The Effect of Using Olive Oil Vegetation Water on Some Physical and Chemical Characteristics of Soil and Nutrient Element Contents of Fig (*Ficus carica* L. cv. Sarilop) Leaves

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ABSTRACT

In that project, it has been aimed to determine method of using that olive oil vegetation water as on organic manure in dried fig production and to obtain positive solution for environmental pollution. Fig and olive are important agricultural products in Aydin province. It has been accepted that reducing of crop nutritient quantities in agricultural lands is caused negative effect on dried fig product quality and yield. The oil vegetation water which is occurred in olive oil factory is caused very serious environment pollution. That project will be carried out in 2006-2012 years. The study is conducted in a farmer orchard which has 80 'Sarilop' dried fig trees, located in Isafakilar village, Incirliova, Turkey. This experiment was designed in respect of randomized blocks with four replications and each replication was consisted of two trees. Totally five applications are on the carpet, those olive oil vegetation water applications include control, 25, 50, 75, 100 kg/per tree, respectively. In addition, there are two groups that determined implementing olive oil vegetation waters in every year and every two years (implementing one year and no implementing one year). According to 2006-2007 periods results; it has been defined that olive oil vegetation water applications are composed some dissimilarities on some physical and chemical properties in the soil. However, similar variations weren't seen on leaf analysis.

Keywords: dried fig, olive oil vegetation water, plant nutrients, soil characteristics.

INTRODUCTION

Turkey is the world's largest fig producing country. In respect of FAO statistics world fig production is 1056820 tones. Turkey's production of 285000 t is 27% of the world's total production and, Turkey's 177900 t of fig exports represents 52% of total world fig exports (Anonymous, 2005). About 70% of Turkey's total fig production is for dry consumption (Aksoy et al., 2003). Because of environmental effects on fruit quality, it is commonly believed that the highest quality dried figs are grown in limited areas of the Big and Small Meander valleys where temperature, relative humidity and wind conditions are optimum for production of high quality dried figs (Özbek, 1978).

'Sarilop' [(*Ficus carica* L.) (syn. 'Calimyrna')] (Storey, 1975) is the most important dried fig cultivar in Turkey and the USA. Aydin and Izmir provinces are the main production centers in Turkey.

Take into account olive production in Turkey which has about 88 million olive trees and annual olive oil production varies from 35000 tons to 200000 tons. Hence, Turkey ranks fourth after Spain, Italy and Greece in the Mediterranean. There are two major by products of the olive oil industry, which are olive pomace and the vegetation water. Because of periodicity of the trees, seasonal operation, small and scattered nature of the olive oil mills, installation and proper management of the treatment facilities are difficult, costly and non-profitable.

Fig (*Ficus carica* L.) is one of the most important cultivar in Turkey. Aydin and Izmir cities are the main production regions for that 'Sarilop' dried fig cultivar.

Fig and olive are important agricultural products in Aydın province. It has been accepted that reducing of crop nutrient quantities in agricultural lands is caused negative effect on dried fig product quality and yield. The oil vegetation water (VW) which is occurred in olive oil factory is caused very serious environment pollution.

In addition, VW is used for different purposes in olive oil producer countries like Spain, Italy and Greece. But, the important one for us is the VW as fertilizer. Nevertheless, when the related literature reviewed, it could be seen that there are not many researches done about the effects of VW when used as fertilizers on chemical and physical properties of soil. Therefore, this project will contribute to obtain some basic knowledge on the related subject (Llamas, 1978; Alvarez, 1979; Potenz, 1980; Morisot, 1981, Levi- Minzi et all. 1992).

That project will be carried out in 2006-2012 years. Main aim of that project is to investigate olive oil vegetation water on tree growth, yield and quality on organic dried fig growing in Turkey. Besides, problem of olive oil vegetation water in Turkey would be able to solve in practical way.

MATERIALS and METHODS

That project will be carried out in 2006-2012 years. The study is conducted in a farmer orchard which has 80 'Sarilop' dried fig trees, located in Isafakilar village, Incirliova, Turkey. This experiment was designed in respect of randomized blocks with four replications and each replication was consisted of two trees. Totally five applications are on the carpet, those olive oil vegetation water applications include 0 (control), 25, 50, 75, 100 kg/per tree, respectively. In addition, there are two groups that determined implementing olive oil vegetation waters in every year and every two years (implementing one year and no implementing one year). Thus, it would be able to determine impacts of different dosages and treatments which are made together with diverse interval on tree habits, yields and quality.

Olive oil vegetation water slush which have been waited in summer months, is dried and then is perfused in tree canopy with explained dosages and is covered by soil.

Leaf samples are selected from four different directions of the tree, primarily the whole third leaf from the base with the first fruit of the current shoots from July to August, the accepted stable period (Kabasakal, 1983). And the leaves are taken in August as 60 leafs and are analyzed and also soil samplings are received from 0-30 cm soil depth and analyzed in October as 60 numbers. Leaf and soil analyses are performed in every year.

Macro and micro nutrient element levels for leaf analyses and texture, salinity, sand-spindle-clay, pH, total salt (%), organic material and macro and micro nutrient element levels for soil analyses are determined considering research calendar.

In soil samples, texture was determined by hydrometer methods (Bouyoucus, 1955), pH was measured using 1/2 soil/water suspension (Anonymous, 1980), electrical conductivity was assigned according to Soil Survey Stuff (1951), %organic matter was also specified by Walkey-Black method (Anonymous, 1980), %$CaCO_3$ was obtained by Scheibler calsimeter (Caglar, 1958), total nitrogen was extracted by Kjeldahl's method (Bremmer, 1965); phosphorus by Bingham's (1949); potassium, calcium and magnesium by IN HN_4 OAc method (Kacar, 1962). By using DTPA extraction, microelements have been determined as Lindsay and Norvell (1978) suggested. Soil excavated from two different depths (0-20 cm., 20-40 cm.), form the materials of the study. After the plant samples had been dried at 70^0C, total nitrogen was analysed by Kjeldahl's method (Kacar, 1972). In extracts obtained by applying Wet Burning, phosphorus was determined by colour-metric via Vauadomolibdo phosphoric yellow colour methods with colormatic; potassium, calcium was determined by fleymphotometric; magnesium and micro elements (Fe, Zn, Mn, B) by using Atomic Absorbtion Spectrophotometer. The results of the analysis have been evaluated by the SPSS statistical software.

RESULTS and DISCUSSION

Dried fig production and marketing is noteworthy for Turkish agricultural sector. Nevertheless, Turkey has also strong position in world olive and olive oil production. Scarcely, seasonal operation, small and scattered nature of the olive oil mills, installation and proper management of the treatment facilities are difficult, costly and non-profitable. In that study, it would be aimed investigation of utilization circumstances of olive oil vegetation water on dried fig trees. In this way, this is the first report from two years results which have been obtained by running project in Erbeyli Fig Research Institute, Aydin, Turkey.

Olive Oil Vegetation Water Composition

Olive oil vegetation water composition was analyzed in 2007 and was shown below (Table 1). Some parameters in the table are different than indicated by Seferoglu et al. (2000). They explained some indicators such as pH:6.24, $CaCO_3$(%): 0.69, organic matter (%): 11.65, total N (%): 1.78, total P (ppm): 154, total K (ppm): 3500, total Ca (ppm): 1000, total Mg (ppm): 1657, total Na (ppm): 240, total Zn (ppm): 79, total Mn (ppm): 190. On the other hand, Anonymous (1996) stated some parameters from olive oil vegetation water analysis pH: 4.83, total N (%): 1.69, total P (%): 0.19, total K (%): 2.6, total Ca (%): 1.0, total Mg (%): 0.33, total Fe (ppm): 197, total Mn (ppm): 54, total Zn (ppm): 43, total Cu (ppm): 12.

Comparison of some physical and chemical characteristics of soil and macro and micro element contents of fig leaves

In that chapter, it is explained alteration of soil nutrient elements respectively. In 2005 year, there wasn't implemented olive oil vegetation water on soil in the fig tree. Soil nutrient elements were shown in Table 1. So far olive oil vegetation water applications were made in 2006 and 2007. Belonging the two years soil nutrient elements results were performed in Table 3 regarding different olive oil vegetation water dosages. There are two groups that determined implementing olive oil vegetation waters in every year and every two years (implementing one year and no implementing one year). Implementations are specified in that way. Treatments which have been conducted, have been shown in the Table 4 are explained in Table 3a and Table 3b.

When the results of the analyses are considered, it was observed that after the application of VW there was a rise in the salt contents of the soils. After the application, soil pH first lowered and then rose and reacted its former level. Likewise, in their study Levi and et all. (1992) and Seferoglu et al. (2000) had the same results for salt and pH. On the other hand, there was not a considerable increase in nitrogen and calcium content of the soils increased in accordance with the doses used.

Table 1. Olive oil vegetation water composition

Elements	Values
pH	5.7
EC (dS/m)	20.5
Organic matter (%)	51.4
Organic carbon (C) (%)	28.8
Total nitrogen (N) (%)	1.3
C/N	22.1
Total phosphorus (P) (%)	0.19
Total potassium (K) (%)	1.57
Total calcium (Ca) (%)	0.82
Total magnesium (Mg) (%)	1.31
Total sodium (Na) (%)	0.06
Total iron (Fe) (ppm)	5130
Total zinc (Zn) (ppm)	57
Total copper (Cu) (ppm)	29
Total manganese (Mn) (ppm)	66

Table 2. Some physical and chemical properties of soil samples in the experimental orchard in 2005

Elements	Values	Statements
pH	6	middle acid
EC (mS/cm)	0.074	non salt
$CaCO_3$ (%)	0.40	poor in lime
Texture (%)	44	with sand
Organic matter (%)	1.271	poor
Total nitrogen (N) (%)	0.064	middle
Total phosphorus (P) (ppm)	1.400	poor
Total potassium (K) (ppm)	63.89	very poor
Total calcium (Ca) (ppm)	579.7	very poor
Total magnesium (Mg) (ppm)	92.19	middle
Total sodium (Na) (ppm)	13.92	very low
Total iron (Fe) (ppm)	10.9	enough
Total manganese (Mn) (ppm)	19.64	enough
Total zinc (Zn) (ppm)	0.27	insufficient
Total copper (Cu) (ppm)	0.49	enough
Total boron (B) (ppm)	0.15	very low

Table 3a. Declaration of different olive oil vegetation water applications in diverse tables

	Control	25 kg application (implementing one year and no implementing one year)	25 kg application (implementing every year)	50 kg application (implementing one year and no implementing one year)	50 kg application (implementing every year)
Term	1	2	3	4	5

Table 3b. Declaration of different olive oil vegetation water applications in diverse tables

	75 kg application (implementing one year and no implementing one year	75 kg application (implementing every year)	100 kg application (implementing one year and no implementing one year	100 kg application (implementing every year)
Term	6	7	8	9

In considering of some physical and chemical characteristics of soil before vegetation water application in the experimental orchard, such as dried fig trees especially located in slope and mountainous areas, soils have poor macro and micro nutrient elements. That result is harmonious with reports of Anaç et al. (1987) and Askin et al. (1998). One of the most important points from that article, acid and salt values haven't been increased thorough vegetation water application. And also %$CaCO_3$, organic matter, phosphorus, potassium values are augmented after applications. Those parameters are important to continue sustainable dried fig production systems in Turkey. For leaf analysis, it was understood that there is no difference taking cognizance of control, different vegetation water dosages and years.

There was not a considerable increase in Mg, Na contents of the soils after the application. There was a parallelism between the rise and the amounts of doses used. Likewise, Püskülcü et all. (1995) arrived at similar results. It was observed that there was a small increase in aggregation stability which is closely related to structure, organic material, lime and sodium contents. This is especially important for those regions where there is low aggregation stability. Yet, if the Na contents decrease as a result of the applications which will be done later, it could decrease aggregation stability. However, because VW has some positive effects on the soil the improvement of the negative factors might increase aggregation stability. It should be remarked that Fe contents of the soil in 2006 and 2007, comparing 2005 year which there was no application, had been increased. We think it would be able to observe what kind of impacts of high Fe contents of the soil on the fig tree and fruit characters in oncoming years.

Table 4. Some physical and chemical properties of soil samples in the experimental orchard in 2006-2007 years*.

	1		2		3		4		5		6		7		8		9	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
pH	6.66	6.91	6.61	6.40	6.30	6.71	6.76	6.43	6.29	6.33	6.82	6.59	7.01	6.65	6.31	6.40	6.95	6.60
EC**	0.095	0.20	0.086	0.10	0.099	0.10	0.155	0.10	0.072	0.13	0.124	0.10	0.194	0.10	0.094	0.10	0.204	0.10
$CaCO_3$ (%)	0.82	0.76	0.94	1.14	0.87	1.05	1.22	1.14	1.02	1.24	0.92	1.05	1.07	1.24	1.14	1.14	1.08	12.4
Organic matter (%)	1.28	2.30	1.04	3.53	1.56	3.53	0.98	3.43	1.07	3.28	1.04	2.87	1.28	2.64	1.45	3.36	1.69	3.38
N (%)	0.07	0.05	0.07	0.06	0.10	0.07	0.06	0.08	0.07	0.07	0.08	0.07	0.09	0.07	0.09	0.07	0.12	0.06
P (ppm)	2.80	2.75	1.33	3.91	3.15	3.69	3.73	4.13	1.77	3.67	3.48	4.00	3.10	3.67	2.86	3.91	4.74	4.04
K ppm)	90.4	90	67.06	155	112.7	170	256.5	120	55.1	130	235.7	157	163.0	145	181.2	155	390.1	140
Ca (ppm)	1030.0	500	875.6	250	1059.0	475	1263.5	275	767.1	200	800.5	275	995.3	300	875.2	250	1065.6	275
Mg(ppm)	188.6	64.5	281.6	281.6	170.2	170.2	233.1	233.1	223.7	223.7	159.3	159.3	159.1	159.1	233.1	198.7	174.3	174.3
Na (ppm)	48.84	65.00	62.53	62.53	51.01	51.01	57.35	57.35	51.97	51.97	39.22	39.22	46.44	46.44	57.35	53.56	45.01	45.01
Fe (ppm)	29.32	3.62	15.61	15.61	15.16	15.16	48.90	48.90	19.11	19.11	23.44	23.44	34.71	34.71	48.90	39.84	18.31	18.31
Mn(ppm)	13.58	2.90	11.04	11.04	12.55	12.55	12.76	12.76	13.74	13.74	11.14	11.14	13.28	13.28	12.76	12.74	13.45	13.45
Zn (ppm)	0.24	0.26	0.44	0.44	0.16	0.16	0.58	0.58	0.57	0.57	0.28	0.28	0.33	0.33	0.58	0.51	0.22	0.22
Cu(ppm)	0.67	0.61	0.36	0.35	0.34	0.34	0.53	0.53	0.39	0.39	0.31	0.31	0.48	0.48	0.53	0.37	0.44	0.44
B (ppm)	0.22	0.69	0.57	0.57	0.17	0.17	0.80	0.80	0.50	0.50	0.45	0.45	0.39	0.39	0.80	0.40	0.18	0.18

* Meaning of the number in the first row in the Table 4 was explained in Table 3a, b.

**EC values are clarified as mS/cm in 2006 and as % in 2007.

Table 5. Macro and micro element contents of fig leaves in the experimental orchard in 2006-2007 years*.

	1		2		3		4		5		6		7		8		9	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
N (%)	1.42	1.42	1.44	1.62	1.41	1.65	1.26	1.59	1.37	1.56	1.25	1.58	1.40	1.49	1.33	1.57	1.28	1.47
P (%)	0.10	0.10	0.10	0.10	0.09	0.11	0.10	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.11	0.05	0.09
K (%)	0.65	0.54	0.55	0.80	0.52	0.92	0.37	0.76	2.38	0.79	2.04	0.89	0.57	1.03	1.73	0.98	0.37	0.74
Ca (%)	3.83	4.53	3.05	4.59	2.91	5.00	3.31	4.76	2.98	5.09	2.92	4.88	2.73	4.72	2.78	4.64	2.74	4.38
Mg (%)	1.00	0.89	0.90	0.89	0.90	0.93	0.95	0.91	0.84	0.88	0.71	0.97	0.74	0.90	0.64	0.81	0.79	0.83
Cu (%)	2.58	1.80	1.96	3.33	1.57	3.30	2.10	2.60	1.34	2.04	1.80	2.00	1.56	2.31	1.44	2.31	1.29	2.03
Mn (ppm)	74.95	86.40	94.57	131.2	76.71	117.0	82.47	112.0	90.45	123.1	105.76	162.9	93.35	172.8	102.47	162.6	87.88	122.7
Zn (ppm)	6.19	10.80	8.04	11.39	5.93	12.05	5.35	11.00	5.76	10.64	9.27	17.34	9.01	16.44	6.69	11.38	4.23	10.99
B (ppm)	37.30	52.43	30.94	56.02	33.06	62.14	34.15	69.37	27.59	63.93	35.19	60.51	36.63	69.63	37.56	47.32	36.10	

* Meaning of the number in the first row in the Table 5 was explained in Table 3a, b.

Finally, that report was prepared from two years result of running project in Fig Research Institute to determinate of impacts using olive oil vegetation water on physical and chemical characteristics of soil, macro and micro element contents of leaves and tree growth, yield and quality on dried fig. In progressive years, it will be given more specific and comprehensive results and indicators from that project.

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