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Effect of Pro.Sol and Folicist on some vegetative growth Characters of Olive transplants (Olea europaea L.) cvs. Sorany and Picual (a)

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Abstract

This study was carried out during the growing season (2014) in Bakrajo Nursery Station/ Sulaimani, Kurdistan Region-Iraq. Uniform and healthy olive *Olea* europaea L.) cvs. Sorany and Picual transplants of (2) years old were used. Transplants were grown in pots each of (5 kg) weight, to investigate the effect of three Folicist concentrations (0, 60 and 120 $mg.L^{-1}$, three concentrations of Pro-Sol (0,100 and 200$mg.L^{-1}$) and their interactions on vegetative growth of Olive cvs. Sorany and Picual transplants. The results showed that as follow: Foliar sprays of Folicist significantly dominated over Pro.Sol at all vegetative growth characters, except plant height, lateral shoot lengths. Picual cv. significantly dominated over cv. Sorany at all vegetative growth characters, except laterals future fertilization requirements, shoot length and leaf number/shoot. The interactions between Pro-Sol, Folicist and cv. Sorany affected significantly on most of the vegetative growth characteriste. While, Pro.Sol, Folicist and cv. Picual interaction increased stem diameter.

Introduction

Olive (*Olea europaea* L.) belong to the olive family (Oleaceae) this family includes (30) genus including (*Olea*) which has (600) species. Olive is botanically called (*Olea europaea* L.). Commercial olives belong to the (*Europaea*) species, this species has two subspecies: *oleaster* and *sativa*. Product of fruits has a nutritional economic value, and it's the only type that belongs to this family, and gives edible fruits with great importance. *[3,16]*.

In Iraq, olive trees growing in some areas of central and Kurdistan areas of Iraq, Nineveh is the governorate leading olive product spreading in villages of 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 *[18,23]*.

Olive mentioned frequently in the Holy Quran 6 times, indicating as sign of great importance of olive fruit resulting from therapeutic and food benefits *[22]*.

Olive is considered as evergreen fruit and the oldest trees for hundreds of

years. Its fruits are rich with important materials such as oils, carbohydrate, protein, vitamins and mineral elements like phosphorus, calcium, iron and other *[12]*.

The importance of olive fruit is due to heavy loading and dietetic value, as the fruit is a good source of vitamins (A, B, C, D, E, and K) and mineral like (K, Ca, Mg and P) *[13]*. In addition, olive oil is filled with mono-unsaturated fatty acids and has many anti-oxidative properties as phenolic acid *[11,24,25]*.

Folicist (Alfalfa, Seaweed and Molasses liquid extract) was organic manure which used to enhances guaranteeing uniform flowering of fruit tree. Enhances the effect of foliar fertilizers biopromoters and plant growth regulators and promote photosynthesis.

Leaf nutrient analysis is the best method for diagnosing tree nutritional status and represents an important tool for determining future fertilization requirements. Presently, the use of leaf analysis as a guide for olive fertilization is still infrequent in Mediterranean countries ***[4, 8].***

This investigation aimed to:

1-Study the olive transplant (Sorany and Picual) to improve and increase vegetative growth character via (Pro.Sol and Folicist) fertilizer application.

2-Make comparison between the effect of spray (Pro.Sol and Folicist) on the olive transplant.

3-Impact of two olive cultivars which newly introduced to the region on the vegetative and root growth of olive transplant.

Materials and methods

The study was carried out during the season (2014) in the Bakrajo nursery station / Sulaimania. Kurdistan region-Iraq, location on 15km southwestern city, with 35^{0},55^{-}, 09^{-}N,45^{0},35^{-},18^{-}E and 760 meters, above sea level. Uniform and healthy Olive (cvs.Sorany and Picual) transplants of two years old. The experiment was starts on (May 23th,2014 as transplants were grown in pots each of (5kg) weight *[20]*.Three Folicist concentrations (0, 60 and 120 $mg.L^{-1)}$, three Pro-Sol concentrations (0,100 and 200 $mg.L^{-1}$) and their interaction were sprayed at 25^{th} May and repeated the same concentrations in June 25^{th} *[1]*.

Folicist (Alfalfa, Seaweed and Molasses liquid extract) was organic manure manufactured in BIOLCHIM s.p.a, ITALY, compounds content from 1.5% Organic nitrogen, 11% organic carbon of biological origin, 6.1%potassium oxide and 10% Betaines).

Pro.Sol fertilizers manufactured in USA, which contented Organic nitrogen 20%; P2O5 20%; K2O, 20% and other non essential elements.

The research is subjecting to experience the climatic conditions prevailing in Kurdistan, a semi- reliable rainfall, characterized by cold and rainy winters, hot and dry summer.

Experimental design and statistical analysis:

Experiments conducted in this study followed a Complete Randomized Block Design in factorial experiment, the experiment comprised of (18) treatments with three replicates each replicate was presented by five pots each pot contains one transplants (2*3*3*3) *[2]*.

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 ($P \leq 0.05$) *[21]*.

Parameters:

The following measurements were recorded on November 25th

Vegetative characteristics

1-Plant height (cm).

2-Stem diameter (cm) was measured by digital Vernier at (5cm) above soil surface.

3-Lateral shoots length (cm). On each experimental unit; 10 current season shoots were selected randomly and labeled at the beginning of the experiment. The increase in shoot length was measured on November 25th, 2014.

Lengths of shoot/transplant

Average lengths of shoot/transplant = ----------

The number of shoots/transplant

4--Lateral shoots number/plant.

5- Leaf numbers/shoot.

Results

1- Plant height (cm)

Table (1) shows that the untreated transplant with Pro-Sol gave the highest value of plant height (97.69 cm), while the lowest value (93.11 cm) was recorded with 100 mg Pro-Sol.L^{-1} and Folisist not affected on plant height of two cultivars.

Table (1):Effect of Pro.Sol, Folicist and their interactions on plant height (cm) of olive transplant cvs. 'Sorany ' and ' Picual '.

Vr.	Folicist	Pro.Sol			Vr.*Foli	Vr.
		0	100	200		
Sorany	0	96.33 a-c	99.67 ab	91.67 a-c	95.89 ab	94.46 a
	60	103.67 a	90.67 a-c	97.80 a-c	97.38 a	
	120	97.33 a-c	86.00 c	87.00 bc	90.11b	
Picual	0	90.80 a-c	93.47 a-c	92.27 a-c	92.18 ab	94.90 a
	60	97.60 a-c	93.73 a-c	93.73 a-c	95.02 ab	
	120	100.40 ab	95.13 a-c	97.00 a-c	97.51a	

Pro.Sol		97.69 a	93.11 a	93.24 a	**Folicist**
Vr.* Pro.	**Sorany**	99.11 a	92.11a	92.16 a	
	Picual	96.27 a	94.11 a	94.33 a	
Foli* Pro.	0	93.57 ab	96.57 ab	91.97 ab	94.03 a
	60	100.63 a	92.20 ab	95.77 ab	96.20 a
	120	98.87 ab	90.57 b	92.00 ab	93.81 a

Means within a column, row and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple ranges test ($P \leq 0.05$).

Results of cultivars revealed that there was no significant increase in plant height but 'Picual ' gave the highest plant height (94.90 cm) compared with 'Sorany' olive cultivar.

Results indicated that the combination between Pro.Sol and Folicist concentrations displayed that Pro.Sol 0 mg.L^{-1} and Folicist 60 mg.L^{-1} appeared to be the most potent treatment, gave the highest plant height (100.63 cm).

Results of Pro.Sol and cultivars interactions revealed that the untreated 'Sorany' transplants with Pro.Sol gave the highest value of plant height (99.11cm). However, the lowest plant height was observed with Pro.Sol100 mg.L^{-1}.

The interactions between Folicist and cultivar had significantly increases plant height of the 'Picual ' transplants when treated with Folicist 120 mg.L^{-1} which gave the highest value (97.51 cm) and the lowest value (90.11 cm) was noticed in 'Sorany' transplants when treated with 120 mg Folicist.L^{-1}.

Results of Pro.Sol, Folicist and cultivars interactions indicated that spraying 'Sorany' olive cultivar, Pro.Sol. plus Folicist. was the most potent treatment which gave (103.67cm) plant highest.

2- Stem diameter (mm)

Table (2) shows that the stem diameter increased significantly with increasing Pro-Sol level application, when transplants treated with Pro.Sol 200 mg.L^{-1} gave the highest value (9.79 mm).

Folicist concentration not affected on stem diameter while untreated transplants gave the highest value of stem diameter compared with other treatments.

Table (2):Effect of Pro.Sol, Folicist and their interactions on stem diameter (mm) of olive transplant cvs. 'Sorany ' and ' Picual '.

Vr.	Folicist	Pro.Sol			Vr.*Foli	Vr.
		0	100	200		
Sorany	0	9.32 a-d	9.34 a-d	9.21 a-d	9.29 b	8.98 b
	60	8.69 b-d	9.39 a-d	10.18 ab	9.42 b	
	120	8.12 cd	7.77 d	8.82 b-d	8.23 c	
Picual	0	10.99 a	10.39 ab	11.00 a	10.79 a	10.38 a
	60	10.66 ab	10.06 a-c	9.56 a-d	10.09 ab	

	120	10.35ab	10.38 ab	9.98 a-c	10.24ab
Pro.Sol		9.69 a	9.56 a	9.79 a	**Folicist**
Vr.* Pro.	**Sorany**	8.72 c	8.83 c	9.40 bc	
	Picual	10.68 a	10.27 ab	10.18 ab	
Foli* Pro.	**0**	10.16 a	9.87 a	10.11 a	10.04 a
	60	9.68 a	9.72 a	9.87 a	9.75 ab
	120	9.23 a	9.07 a	9.40 a	9.23 b

Means within a column, row and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple ranges test at ($P \leq 0.05$).

Results of cultivars revealed that 'Picual ' significantly increased stem diameter (10.38 mm) compared with cv.'Sorany'.

Results indicated that the combination between Pro.Sol and Folicist concentration caused no significant effect on stem diameter.

The interactions between Pro.Sol and cultivar showed that cv.'Picual ' transplants with Pro.Sol 0 $mg.L^{-1}$ gave the highest value when compared with other interactions. Regarding the interactions between Folicist and cultivar it was observed that the cv.'Picual ' transplants when untreated with 0 mg $Folicist.L^{-1}$ gave the highest value (10.79 mm) when compared with other interactions.

The results for the interactions between Pro.Sol, Folicist and cultivar significantly influenced stem diameter, the highest stem diameter (11.00 mm) was observed in 'Picual ' transplant that treated with Pro.Sol 200 $mg.L^{-1}$ plus Folicist 0 $mg.L^{-1}$.

3- Lateral shoots length/plant (cm)

Table (3) shows that the treated transplant with Pro.Sol 100 $mg.L^{-1}$ gave the highest value of lateral shoot length (26.12 cm), while the lowest value (25.87 cm) was recorded with Pro.Sol 200 $mg.L^{-1}$ Folicist had no affected on lateral shoot length of both cultivars.Cultivar 'Sorany' significantly increased lateral shoot length (27.58 cm) compared with 'Picual '.

The interaction between Pro.Sol and Folicist cleared that the highest lateral shoot length per transplant (26.84 cm) when treated with Pro.Sol 100 $mg.L^{-1}$ plus Folicist 0 $mg.L^{-1}$.

Results of Pro.Sol and cultivars interactions revealed that the untreated 'Sorany' transplants with Pro.Sol gave the highest value of lateral shoot length per transplant (28.10 cm) compared with other interaction.

Table (3):Effect of Pro.Sol, Folicist and their interactions on lateral shoot length/plant (cm) of olive transplant cvs. 'Sorany ' and ' Picual '.

Vr.	Folicist	Pro.Sol			Vr.*Foli	Vr.
		0	100	200		
Sorany	0	28.30 a	28.22 a	26.56 a-c	27.69 a	27.58 a
	60	27.55 ab	26.96 a-c	27.50 ab	27.33 a	
	120	28.44 a	26.88 a-c	27.79 ab	27.71 a	
Picual	0	23.92 c	25.46 a-c	24.04 c	24.47 b	24.42 b
	60	23.94 c	24.59 bc	24.56 bc	24.36 b	
	120	23.92 c	24.62bc	24.74 bc	24.43 b	
Pro.Sol		26.01 a	26.12 a	25.87 a	Folicist	
Vr.* Pro.	Sorany	28.10 a	27.35 a	27.29 a		
	Picual	23.92 a	24.89 a	24.45 a		
Foli* Pro.	0	26.11 a	26.84 a	25.30 a	26.08 a	
	60	25.74 a	25.77 a	26.03 a	25.85 a	
	120	26.18 a	25.75 a	26.27 a	26.07 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple ranges test ($P \leq 0.05$).

The interaction between Folicist and cultivar significantly increase in lateral shoot length of the 'Sorany' transplants when treated with Folicist 120 mg.L^{-1} which gave the highest value (27.71cm) and the lowest value (24.36 cm) was noticed in 'Picual ' transplants when treated with Folicist 60 mg.L^{-1}.

The results of interactions between Pro.Sol, Folicist and cultivar significantly influenced lateral shoot length, the highest lateral shoot length (28.44 cm) observed in 'Sorany' transplant that treated with Pro.Sol 0 mg.L^{-1} and Folicist 120 mg.L^{-1}.

4-Lateral shoot number/plant

The obtained results shown in table (4) reveal that spraying olive transplants with Pro.Sol concentrations resulted in a significant increase in lateral shoot number, particularly at 200 mg.L^{-1} level as compared to the control.

Olive transplants treated with Folicist concentrations substantially increased lateral shoot number, especially at 60 mg.L^{-1} as compared to control.

Results of cultivars revealed that 'Picual ' gave the highest value of lateral shoot number per plant (74.47) compared with 'Sorany' cultivar (62.56).

The interactions between Pro.Sol and Folicist denote that the highest lateral shoot number per transplant (76.33) when treated with Pro-Sol 200 mg.L^{-1} plus Folicist 60 mg.L^{-1}.

Results show that the 'Picual ' cultivar treated with 200 mgPro.Sol.L^{-1} significantly increased lateral shoot numbers (76.51). Whereas the interactions between Folicist and cultivar showed that cv.'Picual ' treated with

Folicist 120mg.L^{-1} gave the highest value of lateral shoot number (78.53) and the lowest value (53.00) recorded in 'Sorany' cultivar.

Pro.Sol, Folicist and cultivar interactions significantly increased lateral shoot number per transplant, 'Sorany' transplant treated with Pro.Sol 200 mg.L^{-1} and Folicist 60mg.L^{-1} produced the highest number of lateral shoot per plant (82.33).

Table (4): Effect of Pro.Sol, Folicist and their interactions on lateral shoot number/ plant of olive transplant cvs. 'Sorany ' and ' Picual '.

Vr.	Folicist	Pro.Sol			Vr*Foli.	Vr.
		0	100	200		
Sorany	0	50.73 bc	71.33 a-c	60.20 a-c	60.76 bc	62.56 b
	60	73.93 a-c	65.53 a-c	82.33 a	73.93 ab	
	120	54.27 a-c	45.67 c	59.07 a-c	53.00 c	
Picual	0	68.20 a-c	70.27 a-c	76.40 ab	71.62 ab	74.47 a
	60	77.27 ab	71.13 a-c	71.33 a-c	73.24 ab	
	120	79.13 ab	74.67 a-c	81.80 a	78.53 a	
Pro.Sol		67.26 a	66.43 a	71.86 a		
Vr.* Pro.	Sorany	59.64 b	60.84 ab	67.20 ab	Folicist	
	Picual	74.87 ab	72.02 ab	76.51 a		
Foli.* Pro.	0	59.47 a	70.80 a	68.30 a	66.19 a	
	60	75.60 a	68.33 a	76.33 a	73.59 a	
	120	66.70 a	60.17 a	70.43 a	65.77 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple ranges test at ($P \leq 0.05$).

5- Leaf number/shoot

Data of table (5), showed that foliar application of Pro-Sol increased leaf number per shoot, the highest leaf number value (171.80) produced by transplants treated with Pro.Sol 200 mg.L^{-1}.

Olive transplants treated with Folicist concentrations substantially increased leaf number, especially at 60 mg.L^{-1} as compared to control.

Results of cultivars revealed that 'Sorany' gave the highest leaf number (203.78) compared with 'Picual ' olive cultivar (129.73).

The interactions between Pro.ol and Folicist denote that the highest leaf number per shoot (185.73) was observed in transplants received Pro.Sol 200 mg.L^{-1} and Folicist 0 mg.L^{-1} and the lowest leaf number (144.20) when treated with Pro.Sol 100 mg.L^{-1} and Folicist 120 mg.L^{-1}.

Results of cultivars and Pro.Sol concentrations interactions revealed that spraying 'Sorany' at a rate of Pro.Sol 200 mg.L^{-1} gave the highest leaf number (220.24) compared with other interactions between Pro-Sol and cultivar.

The interactions between Folicist and cultivar had significantly increased in leaf number in 'Sorany' transplants when treated with Folicist 60 mg.L^{-1} giving the highest value (215.53) and the lowest value (125.09) was recorded with Folicist 120 mg.L^{-1} of cv.'Picual '.

Results of Pro.Sol, Folicist and cultivars interactions indicated that spraying 'Sorany' olive cultivar with Pro.Sol 100 mg.L^{-1} and Folicist 60 mg.L^{-1} giving the highest number of leaf (242.73), while the lowest number of leaf (115.53)in 'Picual ' transplant when treated with Pro.Sol 100 mg.L^{-1} and Folicist 120 mg.L^{-1} .

Table (5):Effect of Pro.Sol, Folicist and their interactions on leaf number / shoot of olive transplant cvs. 'Sorany ' and ' Picual '.

Vr.	Folicist	Pro.Sol			Vr* Foli.	Vr.
		0	100	200		
Sorany	0	173.67 a-c	201.93 ab	238.07 a	204.56 a	203.78 a
	60	181.47 a-c	242.73 a	222.40 a	215.53 a	
	120	200.60 ab	172.87 a-c	200.27 ab	191.24 a	
Picual	0	133.73 bc	140.47 bc	133.40 bc	135.87 b	129.73 b
	60	146.60 bc	122.40 c	115.67 c	128.22 b	
	120	138.73 bc	115.53 c	121.00 c	125.09 b	
Pro.Sol		162.47 a	165.99 a	171.80 a	Folicist	
Vr.* Pro.	Sorany	185.24 a	205.84 a	220.24 a		
	Picual	139.69 b	126.13 b	123.36 b		
Foli.* Pro.	0	153.70 a	171.20 a	185.73 a	170.21 a	
	60	164.03 a	182.57 a	169.03 a	171.88 a	
	120	169.67 a	144.20 a	160.63 a	158.17 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple ranges test ($P \leq 0.05$).

Discussion:

The deferens between the two cultivars, may be due to the differences in genotype characteristics for root growth, nutrient absorption efficiency and photosynthesis process ***[6, 16].*** In addition, the genetic characters of the plant species might influence particular nutrient uptake efficiency ***[19].*** Then, these differences in 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 ***[9, 17].***

It is clear from studied parameters that the effect of Pro-Sol and Folicist which contend (N, P, K and other non essential element) on vegetative growth characteristics significantly affected and improved all studied parameters, the results may be due to role of essential nutrient in plants such as photosynthesis reactions,

nucleic acid metabolism, protein and carbohydrate biosynthesis may resulted from increased leaf mineral content ***[10].***

For example the element Potassium takes part in many important processes, regulating the opening and closing of stomata, the transport of organic and inorganic ions within the plant. ***[4,13].***

The significant effect of application of essential nutrient like Nitrogen, Phosphor and Potassium might be accredited to the role in plant cell function, the synthesis of protein and enzymes which are important compounds in the synthesis of chlorophyll and cytochrome and their role in the processes of photosynthesis and respiration that lead to increase cell division and elongation**[5, 14]**.

Conclusions:

1-Foliar spraying of Pro.Sol and Folicist with high concentration fertilization improved most vegetative growth characteristics for both cvs. Sorany and Picual olive transplant.

2- Olive transplant cv. Picual was preferable compared with cv. Sorany.

3-Interaction between Pro.Sol fertilization and Folicist sprayed with high levels and both cultivars increased most vegetative growth characteristics.

Recommendations:

1-Conducting more studies on other cultivars and spraying at low and high concentrations of Pro.Sol and Folicist.

2-Using other level of Pro.Sol and Folicist for improving transplant vegetative growth characters.

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

2-Using other organic or non organic fertilizers with present cultivar

transplants and other cultivars .

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