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DETERMINATION OF NUTRITION STATUS OF NECTARINES GROWN IN LAPSEKİA ROUND BY THE SOIL AND LEAF ANALYSİS

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ABSTRACT

An orchard survey was conducted to assess the nutrient status of nectarines in Lapseki district in Turkey. For this study, leaf and soil samples were collected from 28 nectarine orchards and necessary information was obtained about yield and fertilization. Soil samples were taken once a year at two depths of 0-20 and 20-40 cm. In view of the findings based on soil analyses the results are summarized below:

The texture of the soils analyzed was generally loamy and clay loamy. The calcium carbonate content of the soils was generally low while some units had no calcium carbonate at all. Soil salinity was mostly mid-level. The soil reaction was generally neutral or slightly alkaline. Seventy-five percent of the organic matter in the top and sub-soils were at insufficient levels. Although there were some deficiencies of iron and zinc, all of the macro and micro nutrents were generally at sufficient levels in the soils. According to the leaf analyses, which vary according to year, there were nutritional disorders with N at 26.7%, K at 13.3-26.7 %, Fe at 6.7-66.7 %, Mn at 33.3-40.0 and Zn at 6.7 % at insufficient levelsin the nectarine orchards. There were no nutritional problems with phosphorus, calcium, magnesium, copper and boron during the two years.

INTRODUCTION

Turkish peach production was 608 513 tons, according to data from 2014. In the same year, the district of Lapseki is reported to have produced 58 562 tonnes of peaches (Anonymous, 2014). Hale, Cristaven, R7, and R6 peach varieties and Rostana, Morisiana, Fantasia, Caldes 2000 andCaldes 85 nectarinevarieties are grown in the district of Lapseki and 60 percent of the peaches produced are also exported to other countries (Anonymous, 2009). A previous survey was carried out in the region and variation of the nutrient levels in the leaves was given in tables (Demirer *et al.*, 2003). To determine the fertility of agricultural land in the district of Lapseki 246 soil samples were taken. Researchers reported that the calcium carbonate content and pH of the soils were generally high, while the organic matter and phosphorus content were low. The soil was rich in potassium. Fe and Zn were low in 70% of the soils. Mn was low in 55% of the soils in orchards surveyed. The copper content of the soils was sufficient in 95% of the orchards. Peaches grafted onto peach rootstock grow well in soils with pH between 6-7 and sandy and clay loamy texture.

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Peaches can be grown in sandy soil with sufficient irrigation and good fertilization. Heavy, clay, damp and cold soils cause damage to good hard-nosed glued shoots of growing trees and from winter cold (Guven and Gur, 2002; Anonymous, 2008; Williamson and Crocker, 2000). Chlorosis seen in peach trees is caused by high soil pH, lime and active lime content of the soils. Chlorosis in peach cultivation is reported to start with over 12% active lime. The optimum pH is between 6.0 and 7.0 for peaches (Brohi, 1991 and Mortvedt, 1991). Chlorosis sensitivity increases or decreases depending on genetic differences. The peach-almond hybrid GF677 rootstocks are resistant to chlorosis while Nemaguard is sensitive (Romera *et al.*, 1991). The optimum nutrient levels of peach leaves have been summarized by Reuther and Robinson (1986), Leece *et al.* (1971), Leece (1976), and Shear and Faust (1980). The purpose of this study was to determine the nutritional status and problems of nectarines in the district of Lapseki in Turkey.

MATERIALS AND METHODS

The study was carried out in Turkey's major peach and nectarine production area located in Lapseki, producing approximately 10% of production. Twenty-eight mature nectarine orchards were selected and soil and leaf samples were collected for the purpose of required analyses from these

orchards. Eighty to 100 leaves from the middle of the annual shoots were taken between 15 July and 15 August for leaf analysis. Soil samples were collected from 0-20 and 20-40 cm depths at the same time as the leaf sampling. The soil samples were analyzed for texture (Oztan and Munsuz, 1961), pH (Anonymous, 1981), EC (Dellavalle 1992), organic matter (Nelson and Sommers, 1996), calcium carbonate (Hızalan and Ünal 1966), available P (Olsen and Dean, 1965), exchangeable K, Ca, Mg (Anon., 1981), available Fe, Mn, Zn, Cu (Lindsay and Norvell, 1969) and B (Anon., 1980). The leaf samples were prepared for macro and micronutrient analyses using wet digestion methods after washing, drying and grinding procedures (Anon., 1980). N was analyzed using the Kjeldahl method, P was analyzed spectrophotometrically with the vanadomolybdate phosphoric acid method (Anon, 1980), K, Ca, Mg, Fe, Mn, Zn and Cu were analyzed with AAS and B with the Azomethin -H method (Wolf, 1971).

RESULTS AND DISCUSSION

Soil Analysis Results

Tables 1 and 2 show the minimum, mean and maximum values of some physical and chemical properties of the soils surveyed. Table 3 summarize the percentage distribution of the nectarine orchards according to soil properties. In view of the findings, based on soil analyses, the results are summarized below:

The texture of the soils analyzed was generally loamy and clay loamy. The calcium carbonate contents of the soils were generally low, some units even had no calcium carbonate at all. Soil salinity was mostly mid-level. The soil reaction was generally neutral or slightly alkaline. According to these parameters the soils are suitable for nectarine production. Nectarine likes good infiltration, sandy, clayey and loamy texture soils. Soil pH should be between 6 and 7 (Guven and Gur, 2002; Anonymous, 2008; Williamson and Crocker, 2000). Sixty four percent and seventy one percent of the organic matter respectively in the top and sub-soils were at insufficient levels (Table 3). Farmers have not established a regular habit of manure use in the region. However, 2-3 tonnes/ha of manure is recommended for an orchard over 3 years (Anonymous, 1992). The P, K and Mg contents of both top and sub soils were generally sufficient and high in all the orchards. But the Ca content of both top and sub soils were at high levels.

Although there were some deficiencies of iron and zinc, all of the macro and micro nutrients were generally at high and sufficient levels in the soils. The Fe and Zn contents of the top soils were generally sufficient in all the orchards, but in the sub soils Fe and Zn were low in 21.4% and 50% of the orchards surveyed, respectively. High Ca content of the soils may be responsible for the negative effects on the availability of microelements. Moreover, high P and Cu in the soils would limit availability of Zn and Fe (Kacar and Katkat, 2006; Almeida, 1969). Copper in soil was often found to be high enough which could be attributed to the intensive use of agricultural pesticides containing copper. Although the high Cu levels in the soil were not reflected in leaf C, Fe and Mn uptake is likely to play an inhibitory role in the plant. Copper in soil is often found to be high enough which can be attributed to the intensive use of agricultural pesticides containing copper. The high copper in the soil was also thought to have played an inhibiting role in uptake of Fe and Zn by the plant.

Leaf Analysis Results

Tables 4 and 5 summarize the minimum, mean and maximum values of the leaf nutrient elements and the distribution of the nectarine orchards as percent according to these values. According to the leaf analyses which vary by year, there were nutritional disorders with N at 26.7%, K at 26.7-13.3%, Fe at 66.7-6.7, Mn at 40.0-33.3%, and Zn at 6.7% at insufficient levels in the nectarine orchards (Leece *et al.* 1970 &Leece 1976). There were no nutritional problems with phosphorus, calcium, magnesium, copper and boron over the two years. Parker (1993) suggested that 1363-2270 g/tree fertilizer containing 10% N and 10% K for 5-10 year old peach trees. However, the local farmers were using the recommended dose mostly of nitrogen fertilizer, which was 5-10 times more. Excess nitrogen is a fact that negatively affects the quality of the store. It is known that excess N may diminish the resistance of the plants against cold injury and fungal disease and it may also cause retardation of fruit maturity. For this reason using excess N fertilizers for peach trees should be avoided (Kacar and Katkat, 2006). In the first trial year, the potassium content of the leaves was low in 26.7% of the orchards and sufficient in others, and was low in 13.3% in the second year. The K contents of both top and sub soils were generally sufficient and high in all the orchards. It was observed that an average of 5-30 kg/ha K_2O should be applied as a water-soluble compound fertilizer.

Table 1. Some physical and chemical properties of nectarine orchard soil surveyed in Lapseki

Depth (cm)	Level	Saturation %	EC mmhos/cm	pH 1:2.5	Lime %	OM %
	Min.	34	0.53	5.6	0.4	0.6
0-20	Mean	52	1.23	6.8	2.7	2.1
	Max.	67	2.05	7.7	23.4	3.6
	Min.	30	0.51	6.2	0.4	0.4
20-40	Mean	53	1.12	7.2	3.3	1.5
	Max.	81	1.86	7.7	27.4	2.1

Table 2. Macro and micro element contents of the soils

P	K	Ca	Mg	Fe	Mn	Zn	Cu
(Available) ppm							
17	196	873	10	7.0	9.0	0.6	0.8
79	583	2963	340	105.4	104.6	62.9	52.1
213	1400	8659	1252	575	541	568	321
11	67	1346	32	2.7	5.2	0.2	4.3
43	460	3241	290	4.4	12.7	1.0	10.1
115	892	8765	1006	7.9	23.0	2.4	43.2

Table 3. Percent distribution of the nectarine orchards according to some physical and chemical properties

Soilproperties	Level	Evaluation	(0-20 cm) %	(20-40 cm) %
Saturation, % (Gedikoğlu 1990)	30-50	Loamy	28.6	28.6
	51-70	Clayloam Clay	71.4	67.9
	71-110			3.5
pH (Eyüboğlu 1999)	5.6-6.5	Slightlyacide	14.2	3.6
	6.6-7.5	Neutral	42.9	35.7
	7.6-8.5	Slightly alkaline	42.9	60.7
	>8.5	Strong alkaline		
EC_{25}, ds m^{-1} (Dellavalle 1992)	>0.40	Saltless		3.5
	0.40-0.80	Slightlysalty	14.3	21.5
	0.81-1.20	MediumSalty	42.9	46.4
	1.21-1.60	Salty	42.8	28.6
$CaCO_3$,% (Çağlar 1958)	<1.0	Verylow	35.7	7.1
	1.0-5.0	Low	32.1	53.6
	5.1-15.0	Medium	3.5	14.3
	15.1-25.0	High	10.7	3.5
	>25.0	Veryhigh	18.0	21.5
OrganicMatter, % (Anonymous 1985)	<1.0	Verylow	14.3	17.9
	1.0-2.0	Low	50.0	53.6
	2.1-3.0	Medium	21.4	21.4
	3.1-4.0	High	14.3	7.1
P, mg kg^{-1} (Anonymous 1985)	7.1-20.0	Medium	10.7	42.9
	>20.0	High	89.3	57.1
K, mg kg^{-1} (Anonymous 1980)	100-140	Low		3.5
	140-199	Medium	7.1	14.3
	199-250	Good	17.8	7.1
	250-319	High	14.3	14.3
	>319	Veryhigh	75.1	60.8
Ca, mg kg^{-1} (Anonymous 1980)	715 – 1439	Low	14.3	14.3
	1440 – 2866	Medium	28.6	25.0
	> 2866	High	57.1	60.7
Mg, mg kg^{-1} (Anonymous 1980)	0-44	Low	17.9	17.9
	54-114	Medium	10.7	14.3
	>114	Good	71.4	67.8

Table 4. Some leaf nutrient contents of nectarines

Year		N	P	K	Ca	Mg	Fe	Mn	Zn	Cu	B
		%					ppm				
	Min.	0.8	0.13	1.4	1.7	0.37	31	18	14	7	26
First year	Mean	2.3	0.36	2.0	2.3	0.52	66	53	19	9	37
	Max.	3.1	0.54	2.7	3.5	0.72	105	104	26	12	46
	Min	2.7	0.15	1.4	1.2	0.34	66	29	14	5	37
Second year	Mean	3.5	0.19	2.3	1.8	0.42	116	47	24	7	48
	Max.	4.4	0.25	3.0	2.4	0.53	150	85	33	11	66
Opt.		2.2	0.11	1.5	1.2	0.30	70	40	15	5	20
		3.2	0.25	3.0	2.7	0.80	230	160	50	16	60

Table 5. Percent distribution of the nectarine orchards according to nutrient contents of leaves

Years	Nutritional (status%)	N	P	K	Ca	Mg	Fe	Mn	Zn	Cu	B
		%					ppm				
	Low	26.7	-	26.7	-	-	66.7	40	6.7	-	-
First year	Sufficient	73.3	33.3	73.3	93.3	100	33.3	60	93.3	100	100
	High	-	66.7	-	6.7	-	-	-	-	-	-
	Low	-	-	13.3	-	-	6.7	33.3	6.7	-	-
Second year	Sufficient	26.7	100	86.7	100	100	93.3	66.7	93.3	100	100
	High	73.3	-	-	-	-	-	-	-	-	-

The leaf Ca content was high and/or at sufficient levels in both years. The iron content of the leaves in the first year of trial was inadequate in 66.7% and sufficient in others, while it was low in 6.7% in the second year. The Fe contents of the top soils were generally sufficient in all the orchards, but were low in 71.4% of the sub soils and sufficient in other orchards surveyed. In the majority of soils adequate iron was found in the second year of the experiment. However, there was high lime and iron uptake inhibiting factors such as high pH in some orchard soils. For this reason farmers applied a majority of ferrous preparations to soil and leaves. It is recommended to use 0.5-1.0 kg/da iron-kileyt per year with irrigation systems for the treatment of iron deficiency (Costa *et al.*, 1992).

Mn content of the leaves in the first year of trial was inadequate in 40%, while it was low in 33.3% in the second years. All of the orchard soils contained manganese at a sufficient levels. Although all studied orchard soils had adequate Mn, it was lower in the leaves of some orchards. The reasons for this vary with high soil K, Ca, Mg and Cu negatively affecting the uptake of Mn (Lucas et Knezek, 1972). Fe applications were made by growers, but the importance of Mn was not yet understood. In orchards where manganese was deficient it was suggested that the Fe/Mn ratio balance was impaired against Mn. Conducting studies on the effectiveness and validity of Mn foliar application would be helpful. Zn contents of the leaves was sufficient in 93.3% of

the orchards in the both years. Although the Zn content of the top soils was at sufficient and/or high levels, the sub soils generally contained low amounts of Zn. All of the top soil in peach orchards contained enough zinc, while 46.4% of sub-soils were deficient, 21.4% were critical, and it was determined at sufficient levels in 32.2%. The zinc content of the soil is mostly adequate despite the irregularities related to zinc in the leaves as antagonistic effects between high P and Ca in the soil are possible binding the Zn (Kacar and Katkat, 2006). The leaf Cu content was at sufficient level in the both years. Cu content of the top soils was at sufficient levels in 92.9%, while it was adequate in 96.5% in sub-soils. Copper in the soil may be mostly due to the presence of sufficient and high copper used in agricultural pesticides. Although the high Cu level in the soil was not reflected in the leaf Cu, Fe and Mn uptake was likely to play an inhibitory role in the plant. In the two years the boron content of the leaves was found to be adequate in all the orchards. However, some physiological deteriorations that may be induced by boron deficiency were observed in some orchards. In this regard, there is a need for further field trials.

Conclusions

Soil analysis results showed that there was a salinity problem because of excess fertilizer application. This problem could seriously increase in future years. Growers who use wells must pay special attention to irrigation water salinity. As a result, yield and quality are important to increase exports and domestic consumption for large nectarine growing operations. Therefore, proper fertilization programs developed by determining the characteristics of the soil should be used to avoid unbalanced and ignorant fertilization practices. Fertilization practices should be based on leaf and soil analysis. Otherwise ignorant fertilization practices will lead to pollution of the environment and economic losses.

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