A study of some Environmental Impact on Olive's production in Toushka Area, Egypt

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Abstract: Many vital factors were affecting the agricultural development and sustainability in Egypte project (Toushka). Olive trees (Olea europaeal. L. "cv" Manzanillo and Koroneiki) were cultivated in May, 2007 at the experimental farm of Water Research Study Complex – Abu Simble (WRSC)-Toushka, the trees were cultivated from tell now with zero productivity. The objective of this study is to investigate some of the most important factors that affect the olive trees growth and productivity such as water quality, soil edaphic "some soil physical and chemical properties" and air temperature. The study indicates that water quality for irrigation classified the class: C_2-S_1 which indicates a good quality and can be used to irrigate many crops including all olives species in different soils. The soil physical and chemical properties was classified under Class S_2 "Moderately" which is suitable for cultivate olives. In addition, the temperature in Toushka study area were very high specially during the initial and induction periods, started from December to March; that affecting the period of Flowering and fruit set in April and May. In addition to in winter season there was no amount of frosts for flowering. According to the high temperature in Toushka area may be prevent pollen germination in Olive trees (Koroneiki and Manzanillo).

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1. Introduction

In Egypt the total area harvested 52100 Ha and production 510000 tons according to **FAO stat (2013)**. Salinity stress; always accompanied by different changes in plant metabolism, which is turn affect plant constituent. The most harmful effect due to increasing the osmotic pressure is reduction in water availability to plants. Thus the hazard effect of salinity due to accumulation of Cl^- and Na ions in toxic concentrations minimizing foliar pigments **Saad EL-Dien et al., (1992**). Olive tree "Koroneiki and Manzanillo" conceder Moderately to salinity as mentioned by (**EL-Saied et al., 1995**). **Ben Ahmed et al., (2012)** found that saline water for irrigation (EC_e= 7.5 $dS.m^{-1}$) for olive trees (Olea europaea L.cv.Chemlali) should not be applied without taking into consideration the different surrounding condition where it is used particularly the soil type, the adopted irrigation system, the degree of the crop salt tolerance, the plant growth phase and the climatic conditions (rain fall pattern, temperature average,…). **Atia (2002)** recommended that increasing salinity concentration in the irrigation water up to 4000, 6000 and 8000 ppm for "Rosciola", "Kronaki" and Picual" respectively; significantly increase leaf osmotic potential(total soluble sugar, proline, chloride, sodium and calcium) and decrease leaf contents of pigments (chlorophyll a, b and carotene), leaves nitrogen, phosphors, potassium and the transpiration rate of leaves. **Gucci and Tattini (1997)** found that in addition to environmental condition salinity in the root zone reduced Olive trees growth. High salinity decreased fruit weight and increased the moisture content of fruits and did not affect or reduced oil content of the olive tree **Stefanoudaki (2004)**. Availability of both N and P was found to influence flowering intensity in the olive trees while K had only a minor affect; Fruit set was affected by both N and P but not K levels. Fruit load was not influenced by leaf K concentration. The findings indicate that N and P play fundamental roles in processes affecting olive-tree productivity **Erel, et al (2008).** Application of potassium nitrate improve the vegetative growth, reduce the fruit drops and increase the productivity, increase fruit quality and the oil content. **Hegazi, et al (2011).** Copper toxicity often causes foliar interveinal chlorosis, the leaf becoming necrotic with increasing exposure; Zinc "Zn" deficiency is interveinal chlorosis of the upper (youngest) leaves. Afterwards, shoot growth slows down; giving the affected plant parts a rosette-like appearance. **Reichman(2002).**

Temperature of 32 degrees may be the upper limit of olive flounder and the survival rates of olive flounder decreased significantly at the temperature of 32 degree **Cheng Lina et al., (2011)**. Temperature at (40 degrees) prevented pollen germination in "Koroniki" and "Mastodis", respectively; and all cultivars were sensitive at 40 degrees **Koubouris et al., (2009)**. Increasing temperatures would cause olive trees to flower earlier and their growth period to be lengthened **Perez et al., (2008).** Olive (Olea europaea L.) growth and metabolism are profoundly affected by changes in environmental temperature, extreme temperatures effect the reproductive cycle of the olive and high temperature during flowering adversely effects bloom development, pollination, and fruit set (**Tous Marti and Ferguson 1996**). High temperatures increase pollen incompatibility and Pollen tubes become blocked as temperatures increase from 26.7 up to 32.2 degree, pollen tubes are more aggressive and can reach embryo sacs before the sac degenerates **Nasir and Joe (2009)**.

Experimental site

Experimental farm of Water Research and Studies Complex - Abu Simbel City (WRSC) in Toushka (Plant type study: Olive tree (Olea europea L. cv. Kroneiki and Manzanillo; Experimental area: 6.5 feddans; soil texture class: sandy soil; water irrigation drip system; irrigation level, 100%; Agricultural date: May, 2007 until now; Fertilization program, the amount and types of fertilizer were added according to the recommendation of Ministry of agricultural and productivity equal Zero. means, maximum, minimum and standard deviations (SD) selected from different functions in "Excel" program, with 5 replicates.

Water; Soil and Plant analysis:

Physiochemical characteristics of water samples analyses were carried out according to Standard Methods for Examination of water and wastewater **(APHA, 1992);** Soil analysis: Ten Soil samples were randomly collected from the zone of the root olive tree under the end of canopy; soil samples have been taken by auguring at depth 0-30 and 30-60cm from experimental farm of Water Research Study Complex – Abu Simble (WRSC),. **Fernandez, et al., (1991)**. Under dry land conditions the installation of a drip system, makes the adult tree adapt its rooting system, concentrating the roots within the wet soil zones near the drippers, so that the highest root densities occur in these zones. The samples were air dried, ground to pass through a 2 mm sieve and stored in plastic bottles prior to the physical and chemical analysis. Also, samples of irrigation water was collected and analyzed. The soil samples were analyzed mechanically using the pipette method, described by **Baruch and Barthakur, (1997)**; soil chemically analysis as described by **Jackson (1973)** and **Black, (1982)**. And Leaf plant analysis according to the procedure of **Yash, (1998)**.

3. Results and Discussion

Water analysis.

Data presented in Table (1). Revealed that the pH value of water irrigation studied was 7.12 While the value of EC dS.m^{-1} and TDS mgl^{-1} were 0.70 dS.m^{-1} and 192 mgl^{-1} respectively. Regarding the soluble cations and anions of water sample are in the following order: Na > Ca > Mg then K, While anions are in the following order: Cl > SO_4 > HCO_3. Also, data revealed that the SAR was 1.88. Heavy metals contents Cu, Fe, Mn and Zn were recorded 0.01, 0.12, 0.04 and 0.19 mgl^{-1} respectively. According to **FAO guidelines, 1985)**, concentrations of water irrigation in Table (1) were within the permissible limits. Based on the **U.S Salinity Laboratory** water irrigation fall within the class: C_2-S_1; which is of a good quality and can be used in irrigation of many crops in different soils these results could be confirmed by those obtained by **Ali and Zamzam, (2007).**

Table 1. Water chemical analysis.

pH	EC ds.m^{-1}	TDS mg.l^{-1}	Ions meq.l^{-1}							SAR	Heavy metals conc.,.(mgl^{-1})			
			Ca	Mg	Na	K	HCO_3	Cl	SO_4		Cu	Fe	Mn	Zn
7.12	0.70	192	1.95	1.56	3.1	0.41	0.80	4.01	1.97	1.88	0.01	0.12	0.04	0.19

CO_3 was recorded zero.

General characteristics of soil samples in Toshka area.

Considering the analytical data in Table (2); Show some physical and chemical properties of studied soils. The soil texture class was recorded sandy soils agree with **Elwan, (2009);** soil reaction (pH) value in soils were ranged between 7.67 to 8.20 and 7.48 to7.66 at depth 0-30 and 30-60 cm respectively. Soil reaction tends to be moderate to slight alkaline. These results could be confirmed by these obtained by **EL- Aziz, (2005) and Hassan, (2006).** The electrical conductivity (EC dS.m^{-1}) of soil was ranged between 3.16 dS.m^{-1} to 4.01 dS.m^{-1} at depth 0-30cm and was ranged between 1.77 to 2.14 dS.m^{-1} at depth 30-60cm, soil salinity were decreased with depth these soils are classified under class S_2 "Moderately" soil suitability for agriculture. Organic matter (OM%) content of soil is very low which may be due to the prevailing aridity of Toushka region and its very scanty vegetation agree with **Khader and Hussien, (2003).** Calcium carbonate content ranged between 5.33 to 10.01% and 7.48 to 9.14% at depth (0-30 and 30-60) cm respectively; with an regular distribution pattern with depth agree with **Hassan, (2006).** Soluble ions in soil were followed these order: Na > Ca > Mg > K, while the anion composition was dominated by Cl, HCO_3 and SO_4 as mg.l^{-1} and were followed the order: Cl > HCO_3 > SO_4 and CO_3 was recorded zero. The hazard effect of salinity due to accumulation of Cl and Na ions in toxic concentrations minimizing foliar pigments **(Saad EL-Dien et al., 1992).** Na and Ca cations and Cl anions have been the subject of many studies related to salinity because of their abundance and importance in reducing yield. In addition to Na, Ca and Cl ions, a number of other ions, including Mg and K cations and SO_4, and HCO_3, anions, play important roles in solution and soil salinity in root zone medium solution influence plant growth, by creating osmotic imbalance and via specific physiological toxicity of ions **(Munns, 1993).** Chlorotic and necrotic leaf types and edges general leaf chlorosis,leaf roling, leaf drop, stem tip necrosis, root necrosis, shoot dieback, and defoliation. Concerning the Cation Exchange Capacity (CEC); was ranged between 2.88 in to 3.55 meq. 100 g^{-1} at depth 0-30cm and 2.44 to 3.18 meq.100 g^{-1} at depth 30-60cm). Exchangeable cations were the follows Na > Ca > Mg > K.

Table 2. Soil Physical and chemical analysis.

Character	**Min-Max**	**Mean ± SD**	**Min-Max**	**Mean ± SD**
	at Depth (0-30)cm		**at Depth (30-60)cm**	
Sand %	85.01-86.8	85.6± 0.81	84.19-85.60	84.75±0.57
Silt%	9.17-10.82	10.1±0.85	10.11-11.83	11.01±0.76
Clay%	4.11-4.66	4.3±0.23	3.88-4.66	4.24± 0.31
Texture class		**Sandy soil**		
pH (1:2.5)	7.67-8.20	7.88±0.20	7.48- 7.66	7.54±0.07
EC $dS.m^{-1}$ (1:1)	3.16-4.01	3.53±0.35	1.77-2.14	2.02±0.15
O.M%	0.14-0.2	0.2±0.02	0.11-0.22	0.17± 0.04
$CaCO_3$ %	5.33-10.01	7.9±1.79	7.48- 9.14	8.35±0.65
Soluble ions $mg.l^{-1}$				
Na	493-626	550±55	276-334	315±23.5
K	63-80	71±7	35-43	41±3.0
Ca	107-136	120±12	60-73	69±5.1
Mg	38-48	42±4	21-26	24±2.0
Cl	711-902	793±79	398-482	454.6±34.0
HCO_3	442-561	494±49	247-300	282.9±21.2
SO_4	193-248	217±23	103.7-127	119.7±9.6
CEC $meq100g^{-1}$	2.88-3.55	3.18±0.24	2.44-3.18	2.83±0.3
ESP%	9.7-10.9	10.2±0.50	7.2-7.9	7.7±0.3

Macronutrients $mg.kg^{-1}$					***Optimum as ($mg.kg^{-1}$)**		
	Min-Max	Mean ± SD	Mean ± SD	Min-Max	Poor	Moderate	adequate
	at Depth (0-30)cm		at Depth (30-60)cm				
N	8.7-15.1	12.0± 2.98	10.1-15.0	12.3±1.9	5-15	15-30	30-40
P	1.3-2.2	1.7± 0.33	1.1-2.1	1.8±0.42	3 -8	8-14	14-20
K	54.8-84.4	71.7±11.3	43.6-83.3	70.9±15.9	85-150	150-250	250-450

Micronutrients $mg.kg^{-1}$					****Optimum as ($mg.kg^{-1}$)**		
	Min-Max	Mean ± SD	Mean ± SD	Min-Max	Poor	Moderate	adequate
	at Depth (0-30)cm		at Depth (30-60)cm				
Cu	4.0-6.5	5.0±1.22	3.12-5.69	4.2±0.95	<0.3	0.9-1.2	1.3-2.5
Fe	59.5-110.3	93.6±20.9	66.8-148.0	97.3±32.6	0-5	11-16	17-35
Mn	11.98-39.4	24.8±11.5	7.14-33.14	19.1±10.6	0-4	9-12	13-30
Zn	8.1-16.6	12.2±3.96	8.7-11.1	9.5±1.0	<0.5	1.1-3	3.1-6

*According to, FAO, (2007). ** According to, Jones, (2001) Exchangeable sodium percentage (ESP %) were ranged between 9.7 to10.9 at depth 0-30cm and 7.2-7.9 at depth 30-60cm. Finally, the variation in CEC and ESP % among layers of the investigated soil may be due to the differences in mineralogical composition. It can be concluded that investigated soil suffers from a sever leak of available macronutrients NPK; agree with **Sherif (2011).** On the other hand; soil was adequate in their contents of available Cu, Fe, Mn and Zn.

Olive's production

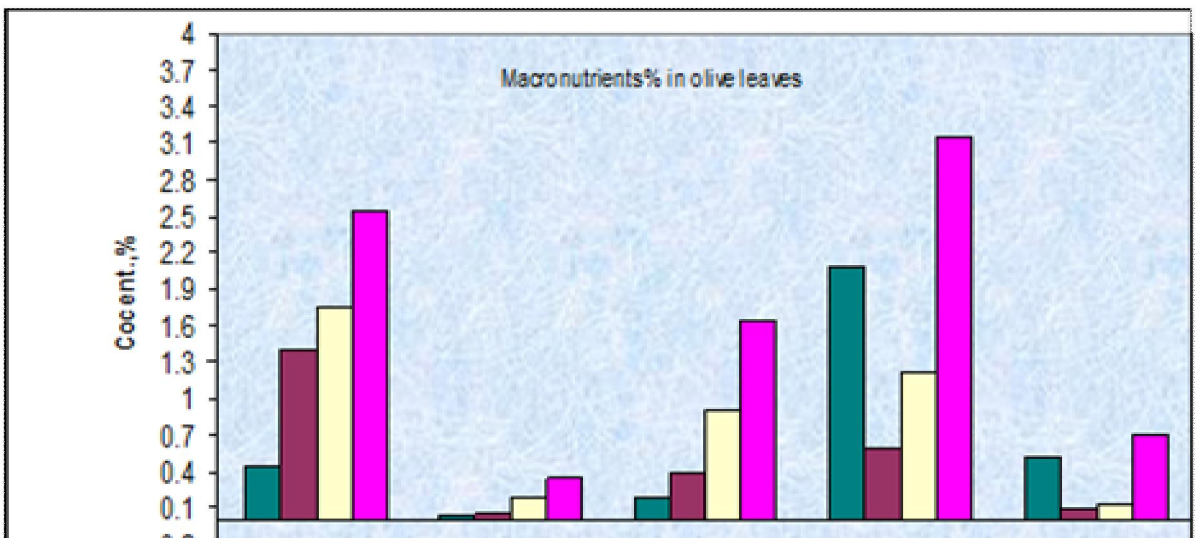
Nutrient concentrations in olive leaves.

Regarding to the data presented in Table (3) and illustrated in figures (1) and (2) revealed that, the values of N, P, K, Ca and Mg were 0.45, 0.04, 0.19, 2.09 and 0.51% respectively. Data revealed that there is a deficient of macronutrients N, P, K content while Ca and Mg were sufficient. Micronutrients (Cu, Fe, Mn and Zn) were (99.25, 247.46, 29.96, and 6.87 ppm) respectively. And in the following order: Fe > Cu > Mn then Zn; according to **Stan Kailis and David Harris, (2007)** data show that there is a toxicity of Copper "Cu" often causes foliar interveinal chlorosis, the leaf becoming necrotic with increasing exposure. and sufficient limits of Fe and Mn but there is lacks of Zn for plant growth. Finally could be concluded that olive trees suffering from lacks in macronutrients "NPK" and micronutrients Mn and Zn.

Table 3. Macro and micro nutrients of olives leave.

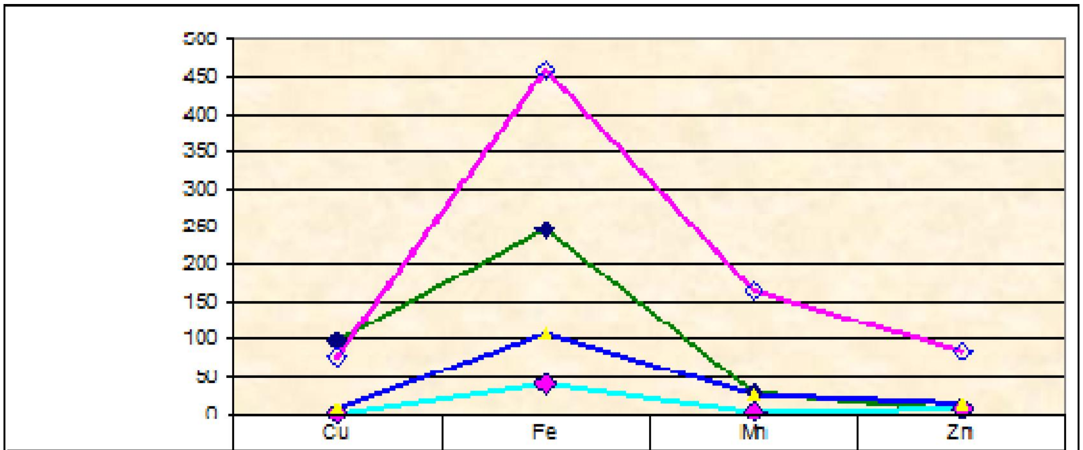
Olive leaves	Macronutrients %					Micronutrients ppm			
	N	P	K	Ca	Mg	Cu	Fe	Mn	Zn
Reading	0.45	0.04	0.19	2.09	0.51	99.25	247.46	29.96	6.87
Deficient limits%	<1.4	>0.05	<0.4	<0.6	<0.08	<1.5	<40	<5	<8
Optimum limits%	1.5:2.0	0.1:0.3	0.8:1.0	1.0:1.43	0.1:0.16	4:9	90:124	20:36	10:24
Toxic limits%	>2.55	> 0.34	>1.65	>3.15	>0.69	>78	>460	>164	>84

Source: Stan Kailis and David Harris. (2007)



	N	P	K	Ca	Mg
Concentrations	0.45	0.04	0.19	2.09	0.51
Deficient Limits%	1.40	0.05	0.40	0.60	0.08
Optimum Limits%	1.75	0.20	0.90	1.21	0.13
Toxic Limits%	2.55	0.34	1.65	3.15	0.69

Figure :(1) Macronutrients % in olive leaves.



	Cu	Fe	Mn	Zn
Concentrations	99.25	247.46	29.96	6.87
Deficient Limits %	1.5	40	5	8
Optimum Limits %	8.5	107	28	17
Toxic Limits %	78	460	164	84

Figure :(2) Micronutrients % in olive leaves.

Effect of Temperature on olive trees.

Data presented in Table (4) and illustrated in figure (3) showed that the average of 3 years, (2009-2012) of climatic conditions at Toushka area; data reveal that the area falls under the extreme arid conditions and is characterized by a hot rainless summer and the precipitation is rare in winter season. Data reveal that the average of temperature in winter season during the months of January and February were recorded 22.3 and 22.7 degree respectively. While in winter season olive plant need amount of frost with average temperatures varying between 1.5°C to 10°C for flower bud differentiation. Olives Flowering at the study area (Toushka) suffering from high temperature during the induction and initiation period (December, January, February and March); the maximum temperature were recorded (43.5, 39.4, 40.4 and 43.4 degree), respectively; while the average was recorded (28.1, 22.3, 22.7 and 25.5 degree), respectively; in addition to high temperatures during the period of Flowering which recorded (43.5 and 47.3 degree) in April and May due to adversely affects bloom development,"40 degree" prevent pollen germination "pollination", and fruit set **(Tous Marit and Ferguson, 1996; Koubouris et al., 2009).** Pollen tubes become blocked as temperatures increase from 26.7 up to 32.2 degree. Agree with **Nasir and Joe, (2009)**.

Table 4: The Climatic data of Toushka area (Average of 3 years, 2010, 2011 and 2012)*

Months	**Temperature**			**Soil Temperature C at 30cm**			**Wind Speed km/h**	**Mean total rainfall mm**
	Max	**Min.**	**Ave.**	**Max.**	**Min.**	**Ave.**		
January	39.4	5.1	22.3	29.3	15.6	22.5	7.0	10.0
February	40.4	5.0	22.7	32.7	16.3	24.5	2.5	0.0
March	43.4	7.7	25.5	37	18.8	27.9	3.0	0.0
April	43.5	12.7	28.1	38	23.2	30.6	2.9	0.0
May	47.3	14.6	31.0	42.4	27.4	34.9	3.0	0.0
June	48.1	17.3	32.7	43.2	32.0	37.6	2.8	0.1
July	46.5	20.6	33.6	44.6	25.0	34.8	2.4	0.0
August	46.7	21.2	34.0	44	33.0	38.5	2.6	0.0
September	39.4	5.1	22.3	42.6	31.4	37.0	2.4	0.0
October	40.4	5.0	22.7	42.4	27.5	35.0	2.1	0.0
November	43.4	7.7	25.5	36.4	19.1	27.8	2.5	0.0
December	43.5	12.7	28.1	31.4	16.9	24.2	2.4	0.0

*According to CIU; NWRC (2009-2012)

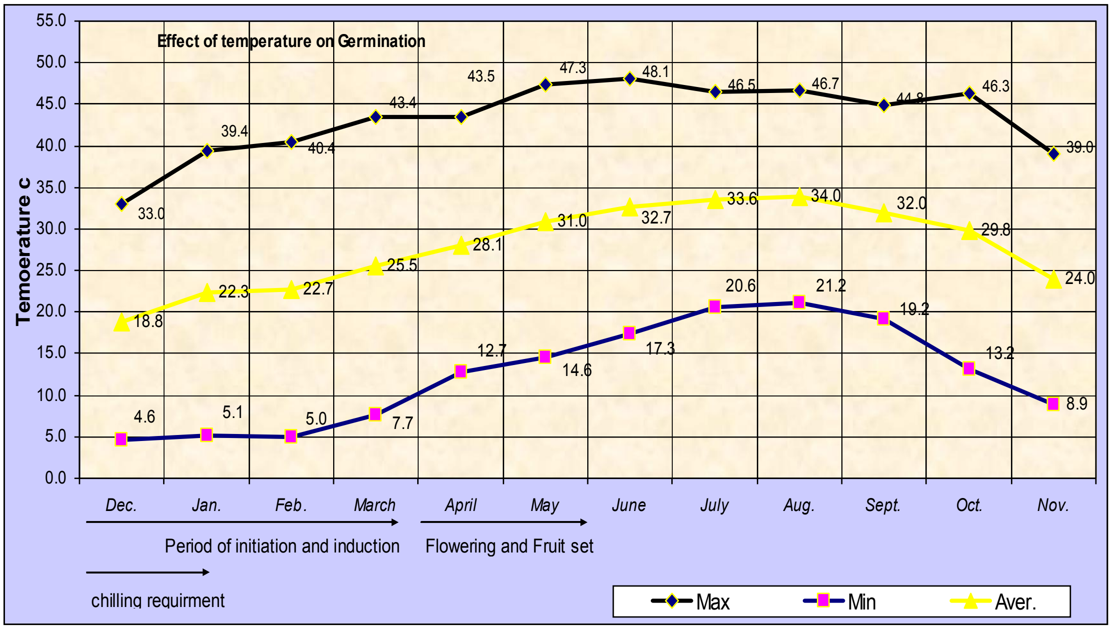


Figure: (3) Max, Min and Average of temperature on olive plant growth

Conclusions

The results of this study clearly demonstrate that cultivated olives were subjected to many factors affected olives plant growth: 1-water quality for irrigation; fall within the class: C_2-S_1; which is a good quality. 2- Influence of various soil properties; It can be concluded that investigated soil suffers from a sever lack of available macronutrients NPK and organic matter; agree with **Sherif (2011).** On the other hand; soil was adequate in their contents of available Cu, Fe, Mn and Zn. And 3-climatic conditions; in Toushka area temperature is one of the most important factors controlling plant growth on vegetative growth and flowering, in Olive (Olea europaeal L.). High temperature at April and May during the period of Flowering adversely effects bloom development and prevent pollen germination in Olive trees (Koroneiki and Manzanillo) in addition to in winter season there was no amount of frosts for olives flowering in Toushka area which conceder suitable for tropical fruits .

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