distilled water only).
2. IBA 4000 mg.L^{-1} (prepared by dissolving 4000 mg of IBA in a liter of distilled water after dissolving it with alcohol).
3. Ascorbic acid (vitamin C) (prepared by dissolving 750 mg in a liter of distilled water).
4. Sucrose 6% (prepared by dissolving 60 g of sucrose in a liter of distilled water).
5. 100% natural honey.
6. Licorice root extract (prepared by dissolving 6 gm of licorice root powder in a liter of warm distilled water for 24 hours, after which the solution is filtered through gauze and prepared for cuttings) (Al-Marsoumi, 1999).
7. Combination (IBA + Licorice Root Extract + Ascorbic Acid)
8. Blend (honey + ascorbic acid + licorice root extract)

1. Cultivation of Cuttings

The olive cuttings were selected from mother trees free from diseases and insects and planted as single trees in the Al Mahaweel gardening station, length (12-15 cm) and diameter (0.5-1.5 mm) containing a pair of leaves and at least two nodes with a vegetative bud developing at each node. The cutting was cut directly under the node, and the cut was made from the top in diagonal methods to prevent water from collecting and to know the upper side of the cutting. The cuttings were treated with rooting agents immediately after cutting them for 24 hours, and the bases of the cuttings were immersed in the aforementioned solutions at a height of 3 cm. and the cuttings were planted after being treated with solutions in plates, as the (river soil) with a height of 10 cm was placed inside a plastic tunnel with a length of 10 m and a width of 5 m, and the growth medium was treated with a fungicide to prevent rotting of the bases of the cuttings. A sample of the experiment soil was taken for the purpose of conducting some chemical and physical analyzes (Table 1).

Table 1. Some chemical and physical properties of the soil of the study area

Traits	values	units
sand	481.4	g.kg^{-1} soil
silt	325.2	g.kg^{-1} soil
Clay	193.4	g.kg^{-1} soil
Texture	Loam	--------
EC. electrical conduction	3.08	Ds.m^2
pH	7.4	---------
total nitrogen	6.7	g.kg^{-1}
availability phosphorous	15.1	g.kg^{-1}
K+ dissolved	26.6	mg.kg^{-1}
Organic matter	0.81	g.kg^{-1}

It was analyzed in the laboratories of the Soil Department (Al-Mussiab Technical College)

After the end of the experiment, the following measurements were taken (branch length, number of branches, percentage of rooted cuttings, root dry weight, percentage of carbohydrates, proteins and ascorbic acid in leaves). After the end of the experiment, the following measurements were taken (the length of the main branch, the number of branches, the percentage of rooted cuttings, the dry weight of the roots, the percentage of protein, the percentage of carbohydrates, the content of ascorbic acid).

Results and Discussion

1. The main branch length (cm)

The results in Table (1) showed that there were no significant differences between the cultivars in the average length of the main branch, where the cultivar Manzanillo recorded 20.66 cm, while the cultivar Bashiqa recorded 20.45 cm. It also showed that planting dates had a significant effect on the length of the main branch, the first date T1 (15 October) was significantly excelled and gave the highest average length of the main branch reached 21.14 cm, while the date T3 (15 January) recorded the lowest average length of the main branch reached 20.08 cm. The results also showed that rooting treatments had a significant effect on the length of the main branch, where C6 was significantly excelled and gave the highest value of 29.88 cm, followed by treatment C1 that gave 27.66 cm, compared to the control treatment C0, which recorded the lowest length of the main branch was 12.55 cm. The effect of the bi-interaction of cultivars and dates had a significant effect on the length of the main branch.

Table 1. The effect of the cultivar, the date of cuttings, the chemical treatments, and the interaction between them on the length of the main branch (cm)

cultivars × planting date	Chemical Treatments (C)								Planting date(T)	Cultivars(A)
	C7	C6	C5	C4	C3	C2	C1	C0		
20.75	25.00	31.00	14.67	16.33	17.33	21.33	27.67	12.67	T1	A1
04.21	25.00	30.67	15.00	17.00	18.00	21.00	29.00	12.67	T2	
20.20	24.00	29.00	14.67	16.00	18.00	20.33	27.33	12.33	T3	
54.21	26.00	31.33	15.33	16.67	18.33	23.00	28.67	13.00	T1	A2
87.19	23.00	29.00	14.33	16.00	17.67	19.33	27.00	12.67	T2	
19.95	24.00	28.33	14.67	16.67	17.67	20.00	26.33	12.00	T3	
0.52	1.47								L.S.D 0.05	
cultivars average (A)	Cultivars × Chemical treatments									
20.66	24.66	30.22	14.78	16.44	17.77	20.88	28.00	12.55	A1	
20.45	24.33	29.55	14.77	16.44	17.89	20.78	27.33	12.56	A2	
N.S	0.85								L.S.D 0.05	
planting dates	planting dates × chemical treatments									
21.14	25.50	31.17	15.50	16.50	17.83	22.17	28.17	12.83	T1	
20.45	24.00	29.83	14.66	16.50	17.83	20.16	28.00	12.66	T2	
20.08	24.00	28.66	14.66	16.33	17.84	20.16	26.83	12.17	T3	
0.36	1.04								L.S.D 0.05	
	24.50	29.88	14.77	16.44	17.83	20.83	27.66	12.55	Average Chemical treatments (C)	
	0.60								L.S.D 0.05	

The treatment of bi-interaction (A1T2) excelled and recorded the highest average length of the main branch amounted to 21.54 cm, while the treatment of interaction (A2T3) gave the least length of the main branch reached 19.95 cm. The interaction treatment (A1C6) gave 30.22 cm), While the interaction treatment (A1C0) gave the lowest average length of the main branch amounted to 12.55 cm, and the treatment of interaction (T1C6) excelled in the length of the main branch as it gave the highest average length of the main branch reached 31.17 cm, while the treatment of interaction (T1C0) gave the lowest average length of the main branch reached 12.17 cm. The results of the triple interaction between the factors of the study showed a significant effect on the length of the main branch, the intervention treatment (A2T1C6) 31.33 cm) excelled on compared to the treatment (A2T3C0), which recorded 12.00 cm.

2. Number of branches (cutting.branch^{-1})

The results in Table (2) showed that there were no significant differences between the cultivars in the average number of branches, where the Manzanillo cultivar recorded 5.01 cutting.branch^{-1}, while the Bashiqa cultivar 4.90 cutting.branch^{-1}. The results also showed that planting dates had a significant effect on the number of branches. The first date, T1 significant, scored the highest average of branches (5.19) cutting.branch^{-1}, then the second date T2 scored 4.96 cutting.branch^{-1}, while the third date T3 recorded the lowest rate of 4.85 cutting.branch^{-1}, The results also showed that the rooting treatments had a significant effect on the number of branches, the C6 treatment significantly excelled on the rest of the other treatments and gave the highest value of 8.66 cutting.branch^{-1}, followed by the C1 treatment which gave 6.88 cutting.branch^{-1}, while the comparison treatment C0 gave the lowest rate of 2.27 cutting.branch^{-1}.The bi- interaction between varieties and dates (A1T1) recorded the highest rate of 5.21 cutting.branch^{-1}, while the interaction (A2T2) treatment (4.75 cutting.branch^{-1}), and the bi- interaction between varieties and chemical treatments (A2C6) recorded the highest rate. 8.77 cutting.branch^{-1} Whereas, the interaction treatment (A2C0) gave the lowest average number of branches, which amounted to 2.11 cutting.branch^{-1}, and the interaction treatment between appointments and chemical treatments was significantly excelled, where the interaction treatment (T2C6) recorded 8.88 cutting.branch^{-1}, while the interaction treatment (T2C0) gave the lowest rate. The number of branches reached 2.00, cutting.branch^{-1}.The triple interaction between the study factors showed a significant increase in the number of branches, as the treatment (A2T1C6) recorded an increase in the number of branches amounted to 9.67 cutting.branch-1, while the treatment (A2T2C0) gave the lowest number of 1.67 cutting.branch^{-1}.

Table 2. The effect of the cultivar, planting date of the cuttings, chemical treatments and the interaction between them on the number of branches (cutting. branch^{-1})

cultivars × planting date	Chemical Treatments (C)								Planting date(T)	Cultivars(A)
	C7	C6	C5	C4	C3	C2	C1	C0		
5.21	6.00	8.67	3.33	4.00	4.33	5.33	7.33	2.66	T1	A1
5.16	6.00	9.00	3.67	3.67	4.67	5.00	7.00	2.33	T2	
4.91	5.67	8.00	3.33	4.00	4.67	5.00	6.33	2.33	T3	
5.16	6.00	9.67	3.33	3.33	4.67	5.00	7.00	2.33	T1	A2
4.75	5.67	8.67	2.67	3.33	4.67	5.00	6.33	1.67	T2	
4.79	5.67	8.00	3.00	3.33	4.33	4.67	7.00	2.33	T3	
0.46	1.32								L.S.D 0.05	
cultivars average (A)	Cultivars × Chemical treatments									
5.01	5.88	8.55	3.44	3.88	4.55	5.11	6.88	2.44	A1	
4.90	5.77	8.77	3.00	3.33	4.55	4.88	6.77	2.11	A2	
N.S	0.76								L.S.D 0.05	
planting dates	planting dates × chemical treatments									
5.19	6.00	9.16	3.33	3.66	4.50	5.16	7.16	2.50	T1	
4.96	5.83	8.88	3.16	3.55	4.66	5.00	6.66	2.00	T2	
4.85	5.66	8.00	3.16	3.66	4.50	4.83	6.66	2.33	T3	
0.33	0.93								L.S.D 0.05	
	5.83	8.66	3.22	3.61	4.55	5.00	6.88	2.27	Average Chemical treatments (C)	
	0.54								L.S.D 0.05	

3. Percentage of rooted cuttings (%)

The results in Table (3) showed that there were no significant differences between the cultivars in the percentage of rooted cuttings, where the cultivar Manzanillo gave 64.58%, compared to the cultivar Bashiqa (A2), which recorded the lowest percentage of 66.32%.The results also showed that there were no significant differences between the dates, where the first date recorded T1 (66.67%), while the second date recorded T2 (64.58%), while the third date gave T3 (65.10%). The results also showed that the chemical treatments had a significant effect on the percentage of rooted cuttings, the C6 treatment significantly outperformed the rest of the other treatments and gave the highest value of 81.94%, followed by the C1 treatment which gave a rooting rate of 80.56%, while the comparison treatment (C0) gave the lowest percentage. The percentage of rooted cuttings was 29.17%. The results of the two-cultivars and dates interaction also showed that there were no significant differences in the percentage of rooted diseases. The interaction treatment (A2T1) gave 68.75%, while the interaction treatment (A2T2) gave (63.54%). The bi- interaction between the cultivars and chemical treatments showed a significant effect on the percentage of rooted cuttings, it gave the interaction treatment (A2C6) and gave the highest rate of the percentage of rooted cuttings amounted to 83.33%, while the interaction treatment (A1C0) gave the lowest average percentage of rooted cuttings amounted to 27.78%While the interaction between appointments and chemical treatments was significantly excelled in the percentage of rooted cuttings, the interaction (T2C6) gave the highest percentage of rooted cuttings 83.33%, while the interaction (T1C0) gave the lowest percentage of rooted cuttings, which amounted to 29.17%.The results also showed that the triple interaction between the experimental factors had a significant effect on the percentage of rooted cuttings. The results showed that the interaction treatment (A2T1C6) was significantly excelled and gave the highest average of the percentage of rooted cuttings that reached 91.67% compared to the interaction treatment (A1T1C0), which recorded 25%. It is worth noting that All previous studies did not reach this high percentage in rooting the cutting, where it is considered the best achievement reached in this study.

Table 3. The effect of cultivar, cutting date, chemical treatments, and the interaction between them on the percentage of rooted cuttings (%)

cultivars × planting date	Chemical Treatments (C)								Planting date(T)	Cultivars(A)
	C7	C6	C5	C4	C3	C2	C1	C0		
64.58	75.00	75.00	58.33	58.33	66.67	75.00	83.33	25.00	T1	A1
63.54	66.67	83.33	50.00	58.33	75.00	66.67	75.00	33.33	T2	
65.62	75.00	83.33	58.33	58.33	66.67	75.00	83.33	25.00	T3	
68.75	75.00	91.67	58.33	66.67	66.67	75.00	83.33	33.33	T1	A2
65.62	75.00	83.33	50.00	58.33	66.67	83.33	83.33	25.00	T2	
64.58	75.00	75.00	58.33	58.33	66.67	75.00	75.00	33.33	T3	
N.S	18.18								L.S.D 0.05	
cultivars average (A)	Cultivars × Chemical treatments									
64.58	72.22	80.56	55.56	58.33	69.44	72.22	80.56	27.78	A1	
66.32	75.00	83.33	55.56	16.11	66.67	77.78	80.56	30.56	A2	
N.S	10.49								L.S.D 0.05	
planting dates	planting dates × chemical treatments									
66.67	75.00	83.33	58.33	62.50	66.67	75.00	83.33	29.17	T1	
64.58	70.83	83.33	50.00	58.33	70.83	75.00	79.17	29.17	T2	
65.10	75.00	79.17	58.33	58.33	66.67	75.00	79.17	29.17	T3	
N.S	12.85								L.S.D 0.05	
	73.61	81.94	55.56	59.72	68.06	75.00	80.56	29.17	Average Chemical treatments (C)	
	7.42								L.S.D 0.05	

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4. Dry weight of the roots (g)

The results in Table (4) showed that the cultivar Manzanillo (A1) was significantly excelled, and it gave the highest average dry weight of the roots, which was 0.97 gm. While the cultivar Bashiqa (A2) gave the lowest root dry weight of 0.96 gm. The results also showed that the first date (T1) was significantly excelled and gave the highest average dry weight of the roots, which was 0.98 g, while the third date (T3) recorded (0.95 g). The treatment (C6) excelled and recorded 1.30 gm compared to the control treatment (C0), which recorded the lowest dry weight of 0.52 gm. The results of the bi-interactions between the study factors gave a significant increase in the dry weight of the roots. The two interaction treatments (A1T2 and A2T1) were significantly excelled and gave the highest average dry weight of the roots amounting to (1.00) g for each, while the bi-interaction between the cultivars and the chemical treatments showed a significant effect on the dry weight. For the root, the interaction treatment (A1C6) gave the highest average dry weight of the roots amounted to 1.31 g compared to the treatment (A1C0), which gave the lowest dry weight rate of the roots was 0.51 g. While the interaction between the dates and the chemical treatments was significantly excelled on the dry weight of the roots, the two interactions treatments (T2C6 and T1C6) gave the highest average dry weight of the roots amounting to 1.31 g for each, while the interaction treatment (T3C0) gave the lowest average dry weight of the roots, which was 0.51 g.The results also showed that the triple interaction between the experimental factors had a significant effect on the dry weight of the root. The interaction treatment (A1T2C6) was significantly superior and gave the highest average dry weight of the roots amounted to 1.34 gm, while the interaction treatment (A1T3C0) gave the lowest average dry weight of the roots amounted to 0.51 gm.

Table 4. The effect of cultivar, cutting date, chemical treatments and the interaction between them on root dry weight (gm)

cultivars × planting date	Chemical Treatments (C)								Planting date(T)	Cultivars(A)
	C7	C6	C5	C4	C3	C2	C1	C0		
0.96	1.15	1.30	0.62	0.85	0.97	1.11	1.21	0.52	T1	A1
1.00	1.13	1.34	0.71	0.91	1.03	1.12	1.24	0.52	T2	
0.95	1.14	1.31	0.64	0.81	0.98	1.08	1.20	0.51	T3	
1.00	1.15	1.33	0.72	0.91	1.05	1.12	1.27	0.52	T1	A2
0.93	1.11	1.28	0.62	0.78	0.95	1.06	1.15	0.54	T2	
0.94	1.12	1.29	0.64	0.78	0.92	1.11	1.17	0.52	T3	
0.01								0.02	L.S.D 0.05	
cultivars average (A)	Cultivars × Chemical treatments									
0.97	1.14	1.31	0.65	0.85	0.99	1.10	1.21	0.51	A1	
0.96	1.12	1.29	0.66	0.82	0.97	1.09	1.19	0.52	A2	
0.01								0.01	L.S.D 0.05	
planting dates	planting dates × chemical treatments									
0.98	1.14	1.31	0.67	0.87	1.01	1.11	1.23	0.52	T1	
0.96	1.12	1.31	0.66	0.84	0.98	1.09	1.19	0.53	T2	
0.95	1.12	1.29	0.63	0.79	0.95	1.09	1.18	0.51	T3	
0.01								0.01	L.S.D 0.05	
	1.13	1.30	0.65	0.83	0.98	1.10	1.20	0.52	Average Chemical treatments (C)	
	0.01								L.S.D 0.05	

Percentage of protein in leaves (%)

The results in Table (5) showed that the cultivar Manzanillo (A1) was significantly excelled, and the highest average percentage of protein in the leaves was 7.93%. Whereas, the cultivar Bashiqa (A2) gave (7.89%). The results also showed that the first date T1 was significantly excelled and gave the highest average percentage of protein in leaves that reached 7.95% compared to the second date T2 and the third T3 which scored 7.89% for each. The results also showed that the chemical treatments had a significant effect on the percentage of protein in the leaves. The C6 treatment was significantly excelled and gave the highest value of 8.94%, while the comparison treatment C0 gave the lowest percentage of protein in the leaves, which amounted to 6.88%.

The bi-interactions between the study factors showed significant differences between them, the interaction (A2T1) treatment significantly excelled on the rest of the other interaction treatments and gave the highest percentage of protein in the leaves amounted to 8.00%, while the treatment (A2T2) gave the lowest protein rate of 7.79%. The bi-interaction between the cultivars and the chemical treatments also showed a significant effect. The interaction treatment (A1C6) gave the highest percentage of protein in the leaves, which amounted to 8.99%, while it gave (A2C0) 6.84%As for the interaction between the appointments and the chemical treatments, the interaction treatment (T1C6) outperformed and recorded the highest percentage of protein percentage in the leaves with 8.99%, while the treatment (T2C0) recorded

(6.83%).The triple interaction between the study factors also showed a significant increase in the percentage of protein, as the treatment (A1T3C6) recorded a significant increase of 9.05% compared to the treatment (A2T2C0), which recorded 6.64%.

Table 5. The effect of cultivar, cutting date, chemical treatments and the interaction between them on the percentage of protein in leaves(%)

cultivars × planting date	Chemical Treatments (C)								Planting date(T)	Cultivars(A)
	C7	C6	C5	C4	C3	C2	C1	C0		
7.91	8.24	8.94	7.30	7.53	7.81	8.03	8.64	6.84	T1	A1
7.98	8.34	8.98	7.35	7.58	7.82	8.10	8.70	7.02	T2	
7.91	8.17	9.05	7.25	7.47	7.80	8.02	8.63	6.89	T3	
8.00	8.36	8.97	7.36	7.57	7.84	8.10	8.77	7.04	T1	A2
7.79	8.17	8.83	7.14	7.39	7.73	7.95	8.52	6.64	T2	
7.87	8.20	8.88	7.09	7.42	7.76	8.24	8.55	6.86	T3	
0.04	0.12								L.S.D 0.05	
cultivars average (A)	Cultivars × Chemical treatments									
7.93	8.25	8.99	7.30	7.52	7.80	8.05	8.65	6.91	A1	
7.89	8.24	8.89	7.19	7.46	7.77	8.09	8.61	6.84	A2	
0.02	0.07								L.S.D 0.05	
planting dates	planting dates × chemical treatments									
7.95	8.29	8.95	7.32	7.55	7.82	8.06	8.70	6.94	T1	
7.89	8.25	8.90	7.24	7.48	7.77	8.02	8.60	6.83	T2	
7.89	8.25	8.90	7.17	7.44	7.78	8.13	8.59	6.87	T3	
0.03	0.08								L.S.D 0.05	
	8.24	8.94	7.24	7.49	7.79	8.07	8.63	6.88	Average Chemical treatments (C)	
	0.05								L.S.D 0.05	

Percentage of carbohydrates in the leaves (%)

The results in Table (6) showed that the Manzanillo (A1) cultivar was significantly excelled in the percentage of carbohydrates in the leaves, which amounted to 0.27%. Whereas, the cultivar Bashiqa (A2) gave (0.26%). The results also showed that planting dates had a significant effect on the percentage of carbohydrates. The second date (T2) and the third date T3) were significantly excelled and gave the highest percentage of carbohydrates, which amounted to 0.27% for each, while the first date (T1) recorded 0.26%. While the C6 treatment significantly excelled on the carbohydrate content of the leaves, and scored 0.40%, compared to the control treatment (C0), which recorded 0.12%. The bi-interaction treatments between the study factors also caused a significant increase in the carbohydrate content of the leaves. The interaction treatment (A1T2) excelled and gave the highest percentage of carbohydrates that amounted to 0.28%), while the treatment (A1T1) gave the lowest carbohydrate average of 0.25%. The bi-interaction between the varieties and the chemical treatments had a significant effect on the carbohydrate content of the leaves. The interaction treatment (A1T6) gave the highest percentage of carbohydrates in the leaves amounted to 0.41% compared to the treatment (A1C0), which gave the lowest average of the percentage of carbohydrates in the leaves amounted to (0.12). %). While the interaction between the dates and the chemical treatments was excelled, where the treatment (T1C6) was significantly excelled on the percentage of carbohydrates in the leaves, it recorded an increase of 0.41%, while the interaction treatment (T2C0) gave 0.11%. The results of the triple interaction between the factors of the study showed a significant increase in the percentage of carbohydrates. The results showed that the triple combination (A2T1C6) was significantly excelled and gave (0.42)%, compared to the triple combination (A2T2C0) 0.11%.

Table 6. The effect of the cultivar, the date of planting cuttings and the chemical treatments and the interaction between them on the carbohydrate content of leaves %

cultivars × planting date	Chemical Treatments (C)								Planting date(T)	Cultivars(A)
	C7	C6	C5	C4	C3	C2	C1	C0		
0.25	0.31	0.40	0.15	0.18	0.21	0.25	0.38	0.13	T1	A1
0.28	0.31	0.41	0.20	0.23	0.27	0.32	0.38	0.12	T2	
0.26	0.29	0.40	0.20	0.21	0.25	0.28	0.36	0.17	T3	
0.26	0.34	0.42	0.16	0.19	0.24	0.29	0.38	0.13	T1	A2
0.25	0.26	0.40	0.19	0.19	0.23	0.30	0.35	0.11	T2	
0.27	0.30	0.39	0.20	0.22	0.25	0.29	0.36	0.14	T3	
0.01	0.03								L.S.D 0.05	
cultivars average (A)	Cultivars × Chemical treatments									
0.27	0.30	0.41	0.18	0.21	0.24	0.28	0.73	0.12	A1	
0.26	0.29	0.40	0.18	0.20	0.24	0.29	0.36	0.13	A2	
0.01	0.02								L.S.D 0.05	
planting dates	planting dates × chemical treatments									
0.26	0.32	0.41	0.15	0.18	0.22	0.26	0.37	0.13	T1	
0.27	0.28	0.40	0.19	0.20	0.25	0.31	0.36	0.11	T2	
0.27	0.29	0.39	0.20	0.21	0.25	0.28	0.35	0.13	T3	
0.01	0.02								L.S.D 0.05	
	0.30	0.40	0.18	0.20	0.24	0.28	0.36	0.12	Average Chemical treatments (C)	
	0.01								L.S.D 0.05	

Ascorbic acid content (μg g^{-1} fresh leaf)

The results in Table (7) showed that the cultivar Manzanillo (A1) was significantly excelled and gave the highest average content of ascorbic acid in the leaves, which was 12.27 μg g^{-1} fresh leaf. While the cultivar Bashiqa (A2) gave 12.08 μg g^{-1} fresh leaf, The first date T1) was significantly excelled and gave the highest rate of ascorbic acid content in the leaves of 12.40 μg g^{-1} fresh leaf, while the third T3 date recorded the lowest average of 12.00 μg g^{-1} fresh leaf. Whereas, treatment C2 was significantly excelled in the content of ascorbic acid and recorded 14.36 μg g^{-1} fresh leaf compared to the control treatment (C0), which recorded 8.91 μg g^{-1} fresh leaf. The results of the bi- interaction between cultivars and dates gave a significant increase in the content of ascorbic acid in the leaves. The interaction treatment (A2T1) was excelled and gave 12.50 μg g^{-1} fresh leaf, while the interaction treatment (A2T2) gave the lowest rate of 11.87 μg g^{-1} fresh leaf. The treatment (A1C2) recorded 14.47 μg g g-1 fresh leaf, while the interaction (A2C0) gave 9.12 μg g^{-1} fresh leaf. While the treatment (T1C2) excelled and recorded the highest rate of ascorbic acid content of 14.56 μg g^{-1} fresh leaf, while the interaction treatment (T3C0) gave 8.41 μg g^{-1} fresh leaf. The triple interaction between the study factors also showed a significant effect on the content of ascorbic acid in the leaves. The triple combination (A2T1C2) excelled it, which recorded 14.61 μg g^{-1} fresh leaf, while the triple interaction (A2T2C0) gave 8.09 μg g^{-1} fresh leaf.

Table 7. The effect of cultivar, cutting date, chemical treatments and the interaction between them in estimating the content of ascorbic acid (μg g^{-1} fresh leaf)

cultivars × planting date	Chemical Treatments (C)								Planting date(T)	Cultivars(A)
	C7	C6	C5	C4	C3	C2	C1	C0		
12.29	13.22	13.72	10.90	11.74	12.23	14.51	12.82	9.22	T1	A1
12.41	13.29	13.82	11.04	11.89	12.33	14.59	12.85	9.53	T2	
12.12	13.18	13.59	10.77	11.62	12.15	14.33	12.69	8.64	T3	
12.50	13.32	13.95	11.15	11.92	12.38	14.61	12.93	9.81	T1	A2
11.87	13.09	13.42	10.48	11.29	12.03	14.11	12.45	8.09	T2	
11.88	13.09	13.51	10.23	11.39	12.03	14.05	12.59	8.20	T3	
0.04	0.11								L.S.D 0.05	
cultivars average (A)	Cultivars × Chemical treatments									
12.27	13.22	13.71	10.90	11.75	12.23	14.47	12.78	9.12	A1	
12.08	13.16	13.62	10.62	11.53	12.14	14.25	12.65	8.70	A2	
0.02	0.06								L.S.D 0.05	
planting dates	planting dates × chemical treatments									
12.40	13.27	13.83	11.02	11.83	12.30	14.56	12.87	9.51	T1	
12.14	13.18	13.62	10.76	11.59	12.17	14.34	12.65	8.81	T2	
12.00	13.13	13.55	10.50	11.50	12.08	14.19	12.64	8.41	T3	
0.03								0.08	L.S.D 0.05	
	13.19	13.67	10.76	11.64	12.19	14.36	12.72	8.91	Average Chemical treatments (C)	
	0.04								L.S.D 0.05	

Discussion

The results showed the Manzanillo cultivar excelled on the Bashiqa cultivar in some vegetative and chemical traits. The reason may be due to the presence of anatomical differences, genetic differences, or a difference in the hormonal and nutritional content within the cuttings, which have a role in the process of root formation (Al-Ahwal, 1998).The reason for the varietal response to rooting treatments and the difference of the studied traits may be due to the genetic factors ruling each cultivar, where the varietal traits are governed by a set of genetic genes between the cultivars and the nature of the interaction of the genetic structure with the environmental conditions (Therios, 2009) and the extent of their genetic expressions for the distinctive characteristics of the variety. Each class has its own characteristics, The date of taking the cuttings of the different plant species has a clear impact on the success or failure of rooting this cuttings, as well as on the characteristics of the root and vegetative group of that cuttings, as each type and plant variety is characterized by the presence of a limited period of time during which its cuttings are able to root well (Hartmann et al., 2002)The date of cutting the cuttings has an effect on rooting, due to the different physiological and anatomical conditions according to different times of the year (Al-Alwani, 2015). The reason may be due to the increase in the studied traits when taking the cutting at the first date, tables (1-7) due to the appropriate climatic conditions and the nutritional content of the cutting. As the cuttings have stored the largest possible amount of carbohydrates before taking the cutting, and this, in turn, stimulates the activation of dormant buds and the emergence of vegetative growths from them, by encouraging the formation of roots and thus increasing the vegetative and root characteristics and the success average of the cutting (Khabou et al., 1999). The chemical treatments also had a significant effect on the success of rooting the olive cuttings and increasing the studied traits. The C6 treatment (IBA + licorice root extract + ascorbic acid) was significantly superior and gave the highest values for all traits. This is due to the role of the auxin IBA in regulating plant growth, as it controls division and expansion. Cellular, revealing vascular tissue, apical dominance, and formation of adventitious roots (Table 1, 2) (Shaeed, 2009 and Rechenmann, 2010). As the rooting rate increases in Table (3) when using IBA, the reason may be due to the increase in the accumulation of nutrients such as sugars necessary for the formation of adventitious roots (Rechenmann, 2010), that is, the higher the auxin concentration, the greater the accumulation of nutrients in the treatment area, or the reason may be due to an increase in the Auxins with some naturally formed substances (Auxin Synergist) in the presence of some specialized enzymes (Poly Phenol Oxidase to form Auxin Conjugates), which are highly effective in stimulating the formation and development of root principles (Salman, 1988). That is, the higher the concentration of auxin, the greater the activity of enzymes specialized in the formation of important interconnections in the process of forming transverse roots on the cutting, or due to the role of ascorbic acid as a strong antioxidant due to its ability to give electrons in many enzymatic and non-enzymatic reactions as well as plays an important role in some physiological processes. In plants, it is the division and growth of cells, and it stimulates the growth of root principles by acting as an inhibitor of the enzyme IAA- oxidase through competition for auxin or through its effect on pH, so that auxin is more effective at low pH stimulus (Sharma et al., 2012. Srivastava and Dubey., 2012). The licorice extract also has an important role in rooting, where it raises the level of internal gibberellins, which in turn stimulates an increase in the level of internal auxin in the plant, and this in turn leads to the emergence of roots, thus increasing the rooting rate and the number of roots (Table 3 and 7) and it contains nutrients and sugars important for the rooting process. The increase in the dry weight of the roots Table (4), when treated with C6, is also due to the role of auxin, ascorbic and licorice root extract in increasing the growth of adventitious roots by improving the rooting rate Table (3) Or it may be attributed to the role of ascorbic acid, which protects cells due to its action as an antioxidant. It is a regulator of plant growth and development and affects cell division and differentiation. The behavior of licorice root extract is similar to gibberellin because it contains the bio-building initiator of gibberellin, which helps in cell division and elongation and stimulates buds, which leads to an increase in The size of the vegetative complex and thus increase the photosynthesis and then increase the processed nutrients that lead to an increase in the dry weight of the roots (Alhagdow et al., 2007). The increase in protein and carbohydrates in the leaves (table 5 and 6) is also due to the rapid division and elongation of the cells of the root principles, the increase in the number of formed roots and the increase in their absorption of nutrients, which led to an increase in photosynthesis processes and the accumulation of photosynthesis products in the leaves (Abdul-Hussein, 1986; Shaheed et al. 2009). Or it may also be due to the extract of licorice roots, which contains glycosides, the most important of which is glycyrrhizin, which is a sweet-tasting substance. and Omar, 1988) Or it may be due to the role of ascorbic acid, which acts as an enzymatic companion (Smirnoff and Wheeler, 2002) within a series of complementary steps to this process to split carbohydrates to form enzymes, release energy and participate in the photosynthesis process, thus increasing the accumulation of manufactured and stored carbohydrates in the leaves (Barth et al., 2006). Also, the increase in the concentration of ascorbic in the leaves (table (7)) can be attributed to the inclusion of the treatments (C2, C6, C7) that led to an increase in its concentration when treating the cuttings. The division and growth of cells led to an increase in its transmission to the leaves and an increase in its content in the leaves (Table 16), which is considered a powerful antioxidant due to its ability to give electrons in many enzymatic and non-enzymatic reactions and plays an important role in some physiological processes in the plant, namely the division and growth of cells and transfer Signal and bio-metabolism, thus increasing its transmission to the leaves and increasing the content of ascorbic in the leaves (table (7)).

References

Al-Ahwal, Kamal Salem Muhammad Jaber. 1998 Changes in internal hormonal and nutritional content and their relationship to rooting of some olive cultivars. PhD thesis. faculty of Agriculture. Baghdad University.

Stone, Ali Obeid, Thamer Khudair Merza and Afrah Mahdi Al-Zalmi, 2002. The effect of growth regulators and the medium of propagation on the growth and rooting of the tender cuttings of the olive cultivar Ashrashi. Iraqi Journal of Agricultural Sciences 122-111: (22) 33.

Salman. Mohammed Abbas. 1988. Propagation of horticultural plants. Ministry of Higher Education and Scientific Research. Baghdad University. Iraq.

Abdul-Hussein, Muslim Abd Ali.1986. Effect of some treatments on the rooting of cuttings of Ashassi and Nibali olive cultivars under spray irrigation. Master Thesis. faculty of Agriculture. Baghdad University.

Al-Alwani, Abdullah. (2015). Effect of fertilization date and plant hormone on rooting of fresh and woody cuttings of some plants. Al-Mukhtar Journal of Science. Vol. 30, No. 1.

Heikal, Mohamed El-Sayed and Abdullah Abdel-Razzaq Omar. (1988). Medicinal and aromatic plants, their production and benefits. Knowledge facility in Alexandria, Egypt.

Alhagdow, M; Mounet, F; Gilbert, L; Nunes-Nesi, A; Garcia, V; Just, D. and Baldet, P. (2007). Silencing of the mitochondrial ascorbate synthesizing enzyme L-galactono-1, 4-lactone dehydrogenase affects plant and fruit development in tomato. Plant Physiology, 145(4), 1408-1422.

Barth, C.; De Tullio M, and Conklin P.L. (2006). The role of ascorbic acid in the control of the flowering time and the onset of senescence. Journal of Experimental Botany, 57(8): 1657–1665.

Farahani, F; Yari, R. and Masoud, S. (2011). Somaclonal variation in Dezful cultivar of olive (Olea europaea subsp. europaea). Gene Conserve, 10(41).

Hartmann, H.T.; Kester, D.E.; Davies, J.R.; and Geneve, R1. (2002). Plant propagation: Principles and practices, 7th ed. Prentice Hall, Englewood Cliffs, NJ.

Khabou, W. and Trigui, A. (1999). Optimisation Of The Hardwood-Cutting As A Method of Olive Tree Multiplication. Acta Hortic., 474, 55-58.

Lanza F 2011. Olive: a global history. London: Reaktion. p. 15.

Murat, İ sfendiyarglu. 2016. Effect of Auxin and Auxin sensitive phase root regeneration cuttings of Olea Europaea. L Bangladesh J. Bot., 45(2): 427-431.

Rahmani, A. H; Albutti, A. S; & Aly, S. M. (2014). Therapeutics role of olive fruits/oil in the prevention of diseases via modulation of anti-oxidant, anti-tumour and genetic activity. International journal of clinical and experimental medicine, 7(4), 799.

Rechenmann, C. (2010). Cellular responses to auxin: division versus expansion. Cold Spring Harbor perspectives in biology, 2(5), a001446.

Shaheed, A.I. (2009). Adventitious root formation. Uni. of Babylon, Iraq.

Shaheed, A.I., Yaseer O.M. and Alwan, A.O. (2009b). Hydrogen bonding of phenolic compounds, ascorbate and sugars as anti oxidants on IAA level via oxidative hypothesis during of mung bean cuttings. Int. J. Chem. Sci.

Sharma, P.; Jhu, A.B. ; Dubey, R.S. and Pessarakli, M. (2012). Reactive Oxygen Species, Oxidative Damage, and Antioxidative defense Mechanism in Plants under Stressful Conditions. Review Article, Journal of Botany, 2012, pp. 26.

Srivastava, S. and Dubey, R.S. (2012). Nitric oxide alleviates manganese toxicity by preventing oxidative stress in excised rice leaves. Acta Physiol. Plant, 34: 819-825.

Therios, I; 2009. Olives. In: Crop Production Science in Horticulture. CABI Publishing, Wallingford, UK.

Wheeler, G.L., & Smirnoff, N. (2002). Antisense suppression of l-galactose dehydrogenase in Arabidopsis thaliana provides evidence for its role in ascorbate synthesis and reveals light modulated l-galactose synthesis. The Plant Journal, 30(5), 541-553.