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EFFECT OF SPRAYING CHITOSAN ON PRODUCTIVITY OF PICUAL OLIVE TREES.

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Key Words: Picual olive trees, Chitosan, growth characters and quality characteristics as well as productivity.

ABSTRACT

Two field trials were carried out during 2018 and 2019 seasons on Picual olive trees with 10-years old and planted at 6x6 meters apart propagated by leafy cutting and growing in private farm in Sahel Selim district-Assiut Governorate. Two and three sprays of chitosan at 250, 500 and 1000 ppm were added to Picual olive trees. To stud the effects of chitosan on growth, yield as well as physical and chemical properties of the fruits and fruit oil characteristics.

The results indicated that two and three sprays of chitosan at 250 to 1000 ppm was responsible for improving Shoot length, number of leaves/shoot as well as total surface area per in the selected tree, nutrients namely N, P and K in the leaves, leaves or branches as well as decreasing total acidity %, flowering % and fruit setting aspects namely length of inflorescence (cm.), number of flowers/ inflorescence, perfect flowers %, as compared with the check treatment.

The promotion was associated with increasing concentrations from 250 to 1000 ppm spraying of chitosan at two times at the beginning of vegetative growth, immediately after berry set and after one month considerably enhanced all growth characters, percentages of N, P, K, Mg and Ca, yield as well as fruit quality and fruit oil characteristics in relative to the check treatment.

Under the experimental conditions and resembling regions it is recommended spraying chitosan at 500 ppm tow times at the beginning of vegetative growth, immediately after berry setting to improve growth and yield, physical& chemical characteristics as well as oil& fruit quality.

INTRODUCTION

The olive fruits are composed of according olive variety about 67% by weight of water, 23% fat (olive oil), 5% protein, 1% nutrients, the most important of which are Ca as well as Fe, Vitamins (A)&(D) which are characterized by the majority of fatty substances, and because it is a

natural fruit, it also contains vitamins (B) &(C) **Alvarez and Datnoff (2001)**

Chitosan compounds play an important role in developmental processes and some of them have key roles in mechanism leading to acclimation for changing environments Chitosan has long been known as a signal molecule in the induction of defense mechanisms in plants **(Raskin, 1992 and Shah, 2003).**

There are many compounds that increase the plant's ability to withstand harsh conditions such as pathological injuries, climatic changes, increased vegetable and fruit growth and the quality of fruits by adding some natural substances that do not have any harmful effect on the health of people, such as chitosan **(Blevius and Lukaszweski, 1998).**

Recent studies suggest that it also participates in signaling during abiotic stresses**.** Previous results suggest that Chitosan could be a promising compound for the reduction of abiotic stress sensitivity in plants, since under certain conditions it has been found to mitigate the damaging effects of various stress factors in plants such as heavy metals, high temperature, chilling or salinity **(Szepesi *et al*., 2009)** by inducing a wide range of processes involved in stress tolerance mechanisms.

Chitosan influence a number of physiological processes including flowering, ion uptake and transport, photosynthesis rate and stomatal conductance **(Raskin, 1992).**

Previous studies showed that application of chitosan as an important antioxidant was essential in improving growth and fruiting in different evergreen fruit crops **(Ahmed *et al*., 2003; Gobara, 2004; Ahmed *et al*., 2007 and Badran and Ahmed, 2009).**

The increase in the yield and the quality of the fruits is considered one of the most important qualities needed to increase the economic income of the Egyptian farmers **(Ebeid, 2007; and Ibrahiem and Al-Wasfy, 2014)**. The increase in plant tolerance to harsh environmental conditions helps to increase the economic yield of the olive crop must be studied and utilized **(Martin and Sibbett, 2005; Abdelaal and Oraby 2013 and El- Khawaga and Mansour, 2014).**

The amine and ¯OH groups endow chitosan with many special properties, making it applicable in many areas and easily available for chemical reactions. Chitosan is safe, non-toxic and can interact with poly anions to form complexes and gels **Perica *et al*., (2001).**

It is concluded that no risks of acute mineral deficiency occur during the biennial cycle. Consideration of alternate bearing cycles is

necessary for optimization of chitosan and N, P, and K application in olive in order to achieve more efficient production, improved produce quality, and minimized environmental consequences **(Zhang and Gladyshev 2009).**

This study was conducted to examine the beneficial effects of using chitosan at various concentrations on growth characters, yield as well as some physical, chemical and fruit oil characteristics of Picual olive trees.

MATERIALS AND METHODS

This investigation was conducted two field experiments designed in complete randomized blocks with 3 replicates during 2018 and 2019 seasons on Picual olive trees with 10-years old and planted at 6x6 meters apart propagated by leafy cutting and growing in private farm in Sahel Selim district - Assiut Gov. of, where the soil is clay.

The soil is well drained and the water table is not less than two meters deep. Soil analysis was done according to **Black (1965) and Chapman and Part (1975)** Table (1)**.**

Two and three sprays of chitosan were carried out at 250, 500 and 1000 ppm three times annually, at the beginning of vegetative growth, immediately after berry setting and after one month later.

All horticultural practices except application of chitosan were done as usual.

Table (1): Analysis of the soil at the trial location.

Constituents	Values
Sand %	**4.5**
Silt %	**15.5**
Clay %	**80.0**
Texture	**Clay**
pH (1:2.5 extract)	**7.91**
E.C (1: 2.5 extract) (mmhos/ 1 cm 25° C)	**1.00**
$CaCO_3$ %	**1.79**
Total N %	**0.07**
Available P (Olsen method, ppm)	**5.1**
Available K (ammonium acetate, ppm)	**400**

The following seven treatments were carried out during the experimental seasons:

1- Control (untreated trees).

2- Spraying chitosan two times at concentration of 250 ppm at the beginning of vegetative growth and immediately after berry setting.
3- Spraying chitosan three times at concentration of 250 ppm at the beginning of vegetative growth, immediately after berry setting and after one month of berry setting.
4- Spraying chitosan two times at concentration of 500 ppm at the beginning of vegetative growth and immediately after berry setting.
5- Spraying chitosan three times at concentration of 500 ppm at the beginning of vegetative growth, immediately after berry setting and after one month of later.
6- Spraying chitosan two times at concentration of 1000 ppm at the beginning of vegetative growth and immediately berry setting.
7- Spraying chitosan three times at concentration of 1000 ppm at the beginning of vegetative growth, immediately after berry setting and after month later.

Each treatment was three of replicated, one tree per each. Chitosan (soluble in Ethyl alcohol) was applied two times (growth start and immediately after the berry setting), three times (the two previous dates and at one month later). Triton B as a wetting agent at 0.05% was added to all chitosan solutions.

Generally, the following measurements were recorded during the two seasons of the study.

1. Leaf area (Leaf area $(cm)^2 = 0.53$ (length x width) + 1.66.) as well as Shoot length (cm.), number of leaves/shoot, length of inflorescence, number of flower inflorescence and vegetative growth length **Ahmed and Morsy (1999).**
2. Chlorophyll a& b and total chlorophylls and total carotenoids (as mg/ 100 g F.W.) **(Von- Wettstein, 1957)**. The determined pigments were expressed as mg- $100g^{-1}$ fresh weight of leaf and calculated according to using the following equations:

Chlorophyll (A) = (9.784 x E.662) - (0.99 xE.644) (mg.g-1 f.w)
Chlorophyll (B) = (21.426 x E.644) (4.65 xE.662) (mg.g-1 f.w)
Carotenoids = (4.495 x E.440) - 0.268 (Chl a + Chl b) (mg.g-1 f.w)
Where: E = Optical density at given wave length (γ).

Total chlorophylls were calculated by summation of chlorophylls a and b and total carotenoids (mg/ 100 g F.W.)

3. Flowering and fruit setting aspects namely length of inflorescence (cm.), number of flowers/ inflorescence,

4. Percentages of N, P, K and Mg in the leaves **(Summer, 1985 and Wilde *et al*., 1985).** A suitable sample (0.5 g) was taken from each dried leaf and wet digested using a mixture of perchloric acid: sulphuric acid (1:4 v/v) **(Piper, 1950)**
5. Yield (kg/ tree); Fruit oil % and oil yield (kg.) / tree. Oil content (%) was determined by extraction the oil from the dried flesh samples using the Soxhlet fat extraction apparatus and using petroleum ether (60-80°C) boiling point as a solvent for about 16 continuous hours and the percentage of oil on dry weight was calculated **(A.O.A.C, 2000).**
6. Total acidity % as well as Av. Fruit weight (g.) and Av. Fruit volume (cm3) **(A.O.A.C., 2000).**

The experiment was set up in complete randomized block design with three replicates each was represented with one Picual olive trees.

All the obtained data were tabulated and statistically analyzed according to **Gomez and Gomez (1984**) **and Mead *et al*., (1993)** using new L.S.D. at 5% for identifying the significant differences between all the tested treatments.

RESULTS AND DISCUSSION

1- Effect spraying chitosan on some vegetative growth and inflorescences characteristics in the leaves:

Data in Table (2) clearly show that foliar application of chitosan (two or three times) at 250 & 500 as well as 1000 ppm significantly annually promoting the six growth characters namely vegetative growth (cm.), leaf area (cm^2), shoot length (cm.), number of leaves/ shoot, length of inflorescence (cm.) as well as number of flowers/ influences rather than the control. The promotion was associated with increasing concentrations of sprays chitosan at 500 ppm three times at the beginning of vegetative growth, immediately after the berry setting and after month of berry setting. Increasing concentration of spraying chitosan at 500 ppm two times and 1000 ppm two and three times had no significant promotion on these parameters. The maximum values were recorded on the trees at Picual olives trees received three sprays of chitosan at 500 ppm. Untreated plants produced the minimum values. Similar trend was noticed during the two experimental seasons.

These results might be attributed to the positive action of spraying chitosan on enhancing all division, the biosynthesis of organic foods and uptake of nutrients **(Raskin, 1992).**

Table (2): Effect spraying chitosan on some vegetative growth and inflorescences characteristics of Picual olive variety during 2018 & 2019 seasons.

Character	Leaf area (cm^2)		Shoot length (cm.)	
Chitosan treatments	2018	2019	2018	2019
1- Control	4.13	4.21	19.03	21.09
2- Chitosan at 250 ppm two times	4.30	4.35	20.05	22.13
3- Chitosan at 250 ppm three times	4.35	4.39	21.07	22.18
4- Chitosan at 500 ppm two times	4.39	4.42	22.04	22.22
5- Chitosan at 500 ppm three times	4.48	4.52	23.20	23.27
6- Chitosan at 1000 ppm two times	4.50	4.53	23.22	23.29
7- Chitosan at 1000 ppm three times	4.52	4.55	23.24	23.31
New L.S.D at 5 %	0.24	0.27	1.72	1.91
Character	Number of leaves/shoot		vegetative growth length (cm.)	
1- Control	19.20	20.02	20.94	21.09
2- Chitosan at 250 ppm two times	20.46	21.23	21.98	22.13
3- Chitosan at 250 ppm three times	21.77	22.34	21.93	22.08
4- Chitosan at 500 ppm two times	22.08	23.44	22.68	22.79
5- Chitosan at 500 ppm three times	24.00	25.65	23.05	23.20
6- Chitosan at 1000 ppm two times	24.16	25.70	23.31	23.56
7- Chitosan at 1000 ppm three times	24.75	26.12	23.36	23.66
New L.S.D at 5 %	1.02	1.04	1.18	1.26
Character	length of inflorescence (cm.)		number of flowers/ inflorescence	
1- Control	1.91	1.92	18.0	20.0
2- Chitosan at 250 ppm two times	2.01	2.02	20.0	22.5
3- Chitosan at 250 ppm three times	2.12	2.13	22.3	25.0
4- Chitosan at 500 ppm two times	2.23	2.25	25.0	27.0
5- Chitosan at 500 ppm three times	2.34	2.37	28.0	30.0
6- Chitosan at 1000 ppm two times	2.45	2.46	29.0	31.0
7- Chitosan at 1000 ppm three times	2.57	2.57	31.0	33.0
New L.S.D at 5 %	0.17	0.17	3.4	3.5

The maximum values was clear at application of spraying chitosan as 500 ppm three times at character namely vegetative growth (cm.) obtained at leaf area (cm^2), shoot length (cm.), number of leaves/ shoot, length of inflorescence (cm.) of height as well as number of flowers/ influences length of inflorescence, initial fruit setting % were observed on Picual olive cv. Similar results were announced during both seasons.

Spraying chitosan has increased a rich in both organic and nutrients substances essential for plant growth and stimulates the roots **Barranco *et al*., (2002).**

The essential role of application of spraying chitosan on stimulating growth and nutritional status in favour of producing greater fruit retention surely reflected in improving the yield.

Present results are found on agreement with those obtained by **Ahmed *et al*., (2003); Gobara (2004); Ahmed *et al*., (2007) and Badran and Ahmed (2009).**

Table (3): Effect spraying chitosan on chlorophyll, carotenoids (g/ 100g F. W.) and leaf mineral content of Picual olive variety during 2018 & 2019 seasons.

Character	Chlorophyll a (g/ 100 g F.W.)		Chlorophyll b (g/ 100 g F.W.)	
Chitosan treatments	2018	2019	2018	2019
1- Control	4.56	4.62	2.59	2.61
2- Chitosan at 250 ppm two times	4.75	4.80	2.72	2.77
3- Chitosan at 250 ppm three times	4.66	4.73	2.71	2.80
4- Chitosan at 500 ppm two times	4.77	4.84	2.81	2.91
5- Chitosan at 500 ppm three times	4.85	4.92	2.93	3.12
6- Chitosan at 1000 ppm two times	4.91	4.96	2.99	3.16
7- Chitosan at 1000 ppm three times	4.90	4.97	3.04	3.23
New L.S.D at 5 %	0.29	0.35	0.38	0.41
Character	Total chlorophylls (g/ 100 g F.W.)		Total carotenoids (g/ 100 g F.W.)	
1- Control	7.15	7.23	2.15	2.22
2- Chitosan at 250 ppm two times	7.47	7.57	2.28	2.36
3- Chitosan at 250 ppm three times	7.37	7.53	2.32	2.41
4- Chitosan at 500 ppm two times	7.58	7.75	2.43	2.57
5- Chitosan at 500 ppm three times	7.78	8.04	2.51	2.70
6- Chitosan at 1000 ppm two times	7.90	8.12	2.57	2.76
7- Chitosan at 1000 ppm three times	7.94	8.20	2.63	2.89
New L.S.D at 5 %	0.54	0.65	0.18	0.32
Character	N %		P %	
1- Control	1.32	1.49	0.08	0.11
2- Chitosan at 250 ppm two times	1.46	1.64	0.11	0.15
3- Chitosan at 250 ppm three times	1.45	1.60	0.14	0.18
4- Chitosan at 500 ppm two times	1.57	1.72	0.19	0.22
5- Chitosan at 500 ppm three times	1.69	1.87	0.22	0.24
6- Chitosan at 1000 ppm two times	1.71	1.91	0.23	0.25
7- Chitosan at 1000 ppm three times	1.73	1.93	0.25	0.26
New L.S.D at 5 %	0.29	0.18	0.11	0.17

2- Effect spraying chitosan on yield of fruits (kg/ tree):

Yield (kg.)/ tree of to Picual olive trees was significantly maximized in spraying chitosan at 500 ppm three times at the beginning of vegetative growth, immediately after the berry setting and after month of berry setting, (Table 4) relative to the check treatment. Promotion on the yield was observed due to using spraying of chitosan at 500 ppm three times, in descending order. Yield was significantly maximized in the treatment that including the application spraying of chitosan at 500 ppm three times.

Tow sprays with chitosan at 500 ppm at the beginning of vegetative growth, immediately after the berry setting and one month later give the economical point of view gave the best results with regard to yield of Picual olive trees.

3- Effect spraying chitosan on some physical characteristics of the fruits:

Data in Tables (3 & 4) clearly show that application of spraying chitosan three times times at 500 ppm at the beginning of vegetative growth, immediately after berry setting and after month of berry setting significantly improved fruit quality in terms of increasing on chlorophyll (a & b) as well as total chlorophylls and total carotenoids (g/ 100 g F.W.)& decreasing total acidity % comparing with the check treatment. The promotion was associated with increasing concentration of application spraying of chitosan at 500 ppm three times. Therefore, the best results with regard to quality of the fruits from economical point of view were obtained with using three sprays of chitosan at 500 ppm. Unfavourable effects on quality of the fruits were observed on untreated plants. Similar trend was revealed during both seasons.

The promoting effect of chitosan on improving the biosynthesis and translocation of plant pigments and sugars **(Raskin, 1992)** could result in enhancing fruit quality.

4- Effect spraying chitosan at some chemical characteristics on the fruits:

It is revealed from the data in Tables (4 & 5) that percentages of N, P, K and Mg in the leaves significantly were maximized in Picual olive cv. in descending order.

Treating Picual olive cv. with application of chitosan two times at concentrate 500 ppm three times at the beginning of vegetative growth, immediately after the berry setting and after month of berry setting had significant promotion on the leaf pigments and nutrients relative to the check treatment. Using this treatment gave the maximum values. These results were true during all seasons.

As application chitosan through spraying increases the efficiency of N, P, K and Mg absorption, which is reflected in the efficiency in the roots absorption of mineral elements and water and thus works to modify the diet of cells that may be disrupted as a result of salinity and drought **Keshavarz *et al*., (2011).**

In this regard, we mention that spraying with chitosan induces the plant to show physical resistance by creating skin cells coated with silicates and then pushing the metabolism process to form phenolic substances and chitinase enzymes that dissolve the fungus fragments, and this mechanism is called a biochemical barrier. Silicon plays an important role in increasing the plant's ability to withstand stress Salt and drought.

Table (4): Effect spraying chitosan on percentages of potassium & magnesium; percentage of total acidity as well as fruit weight (g); fruit volume (cm^3) and yield (kg/tree) of Picual olive variety during 2018 & 2019 seasons.

Character	K %		Mg %	
Chitosan treatments	2018	2019	2018	2019
1- Control	0.47	0.52	0.09	0.12
2- Chitosan at 250 ppm two times	0.54	0.68	0.11	0.20
3- Chitosan at 250 ppm three times	0.61	0.84	0.13	0.22
4- Chitosan at 500 ppm two times	0.83	0.98	0.16	0.29
5- Chitosan at 500 ppm three times	0.97	1.09	0.21	0.37
6- Chitosan at 1000 ppm two times	1.07	1.17	0.24	0.39
7- Chitosan at 1000 ppm three times	1.21	1.34	0.29	0.41
New L.S.D at 5 %	0.22	0.31	0.13	0.21
Character	Yield (kg/ tree)		Fruit weight (g.)	
1- Control	48.7	49.2	4.04	4.10
2- Chitosan at 250 ppm two times	49.3	49.8	4.17	4.24
3- Chitosan at 250 ppm three times	50.6	51.2	4.24	4.32
4- Chitosan at 500 ppm two times	51.3	52.6	4.31	4.37
5- Chitosan at 500 ppm three times	52.4	53.4	4.38	4.41
6- Chitosan at 1000 ppm two times	53.9	54.9	4.42	4.48
7- Chitosan at 1000 ppm three times	54.7	55.8	4.47	4.54
New L.S.D at 5 %	1.12	1.24	0.19	0.27
Character	Fruit volume (cm^3)		Total acidity %	
1- Control	5.60	5.90	0.320	0.337
2- Chitosan at 250 ppm two times	5.66	5.96	0.300	0.298
3- Chitosan at 250 ppm three times	5.71	6.02	0.270	0.260
4- Chitosan at 500 ppm two times	5.76	6.08	0.265	0.255
5- Chitosan at 500 ppm three times	5.82	6.18	0.263	0.252
6- Chitosan at 1000 ppm two times	5.85	6.20	0.261	0.250
7- Chitosan at 1000 ppm three times	5.90	6.23	0.259	0.248
New L.S.D at 5 %	0.07	0.05	0.018	0.021

5- Effect spraying chitosan on oil and fruit characteristics:

It is clear from the data in Table (5) that Picual olive cv., spraying with chitosan at 500 ppm three times at the beginning of vegetative growth, immediately after the berry setting and after month of berry setting give the highest values of fruit oil, oil yield/ fed. (kg.) significantly were followed by increasing of fruit weight and volume and initial fruit setting % Pulp % but total acidity was had minimum values from this treatment reducing saturated over the control treatment.

The best results with regard to oil and fruit characteristics quality of the fruits were obtained spraying chitosan at 500 ppm two times at the beginning of vegetative growth, immediately after the berry setting and after month of berry setting. These results were true during both seasons.

The beneficial of spraying of chitosan on stimulating the biosynthesis of natural hormones, nutrient uptake, photosynthesis,

biosynthesis of plant pigments and sugars as well as protecting the plants from various stresses could explain the present results. Chitosan were responsible for increasing antioxidant defense systems through reducing reactive oxygen species. Their important role in enhancing cell division process did not neglect in this respect **(Klesiig *et al*., 2000 and Rao *et al*., 2000).** These results are in concordance with those obtained by **Eshmawy (2010); Roshdy *et al*., (2011); Sayed *et al*., (2011); Hegab and Hegab (2011) and Al- Wasfy (2013).**

Table (5): Effect spraying chitosan on percentages of oil& oil yield (kg.); initial fruit setting and percentage of pulp of Picual olive variety during 2018 & 2019 seasons.

Character	Fruit oil %		Oil yield (kg.)	
Chitosan treatments	2018	2019	2018	2019
1- Control	13.54	13.58	7.6	9.2
2- Chitosan at 250 ppm two times	14.12	14.17	8.8	11.6
3- Chitosan at 250 ppm three times	14.23	14.28	9.9	12.9
4- Chitosan at 500 ppm two times	14.33	14.37	10.8	13.1
5- Chitosan at 500 ppm three times	14.46	14.52	12.9	15.3
6- Chitosan at 1000 ppm two times	14.48	14.56	13.5	16.4
7- Chitosan at 1000 ppm three times	14.49	14.61	14.2	17.3
New L.S.D at 5 %	0.81	0.92	0.82	1.04
Character	Initial fruit setting %		Pulp %	
1- Control	19.7	19.9	81.90	85.53
2- Chitosan at 250 ppm two times	21.0	20.8	83.81	85.74
3- Chitosan at 250 ppm three times	22.3	22.7	87.62	88.80
4- Chitosan at 500 ppm two times	23.6	23.9	88.97	90.30
5- Chitosan at 500 ppm three times	26.0	26.7	90.77	92.67
6- Chitosan at 1000 ppm two times	26.4	26.9	90.82	92.80
7- Chitosan at 1000 ppm three times	27.2	27.7	91.88	93.95
New L.S.D at 5 %	1.4	1.6	0.73	1.26

Chitosan was found by **Sauvas *et al*., (2002) and Melo *et al*., (2003)** to enhance the tolerance of fruit crops to biotic and abiotic stresses, the biosynthesis of organic foods, uptake of water and nutrients and the formation of double layers on plant tissues .

These results are in agreement with those obtained by **Ebeid (2007) ; Ahmed *et al*., (2009)** who worked on chitosan**, El- Badawy and Abd El-Aal (2013) and Fathalla (2013)** who worked on amino acids.

CONCLUSION

Under the experimental conditions and resembling regions it is recommended spraying chitosan at 500 ppm tow times at the beginning of vegetative growth, immediately after berry setting to improve growth and yield, physical& chemical characteristics as well as oil& fruit quality.

REFERENCES

Abdelaal, A.M.K. and Mona M.M. Oraby (2013): Using silicon for increasing the mango cv Ewaise transplants to drought. World Rural Observations, 5(2): 36-40 .

Ahmed, F.F. and M.H. Morsy (1999): A new method for measuring leaf area in different fruit species. Minia J. of Agric. Res. & Develop., 19: 97-105.

Ahmed, F.F.; A.S. Abdalla and Asmaa M.T. Sabour (2003): Growth and fruiting of Williams banana as affected by some antioxidant and biofertilizer treatments. Minia J. of Agric. Res. & Develop., 23(1): 51 – 68.

Ahmed, F.F.; A.Y. Mohamed and B.M. Abdalla (2007): The relation between using some antioxidants and productivity of Sewy date palms. Minia J. of Agric. Res.& Develop., 27 (4): 753–770.

Ahmed, W.; A. Niaz ; S. Kanwal and A. Rahmatullah (2009): Role of Boron in Plant Growth. A review J. Agric. Res. 47(3): 29-338. ISSN- 0368-1157.

Al- Wasfy, M.M.M. (2013): Response of Sakkoti date palms to foliar application of royal jelly, silicon and vitamins B. Nature of Sci., 9(5): 315-321.

Alvarez, J. and E. Datnoff (2001): The economic potential of silicon for integrated management and sustainable rice production. Crop. Prot., 20:53-48.

A.O.A.C., Association of Official Agricultural Chemists (2000): Official Methods of Analysis of. A.O.A.C. international 17th Ed. Published by O. A. C. international U. S. A.

Badran, M.A.F.M. and F.F. Ahmed (2009): The promotive effect of some antioxidants on the productivity of Taimour mango trees. Minia J. of Agric. Res.& Develop., 29 (2): 333–348.

Barranco, D. ; A. Cimato ; P. Fiorino ; L. Rallo ; A. Touzani ; C. Casyaneda ; F. Serafini and I. Trujillo (2002): Methodology descriptor files, World Cataloge of olive varieties pp. 95, 96, 129. 130 publisher International olive council .

Black, C.A. (1965): Methods of Soil Analysis. Amer. Soc. of Madison, Wisconsin, U.S.A. pp 1-20.

Blevius, D.G. and K.M. Lukaszweski (1998): Boron in plant structure and function. Anna. Plant physio. Plant Mol.Biol.49: 481

Chapman, H.D. and P.F. Pratt (1975): Methods of Analysis for Soil, Plants and Waters. California Univ. Division of Agric., Sci., pp. 172 – 173.

Ebeid, Sanaa (2007): The promotive effect of seaweed extract and boron on growth and fruiting of Hindy Bisinnara mango trees. Minia J. of Agric. Rev. & Develop., 27 (3): 579-594.

El-Badawy, H.E.M. and M.M. Abd El-Aal (2013): Physiological response of Keitte mango (*Mangifera indica* L.) to Kintein and tryptophan J. of Appleid Science Res. Co., 11(2): 14-22.

El-Khawaga, A.S. and A.E.A. Mansour (2014): Promoting productivity of Washington Navel orange trees by using some crop seed sprout extracts, silicon and glutathione. Middle East J. of Applied Sci., 4 (3): 779-785.

Eshmawy, A.M.Sh. (2010): Effect of some antioxidants and different pollination methods on fruiting of Sewy date palms. M. Sc. Thesis, Fac. of Agric. Minia Univ. Egypt.

Fathalla, A.M. (2013): Physiological studies on some mango cultivars. Ph. D. Thesis Fac. of Agric. Menoufia Univ. Egypt.

Gobara, A.A. (2004): Growth and fruiting of Washington Navel orange in relation to foliar application of some antioxidants. Minia J. of Agric. Res.& Develop., 24 (3): 581 – 600.

Gomez, K.A. and A.A. Gomez (1984): Statistical Procedures for Agricultural Research. Inter. Sci. Publication, John Wiley., Pp 20 – 40.

Hegab, M.M.Y. and M.Y. Hegab (2011): Response of Valencia orange trees for spraying some vitamins. Minia J. of Agric. Res. & Develop., 31 (1): 97 – 110.

Ibrahiem, H.I.M. and M.M. Al- Wasfy (2014): The promotive impact of using silicon and selenium with potassium and boron on fruiting of Valencia orange trees grown under Minia region conditions World Rural Observations., 5 (I): 1-14.

Keshavarz, K.; K. Vahdati ; M. Samar ; B. Azadegan and B.H. Brown (2011): Foliar application of zinc and boron improves walnut vegetative and reproductive growth. Hort. Technology, 21 (2): 181-186.

Klesiig, D.F. ; J. Durner ; R. Noad ; D.A. Navarre ; D. Wendhenme ; D. Kumar ; J.M. Zhuu ; J. Shah ; S. Zhang ; P. Kachroo ; Y. Triaf ; D. Pontier ; E. Lam and H. Silvo (2000): Nitric oxide and salicylic acid signaling in plant defense. Proc. Natl. acad. Sci., U. S. A., 97: 8849 – 8855.

Martin, C.G. and S.G. Sibbett (2005): Botany of the Olive. In: Olive Production Manual second edition. (Eds. SIBBETT,G.S.; Ferguson, L., and Lindstrand, M.), University of California, Agriculture and Natural Resources, Okland, California, pp. 15-19.

Mead, R.; R.N. Cunjow and A.M. Harted (1993): Statistical Methods in Agricultural and Experimental Biology. Second Ed. Chapman & Hall. London, pp. 10- 44.

Melo, S.P.; G.H. Kordnarfer ; C.M. Korndarfer ; R.M.G. Lana and D.G. Santaon (2003): Silicon accumulation and water deficient tolerance in grasses. Scientia Agricola., 60: 755-759.

Perica, S.; N. Bellaloui ; C. H. Greve and P. H. Brown (2001): Boron transport and soluble carbohydrate concentrations in olive. Journal of the American Society for Horticultural Science, 126 (3): 291-296.

Piper, C.S. (1950): Soil and Plant Analysis, Inter Science New York., pp: 48-110 .

Rao, M.V.; J.R. Koch and K.R. Davis (2000): Ozone a total for robbing programmed cell death in plants. Plant Mol. Bid. 44: 346 – 358.

Raskin, I. (1992): Role of salicylic acid in plants. Annu. Rev. Plant Physiol. Plant Mol. Bid., 43: 439 – 463.

Roshdy, Kh.A.; R.I. Saad and B.M. Abdalla (2011): Effect of some antioxidants on fruiting of Williams banana. Egypt. J. of Appl. Sci.,26 (3): 118 – 127.

Sauvas, D.; Manos, G.; Kotsiras, A. and Souvaliotis, S. (2002): Effects of silicon and nutrient- induce salicylic on yield. Flower quality and nutrient uptake of gerbera grown in a closed hydroponic system. J. Appl. Bat., 76: 153-158.

Sayed, E.E.A.; H.H.M. Saied and E.G. Gad Alla (2011): Effect of some vitamins on fruiting of Zaghloul date palms. Minia J. of Agric. Res. & Develop., 3(3): 371 – 381.

Shah, J. (2003): The salicylic acid loop in plant defense. Curr opin Plant Biol 6: 365 – 371.

Summer, M.E. (1985): Diagnosis and Recommendation. Integrated system (DRIS) as a guide to orchard fertilization. Hort. Abst., 55(8): 7502.

Szepesi, A. ; J. Csiszar ; K. Genus ; E. Horvath ; F. Horvath ; M. I. Simon and I. Tari (2009): Salicylic acid improves acclimation to sall stress by stimulating abscisic aldehyde oxidase activity and abscisic acid accumulation and increases Na^+ content in leaves without toxicity symptoms in *solanum lycopersicum* L. J. of Plant Physiol., 166: 914 – 925.

Von-Wettstein, D.V. (1957): Chlroophyll- Lethale under submikroshopische formilkechrel der plastiden celi, prp. Trop. Res. Amer. Soc. Hort. Sci., 20: 427 – 433.

Wilde, S.A.; R.B.Corey; J.G. Layer and G.K. Voigt (1985): Soils and Plant Analysis for Tree Culture. Oxford, IBH, New Delhi, India., pp 1-130.

Zhang, Q. and P.H. Gladyshev (2009): Distribution and transport of foliar applied zinc in pistachio. J. of the American Society for Horticultural Science.,124 (4):433–436.

"تأثير رش الشيتوزان على إنتاجية أشجار الزيتون البيكوال"

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هناك العديد من المركبات التي تزيد من قدرة النبات على تحمل الظروف القاسية مثل الإصابات المرضية والتغيرات المناخية وزيادة نمو الخضار والفاكهة وجودة الثمار عن طريق إضافة بعض المواد الطبيعية التي ليس لها أي تأثير ضار على الصحة العامة مثل الشيتوزان.

أقيمت تجربتان حقليتان على أشجار الزيتون صنف بيكوال عمرها 10 سنوات فى مزرعة خاصة بأسيوط منزرعة على أبعاد 6×6 متر خلال موسمي الدراسة 2018 ، 2019م، تم رش أشجار الزيتون صنف البيكوال بواقع مرتين وثلاث مرات بمادة الشيتوزان بمعدل 250، 500، 1000 جزء في المليون.

ركزت هذه الدراسة على التأثيرات المختلفة لرش مادة الشيتوزان على النمو الخضري والمحصول وكذلك الخصائص الفيزيائية والكيميائية لثمار اشجار الزيتون صنف البيكوال.

ان معاملة اشجار الزيتون صنف البيكوال بواقع رشتين وثلاث من مادة الشيتوزان بمعدل 250 إلى 1000 جزء في المليون كان له عظيم الاثر في تحسن نمو الاشجار وارتفاعها وزيادة إجمالي مساحة السطح الكلية لكل شجرة ، والعناصر الغذائية متمثلة في النيتروجين والفوسفور

والبوتاسيوم والعناصر الصغري في الاوراق والثمار، فضلاً عن خفض نسبة الحموضة الكلية مقارنةً بمعاملة الكونترول

اشارت نتائج الدراسة الي أنه بزيادة التركيزات التي تم رشها من مادة الشيتوزان من 250 إلى 1000 جزء في المليون مرتين في بداية النمو الخضري ، مباشرة بعد العقد وبعد شهر واحد ادي الي تحسن في جميع خصائص النمو بشكل كبير ونسب العناصر الغذائية والمحصول وجودة الثمار كما ونوعا بالمقارنة بالكونترول.

تم الحصول على أفضل النتائج فيما يتعلق بالمحصول وجودة الثمار من خلال معاملة أشجار الزيتون صنف البيكوال بالرش بمادة الشيتوزان مرتان بمعدل 500 جزء في المليون في بداية النمو الخضري ، مباشرة بعد عقد الثمار الي تحسن واضح في كمية المحصول كماً ونوعاً مما ادي للحصول علي محصول اقتصادي.