

DETERMINATION OF THE NUTRIENT STATUS OF PEACHES GROWN IN LAPSEKI

Serap Soyergin

Canakkale Onsekiz Mart University, Lapseki Vocational College, Turkey

Abstract

An orchard survey was conducted to assess the nutrient status of peaches in Lapseki district in Turkey. For this study, leaf and soil samples were collected from 28 peach 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 nutrients 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 21.4%, K at 5.5-35.7%, Fe at 10.7-82.1, Mn at 25% and Zn at 35.7% at insufficient levels in the peach orchards. There were no nutritional problems with phosphorus, calcium, magnesium, copper and boron during the two years.

Key words: *Peach, nutrient status, soil analysis, leaf analysis*

1. 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 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. 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 (Güven 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 6.0-7.0 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 peaches in the district of Lapseki in Turkey.

2. MATERIALS AND METHODS

The study was carried out in Turkey's major peach production area located in Lapseki, producing approximately 10% of production.

Twenty-eight mature peach 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).

3. RESULTS AND DISCUSSION

3.1. 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 and 4 summarize the percentage distribution of the peach orchards according to soil properties.

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

Depth (cm)	Level	Saturation %	EC mmhos/cm	pH 1:2.5	Lime %	OM %
0-20	Min.	32	0.52	5.4	0.4	0.9
	Mean	55	1.18	7.1	5.1	1.9
	Max.	70	2.39	7.6	23.4	3.6
20-40	Min.	33	0.37	5.9	0.4	0.4
	Mean	54	1.12	7.3	6.6	1.5
	Max.	75	2.01	7.7	33.0	3.0

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 peach production. Peach likes good infiltration, sandy, clayey and loamy texture soils. Soil pH should be between 6-7 (Güven & Gür, 2002; Anonymous, 2008; Williamson & Crocker, 2000).

Table 2. Macro and micro element contents of the soils

Depth (cm)	Level	P	K	Ca	Mg	Fe	Mn	Zn	Cu
(Available) ppm									
0-20	Min.	1	92	965	7	3.1	1.0	2.0	0.1
	Mean	60	561	3283	244	251.5	82.4	74.2	32.6
	Max.	148	1238	6117	562	4504	1007	638	379
20-40	Min.	11	108	865	12	2.1	2.0	0.1	0.1
	Mean	38	388	3303	214	4.3	11.2	1.7	4.6
	Max.	172	1121	6215	1050	12.3	27	24	11.7

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

Soil properties	Level	Evaluation	(0-20 cm) %	(20-40 cm) %
Saturation, % (Gedikoğlu 1990)	30-50	Loamy	28.6	28.6
	51-70	Clay loam	71.4	67.9
	71-110	Clay		3.5
pH (Eyüboğlu 1999)	5.6-6.5	Slightly acide	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	Slightly salty	14.3	21.5
	0.81-1.20	Medium Salty	42.9	46.4
	1.21-1.60	Salty	42.8	28.6
CaCO ₃ ,% (Çağlar 1958)	<1.0	Very low	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	Very high	18.0	21.5
Organic Matter, % (Anonymous 1985)	<1.0	Very low	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

Table 4. Percent distribution of the P, K, Ca and Mg content in soils

Soil properties	Level	Evaluation	(0-20 cm) %	(20-40 cm) %
P, mg kg ⁻¹ (Anonymous 1985)	7.1-20.0 >20.0	Medium High	10.7 89.3	42.9 57.1
K, mg kg ⁻¹ (Anonymous 1980)	100-140 140-199 199-250 250-319 >319	Low Medium Good High Very high	7.1 17.8 14.3 75.1	3.5 14.3 7.1 14.3 60.8
Ca, mg kg ⁻¹ (Anonymous 1980)	715 – 1439 1440 – 2866 > 2866	Low Medium High	14.3 28.6 57.1	14.3 25.0 60.7
Mg, mg kg ⁻¹ (Anonymous 1980)	0-44 54-114 >114	Low Medium Good	17.9 10.7 71.4	17.9 14.3 67.8

Seventy-five percent of the organic matter 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.

3.2. Leaf Analysis Results

Tables 5 and 6 summarize the minimum, mean and maximum values of the leaf nutrient elements and the distribution of the peach orchards as percent according to these values.

According to the leaf analyses which vary by year, there were nutritional disorders with N at 21.4%, K at 5.5-35.7%, Fe at 10.7-82.1, Mn at 25%, and Zn at 35.7% at insufficient levels in the peach 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).

Table 5. Some leaf nutrient contents of peaches

Year		N	P	K	Ca	Mg	Fe	Mn	Zn	Cu	B
		%					ppm				
First year	Min.	1.0	0.05	1.1	1.7	0.35	28	29	9	6	27
	Mean	2.3	0.29	1.8	2.5	0.50	60	48	16	9	38
	Max.	2.8	0.68	2.7	3.9	0.67	116	84	20	12	60
Second year	Min	2.6	0.18	1.6	1.3	0.32	60	22	19	6	34
	Mean	3.5	0.21	2.1	1.8	0.43	12	51	23	9	43
	Max.	4.3	0.27	3.3	2.9	0.51	194	118	33	36	51
Opt.		2.2	0.11	1.5	1.2	0.30	70	40	15	5	20

Table 6. Percent distribution of the peach orchards according to nutrient contents of leaves

Years	Nutritional status(%)	N	P	K	Ca	Mg	Fe	Mn	Zn	Cu	B
		%					ppm				
First year	Low	21.4	14.3	35.7	7.0	-	82.1	25.0	35.7	-	-
	Sufficient	78.9	25.0	64.3	64.4	100	17.9	75.0	64.3	100	100
	High	-	60.7	-	28.6	-	-	-	-	-	-
Second year	Low	-	-	5.5	-	-	10.7	25.0	-	-	-
	Sufficient	21.4	96.5	93.0	96.5	100	89.3	75.0	100	96.5	100
	High	78.9	3.5	3.5	3.5	-	-	-	-	3.5	-

In the first trial year, the potassium content of the leaves was low in 35.7% of the orchards and sufficient in others, and was low in 3.5% 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 K₂O should be applied as a water-soluble compound fertilizer.

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 82.1% and sufficient in others, while it was low in 50% 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 were found to be at insufficient levels in 25% of orchards in both 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 64.3% of the orchards in the first year. In the second year the Zn content of the leaves in all orchards was at adequate levels. 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 first year, while it was sufficient in 96.5% of the orchards in the second year. 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.

4. 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 peach 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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