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Influence of Date, IBA and their interactions on cut rooting vegetative, growth of two olive cultivars

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Abstract: *This study was carried out during the growing season (2016) in Bakrajo Nursery Station/ Sulaimani, Kurdistan Region-Iraq. Uniform and healthy olive (Oleaeuropaea L.) cvs.Shami and Qaisicuttings were used. Filled with sand building to investigate the effect of three IBA hormone concentrations (0, 1000, 2000 and 3000ppm), three dates (15/3, 1/4 and 15/4) on vegetative growth and cut rooting of semi-hard wood olive cuttings cvs. 'Shami ' and ' Qaisi ʻ.The results are summarizing as follows: treatment of IBA hormone significantly increased on most vegetative growth and rooting. Shami cv. significantly dominated over cv. Qaisi on most of the vegetative growth and the root growth. The interactions between date, IBA and cv. Shami affected significantly on most of the vegetative growthand root growthcharacteristics. It was found that 3000ppm IBA increased the Lateral shoots number / cutting,Cutting height (cm), Lateral shoots length number of roots, the percentage of rooted cuttings, root length. But, control treatment had the lowest effect on the traits of vegetative growthand rooting in olive cuttings.*

Key words*: Olive,Time of cutting,Indole Butyric Acid, semi-hard wood cuttings.*

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I. Introduction

Olive (*Oleaeuropaea* L.), belonging to family Oleaceae, is a relatively slow growing plant, long lived with life reported to be many thousand years It is perhaps the most ancient cultivated fruit tree of arid and semi-arid areas of Mediterranean basin [1]. The native of olive is the Mediterranean region, Africa and Asia [2] Olive growing plays in important role in the economy of a country**.** In Iraq, olive trees growing in some areas of central and Kurdistan region of Iraq, Nineveh is the governorate leading olive producer, its cultivation in Nineveh spreading in an area including villages of (Baashiqa, Bahzany, Fadiliya, Sheikh Uday, Dhecan, Sinjar), Diyala, Kirkuk, Baghdad, Erbil, Duhok, Aqrah, Bamerni, followed by Babylon[3]The propagation of olive cultivars requires grafting or budding on seedling rootstocks or propagation of self-rooted cultivars from 1 or 2 year old woody cuttings[4] Although self-rooted cultivars can be established in new olive orchards, but low rooting ability, the unsatisfactory viability, and the low rooting quality of cuttings in some cultivars represent limiting factors[5] Olive has been propagated from large parts (shoots, branches, ovules, suckers) since ancient times[6] olive has been propagated mainly by cutting, Stem cuttings are the important means of vegetative propagation in horticultural industry for mass production within a short time, but great differences in the rooting potential between cultivars or clones within cultivars were shown in olive[7].The biggest problem in vegetative propagation, in some olive cultivars, is the low ability of rooting leading to low percentage of rooting[8]**.** Wounding the basal of olive cuttings have been accepted as techniques to improve the effect of auxintreatments[6][9] Evaluated of the effect of different IBA concentration and different kinds of cutting on rooting of two compatible olive cultivars cuttings. five levels of IBA treatment as a rooting hormones (0, 2500, 3000, 3500 and 4000 ppm) on two olive cultivars (mission and koroneiki), the results indicated that there were a considerable difference between the different levels of IBA, and the treatment of cutting with IBA by 3500 ppm concentration gave the highest effect on the increase in the rooting indexes of the olive cultivars mission and koroneiki. IBA has long been used to promote the rooting in cuttings of a wide range of plant species[10]. Different classes of plant growth regulators have been proven to influence root initiation. To date, auxins have been shown to have the greatest effect on rooting[11].Olive cuttings root well using synthetic auxin indole-3-butyric acid [6], but in difficult-to-root cultivars the auxin either fails to promote rooting or promotes it only slightly[5].[12]reported that in IBA-treated cuttings the number of roots was high but their growth was reduced in comparison with untreated cuttings.Rooting hormones should be applied to the base of cuttings to increase overall rooting percentages, hasten root initiation, increase the number and quality of roots and encourage uniformity of rooting. The most widely used hormone is (IBA) [13**.**[14]treated hardwood cuttings of Ascolano and Frantoio with 500 or 1000 ppm IBA and found that they resulted in better rooting of olive and that cuttings taken in March had better rooting than those taken in late summer and early autumn. The low rooting ability and low quality of roots are limiting factors to olive propagation by cuttings; so, easy-to-root cultivars may be

interesting in establishing new olive orchard[5]. Indole butyric acid (IBA) is an important auxin used to increase cuttings rooting ability. However, IBA sometimes don't stimulate rooting of olive cuttings [15]. Low rooting ability of Olive can be the result of not choosing the best time of removing cuttings from the mother plants and cultivars[4].

This investigation aimed To study the olive cutting (Shami and Qaisi) to improve and increase vegetative growth affected of different concentrations of IBA, determine the best timing of the olive cutting in the climate of Kurdistan region.Comparison between the effect of treated (IBA and date) on the olive cutting and impact of two olive cultivars which newly entered to the region on the vegetative growth of olive cutting .

II. Material and Methods:

The study was carried out during (2016) in the nursery of Bakrejo station/ Suleimania. Kurdistan region-Iraq, Olive is one of the hard-torooting plants, The experiments were started in (march 15th 2016), [16] was composed of IBA (Indule3-butyric acid) treatment at four levels (0,1000, 2000 and 3000ppm), three Dates (15/3, 1/4 and 15/4) and their interactions on two olive cultivars Shami and Qaisi**.**

Experimental design and statistical analysis:

Experiments conducted in this study followed a Complete Randomized Block Design in factorial experiment, the experiment comprised of (24) treatments with three replicates each replicate was presented by (10) cuttings,No. of cutting (360)for each date for each cultivar [17]**.**Obtained data were tabulated and statistically analyzed by computer using SAS system (1996). The differences between various treatment means were tested with Duncun multiple range test at level (5%).[18].

The vegetative and rooting parameters were measured:

The following measurements were recorded on 15thNove 2016.

1-Lateral shoots number/cutting2-Cutting height (cm) 3-Lateral shoots length (cm) 4-Root length (cm)
5-Root number/cutting 6-Percentage of root/cutting (%)

$$\text{Root cutting(\%)} = \frac{The\ number\ \ of\ secondary\ \ roots\ \ over\ the\ main\ \ roots}{10} \text{ x } 100\ (\%)$$

III. Results And Discussion

3.1.Lateral shoots number / cutting.

In table (1) showed that cultivar Shami significantly increased lateral shoot number (2.120) compared with Qaisi cultivar.The lateral shoot number per cutting increased significantly on date (15/3) gave the highest value (2.365).

Table (1): Effect of cultivars, date, IBA and their interactions on lateral shoots number/ cutting of semi-hard wood olive cutting cvs. 'Shami ' and ' Qaisi'.

Cultivar	IBA (ppm)	Date			Cv.* IBA	Cv.
		15/3	¼	15/4		
Shami	0	2.400 cd	1.810 f-h	1.673 g-j	1.961 b	2.120 a
	1000	1.937 e-g	1.807 f-h	1.293 ij	1.679 cd	
	2000	2.353 c-e	2.210 c-f	1.687 g-i	2.083 b	
	3000	2.863 b	3.550 a	1.857 f-h	2.757 a	
Qaisi	0	1.963 d-g	1.757 f-h	1.847 f-h	1.856 bc	1.961 b
	1000	3.390 a	2.553 bc	1.887 e-g	2.610 a	
	2000	1.823 f-h	1.577 g-j	1.220 j	1.540 d	
	3000	2.193 c-f	1.400 h-j	1.917 e-g	1.837 bc	
Date		2.365 a	2.083 b	1.673 c	IBA	
Cv.* Date	Shami	2.388 a	2.344 a	1.628 b		
	Qaisi	2.343 a	1.822 b	1.718 b		
IBA* Date.	0	2.182 bc	1.783 de	1.760 e	1.908 b	
	1000	2.528a	2.180 bc	1.590 ef	2.144 a	
	2000	2.088 cd	1.893 c-e	1.453 f	1.812 b	
	3000	2.663 a	2.475 ab	1.887 c-e	2.297 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple ranges test at 5% level.

When the Shami olive cutting cultivar treated with IBA concentration at 3000 ppm gave the highest value compared with other treatment. Results on Date and IBA show that the cutting when treated on date (15/3) and 3000ppm IBA gave the highest value (2.663) lateral shoot number compared with other interaction. Results show that the Shami cultivar treated on Date (15/3) significantly increased lateral shoot numbers (2.388) per cutting. Whereas the interactions between IBA and Cultivar showed that cvs. Shami treated with 3000ppm IBA gave the highest value of lateral shoot number (2.757) and the lowest value (1.540) recorded in Qaisi cultivar.

3.2. Cutting height (cm)

The obtained results of (Table 2) revealed that cultivars 'Qaisi' gave the highest cutting height (16.553cm) compared with ' Shami' olive cutting cultivar. Dates resulted in a significant increase in cutting height, particularly on Date (1/4) as compared on Date (15/3). Olive cuttings treated with most of IBA concentrations substantially increased cutting height, especially at 3000ppm IBA as compared with other dates. Results indicated that the combination between Date and IBA concentrations displayed on date (1/4) with 3000ppm IBA appeared to be the most potent treatment, as it gave the highest cutting height (17.487cm).

Table (2): Effect of cultivars, date, IBA and their interactions on cutting height (cm) of semi-hard wood olive cutting cvs. 'Shami ' and ' Qaisi '.

Cultivar	IBA(ppm)	Date			Cv.* IBA	Cv.
		15/3	¼	15/4		
Shami	0	14.457 kl	16.663 b-g	15.047 j-l	15.389 d	15.691 b
	1000	15.267 i-l	16.570 c-h	15.557 g-k	15.798 b-d	
	2000	14.210 l	16.877 a-f	15.687 f-j	15.591 cd	
	3000	15.057 j-l	17.190 a-d	15.713 f-j	15.987 b-d	
Qaisi	0	15.433 h-k	16.210 d-j	17.430 a-c	16.358 b	16.553 a
	1000	15.307 i-l	16.600 c-h	16.223 d-j	16.043 bc	
	2000	15.827 e-j	16.343 c-i	16.930 a-e	16.367 b	
	3000	16.663 b-g	17.783 ab	17.887 a	17.444 a	
Date		15.278 c	16.780 a	16.309 b	IBA	
Cv.* Date	Shami	14.748 c	16.825 a	15.501 b		
	Qaisi	15.808 b	16.734 a	17.118 a		
IBA* Date.	0	14.945 e	16.437 bc	16.238 bc	15.873 b	
	1000	15.287 de	16.585 bc	15.890 cd	15.921 b	
	2000	15.018 e	16.610 bc	16.308 bc	15.979 b	
	3000	15.860 cd	17.487 a	16.800 ab	16.716 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple ranges test at 5% level.

Results of Dates and cultivars interactions revealed that treated 'Qaisi on date (15/4) gave the highest cutting height (17.118cm). However, the lowest cutting height was observed on date (15/3) ' Shami ' olive cutting cultivar (14.748 cm).Results of IBA concentrations and cultivars interactions revealed that treated 'Qaisi 'olive cutting cultivar with IBA at a rate of 3000ppm resulted in the highest cutting height (17.444cm). However, ' Shami' olive cutting cultivar gave the lowest values (15.389 cm).Results of Date, IBA and cultivars interactions indicated that treated 'Qaisi 'olive cutting cultivar on date (15/4) with 3000ppm IBA was the most potent treatment which gave (17.887)cm cutting height while the lowest cutting height coincided with treated 'Shami olive cutting cultivar on date (15/3) with 2000ppm IBA (14.210)cm.

3.3. Lateral shoots length (cm)

The obtained results at table (3) Shami gave the highest value of lateral shoot length per cutting (8.340cm) compared with Qaisi cultivar (5.701cm). Results of date revealed that the lateral shoot length per cutting increased significantly on date (15/3) gave the highest value (9.145cm).When the olive cuttings treated with IBA concentration at 3000ppm IBA gave the highest value compared with other concentration. Results on Date and IBA show that the cutting when treated on date (15/3) and 3000ppm IBA gave the highest value (12.625cm) lateral shoot length compared with other interaction. The interactions between Date and cultivars showed that the cvs. Shami treated on date (15/3) gave the highest value compared with other Dates.

Table (3): Effect of cultivars, date, IBA and their interactions on lateral shoot length/cutting (cm) of semi-hard wood olive cutting cvs. 'Shami ' and ' Qaisi '.

Cultivar	IBA	Date			Cv.* IBA	Cv.
		15/3	¼	15/4		
Shami	0	8.443 ef	4.830 k-m	5.067 kl	6.113 d	8.340 a
	1000	7.177 gh	5.427 jk	4.637 k-n	5.747 d	
	2000	10.750 c	8.023 fg	7.963 fg	8.912 b	
	3000	15.400 b	16.253 a	6.110 ij	12.588 a	
Qaisi	0	9.120 de	4.977 kl	3.887 n	5.994 d	5.701 b
	1000	6.373 hi	4.640 k-n	3.997 mn	5.003 e	
	2000	6.047 ij	4.397 l-n	4.617 k-n	5.020 e	
	3000	9.850 d	8.233 f	2.273 o	6.786 c	
Date		9.145 a	7.098 b	4.819 c	IBA	
Cv.* Date	Shami	10.443 a	8.633 b	5.944 d		
	Qaisi	7.848 c	5.562 d	3.693 e		
IBA* Date.	0	8.782 b	4.903 de	4.477 d-f	6.054 c	
	1000	6.775 c	5.033 d	4.317 ef	5.375 d	
	2000	8.398 b	6.210 c	6.290 c	6.966 b	
	3000	12.625 a	12.243 a	4.192 f	9.687 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple ranges test at 5% level.

Also the interactions between IBA and Cultivar showed that the Shami cutting gave the highest value (12.588cm) compared with other treatment.The interactions between Date, IBA and CultivarsShami cultivar treated with 3000ppm IBA on date (1/4) gave the highest value (16.253cm).

3.4. Root length (cm).

In table (4) noted that the cutting when treated on date (15/3) gave the highest value of root length (15.189cm) and the lowest value (5.908) recorded on date (15/4).For the application of IBA show that when the cutting treated by 3000ppm IBA gave the highest value (13.847cm) when compared with other concentration.The root length was significantly influenced by cultivars, Shami cutting had around (13.696cm) that highest than Qaisi cutting cultivar. Results on Date and IBA show that the cutting when treated by 3000ppm IBA gave the highest value (20.622cm) of root length on date (15/3) when compared with other interactions and the lowest value (3.043cm) was recorded in untreated cutting on date (15/4).

Table (4): Effect of cultivars, date, IBA and their interactions on root length of semi-hard wood olive cutt cvs. 'Shami ' and ' Qaisi '.

Cultivar	IBA (pmm)	Date			Cv.* IBA	Cv.
		15/3	1/4	15/4		
Shami	0	11.083 de	7.253 gh	6.087 hi	8.141 d	13.696 a
	1000	13.880 cd	10.737 ef	8.887 e-h	11.168 c	
	2000	20.427 b	11.410 de	14.840 c	15.559 b	
	3000	25.960 a	24.030 a	9.760 e-g	19.917 a	
Qaisi	0	7.243 gh	6.347 hi	0.000 j	4.530 e	6.323 b
	1000	20.297 b	3.620 i	7.693 gh	10.537 c	
	2000	7.340 gh	0.000 j	0.000 j	2.447 f	
	3000	15.283 c	8.047 f-h	0.000 j	7.777 d	
Date		15.189 a	8.930 b	5.908 c	IBA	
Cv.* Date	Shami	17.838 a	13.358 b	9.893 c		
	Qaisi	12.541 b	4.503 d	1.923 e		
IBA* Date.	0	9.163 d	6.800 e-g	3.043 h	6.336 d	
	1000	17.088 b	7.178 d-f	8.290 de	10.852 b	
	2000	13.883 c	5.705 fg	7.420 d-f	9.003 c	
	3000	20.622 a	16.038 b	4.880 gh	13.847 a	

Means within a column, row and their interactions followed with the same letters are not significantly

different from each other's according to Duncan's multiple ranges test at 5% level.

Results show that the Shami cutting cultivar treated on date (15/3) significantly increased the highest root length (17.838cm) per cutting when compared to the other dates.Also the interactions between IBA concentration and cultivar note the 'Shami' cutting gave the highest value (19.917cm) of root length when treated with 3000ppm IBA. However the treated with 2000ppm IBA Qaisi cutting cultivar gave a lowest value of root length (2.447cm).Date, IBA and Cultivar interactions significantly increasing root length per cutting, Shami cutting treated with 3000ppm IBA on date (15/3) produced the highest number of root length per cutting (25.960cm).

3.5. Root number/cutting:

In table (5) shows that olive cuttings treated on date (15/3) gave the highest root number value (8.096) when compared with other dates. While the olive cuttings treated with IBA concentration at level 3000ppm gave the highest value compared with other concentration.Results of cultivars revealed that Shami gave the highest value of root number (8.003) when compared with Qaisi cultivar (4.711). Results indicated that the combination between Date and IBA concentrations displayed on date (1/4) and 3000ppm IBA gave the highest root number (9.350). Results of cultivars and Date concentrations interaction revealed that treated 'Shami' on date (15/3) gave the highest root number (8.600). Whereas the interactions between IBA and Cultivar showed that the Shami cultivar when treated with 3000ppm IBA gave the highest value roots number (9.100) per cutting and the lowest value (1.611) was recorded in Qaisi cultivar when treated with 2000ppm IBA. Date, IBA and Cultivar interactions significantly increasing root number per cutting, Shami cutting treated with 3000ppm IBA on date (1/4) produced the highest number of root number per cutting (9.367).

Table (5): Effect of cultivars, date, IBA and their interactions on root number per cutting of semi-hard wood olive cutting cvs. 'Shami ' and ' Qaisi '.

Cultivar	IBA(ppm	Date			Cv.* IBA	Cv.
		15/3	¼	15/4		
Shami	0	8.500 a-c	6.033 f	7.267 de	7.267 c	8.003 a
	1000	8.033 b-e	8.500 a-c	6.000 f	7.511 c	
	2000	8.600 a-c	8.200 a-d	7.600 c-e	8.133 b	
	3000	9.267 a	9.367 a	8.667 a-c	9.100 a	
Qaisi	0	7.067 ef	4.300 g	0.000 h	3.789 e	4.711 b
	1000	9.300 a	3.867 g	8.667 a-c	7.278 c	
	2000	4.833 g	0.000 h	0.000 h	1.611 f	
	3000	9.167 ab	9.333 a	0.000 h	6.167 d	
Date		8.096 a	6.200 b	4.775 c	IBA	
Cv.* Date	Shami	8.600 a	8.025 b	7.383 c		
	Qaisi	7.592 bc	4.375 d	2.167 e		
IBA* Date.	0	7.783 b	5.167 e	3.633 f	5.528 b	
	1000	8.667 a	6.183 d	7.333 bc	7.394 a	
	2000	6.717 cd	4.100 f	3.800 f	4.872 c	
	3000	9.217 a	9.350 a	4.333 f	7.633 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from
each other's according to Duncan's multiple ranges test at 5% level.

3.6. Percentage of root/cutting (%):

In table (6) shows that olive cutting treated on date (15/3) gave the highest percentage of root per cutting (80.958 %) when compared with other Dates. While the olive cuttings treated with IBA concentration at level 3000ppm gave the highest value compared with other concentration. Results of cultivars revealed that cvs. Shami significantly increased percentage of root per cutting (80.028 %) compared with cvs. Qaisi. Results indicated that the combination between Date and IBA concentrations displayed on date (1/4) and 3000ppm IBA gave the highest percentage of root per cutting (93.500 %). Results of cultivars and Dates interaction revealed that treated 'Shami' on date (15/3) gave the highest percentage of root per cutting (86.000 %).Results of IBA and cultivars interactions revealed that treated cvs. 'Shami' with IBA at level 3000ppm resulted in the highest percentage of root per cutting (91.000 %). Date, IBA and Cultivar interactions significantly increasing percentage of root per cutting, Shami cutting treated with 3000ppm IBA on date (1/4) produced the highest number of percentage of root per cutting

(93.667 %).

Table (6): Effect of cultivars, date, IBA and their interactions on percentage of root per cutting of semi-hard wood olive cutting cvs. 'Shami ' and ' Qaisi '.

Cultivar	IBA (ppm)	Date			Cv.* IBA	Cv.
		15/3	1/4	15/4		
Shami	0	85.000 a-c	60.333 f	72.667 e	72.667 c	80.028 a
	1000	80.333 b-e	85.000 a-c	60.000 f	75.111 c	
	2000	86.000 a-c	82.000 a-d	76.000 c-e	81.333 b	
	3000	92.667 a	93.667 a	86.667 a-c	91.000 a	
Qaisi	0	70.667 ef	43.000 g	0.000 h	37.889 e	47.111 b
	1000	93.000 a	38.667 g	86.667 a-c	72.778 c	
	2000	48.333 g	0.000 h	0.000 h	16.111 f	
	3000	91.667 ab	93.333 a	0.000 h	61.667 d	
Date		80.958 a	62.000 b	47.750 c	IBA	
Cv.* Date	Shami	86.000 a	80.250 b	73.833 c		
	Qaisi	75.917 bc	43.750 d	21.667 e		
IBA* Date.	0	77.833 b	51.667 e	36.333 f	55.278 b	
	1000	86.667 a	61.833 d	73.333 bc	73.944 a	
	2000	67.167 cd	41.000 f	38.000 f	48.722 c	
	3000	92.167 a	93.500 a	43.333 f	76.333 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple ranges test at 5% level.

IV. DISCUSSION

It's clear from most tables that the vegetative growth and rooting characteristics significantly differed between the two cultivars. The differences between the cultivars in vegetation growth characteristics such as (cutting height, lateral shoot length, lateral shoots number) may be ascribed to the differences in genotype characteristics for root growth, nutrient or hormone absorption efficiency and photosynthesis process[19];[20]. In addition, the genetic integrity of the plant species might influence particular hormone or nutrient uptake efficiency [21]. Then, these differences in hormone or nutrient uptake efficiency between cultivars may cause differences in vegetation growth characteristics.Also, the differences in growth vigor between the two cultivars may be attributed to the response of different cultivars to the local environmental conditions according to the genetic variation between the cultivars [22]; [23]. It is clear from studied parameters that the effect of IBA hormone on vegetative growth and rooting characteristics significantly affected and improved all parameters, the results may be due to role of essential nutrient in cuttings such as photosynthesis reactions, nucleic acid metabolisms protein and carbohydrate biosynthesis due to increased leaf mineral content. [23].

V. Conclusions:

It's clear from this study that:

1-Dates improved root growth characteristics for two cultivars of olive cutting cv. Shami and Qaisi,especialy on date (15/3).

2-Cutting treatment of IBA hormone with high concentration significantly increased root growth characteristics for two cultivars of olive cutting cv. Shami and Qaisi.

3-Olive cutting Cv. Shami were preferable compared with Cv.Qaisi.

4-Effect between dates and IBA hormone treatment in high levels and two cultivars increased root growth characteristics.

RECOMINDATIONS:

Depending on the conclusions mentioned above, the following points of view can be recommended:

1-Conducting other studies on other cutting cultivars and treatment at high concentrations of IBA on dates.

2-Using other level of IBA for improving cutting root growth.

3-Conducting anatomical studies for the studied cuttings to know the effect of the used material on tissues structure.

4- Study the effect of date of application to choose the suitable date of treatment of IBA.

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