Plant nutrient status of sour cherry (*Prunus Cerasus* L.) cultivars grown in Aegean region of Turkey

Bülent Topcuoğlu and M. Kubilay Önal

Abstract— **The study was conducted on 29 sour cherry (Prunus cerasus L.) cultivars collected from Aegean Region of Turkey for assessing the plant nutrient concentrations and their relations with soil characteristics. Total quantities of N, P, K, Ca, Mg, Fe, Zn, Mn and Cu accumulated within the leaf and fruits were used to make provisional estimates of the uptake of plant mineral essential nutrients by the cherry cultivars used in this study. All investigated nutrients were recorded significantly different within the cultivars. The concentrations of all elements except Zn in sour cherry leaves were ranged in referenced limits. Fruit mineral contents of sour cherry cultivars were recorded in higher concentrations both in 1507 and 1525 cultivars for all elements. In low organic matter and slightly alkaline soil conditions, most of sour cherry cultivars contained Zn in deficiency level and most of cultivars also contained low N levels in leaf tissues. Nitrogen and Zn are likely to be a major component of fertiliser programme for evaluated cultivars in possible cultural conditions. Leaf mineral concentrations were recorded higher than that of fruit minerals. Genotype 1512 contained the least mineral contents for all elements both in leaf and fruit tissues. Among the Sour cherry cultivars, the concentration of plant leaf nutrients in 1515 and 1530 cultivars were higher than the other investigated cultivars at the same soil conditions. Application of these data in future studies has potential utility within the fields of agro-biodiversity conservation and nutrition of sour cherry cultivars.**

Keywords— **Cherry cultivars, Mineral status, Genotypic variability.**

I. Introduction

Sour cherry is widely planted in the Central Anatolia and Aegean Region of Turkey. These districts have the best climatic factors, such as brillant illumination, low temperature and great difference in temperature between day and night. A few studies [1, 2, 3, 4] have revealed wide variability in cherry types and varieties for different characters.

Differences among species and cultivars in plant response to mineral nutrient deficiency have been reported by many authors. Nutrient concentration and uptake by different plant cultivars are the most important criteria for identifying the existing genetic specificity of plant nutrition [5]. The tolerance in a given plant species or genotype to nutrient stress is closely related to its nutrient use efficiency. For a given genotype, nutrient use efficiency is reflected by the ability to produce a high yield in a soil that is limiting in one or more mineral nutrients for a standard genotype [6]. The exploration of genotypic variability in the responses of sour cherry cultivars to mineral nutrient deficiency may allow identification of physiological or biochemical tools to screen tolerant varieties and to improve the productivity of this plant. Variability among cultivars in potential for uptake of mineral nutrients is caused by factors which are at least partly under genetic control. However, balanced nutrition is required for maximum tree performance and foliage is the tissue most generally used in diagnosis.

Although there is extensive research on the pear, literature does not report enough data on the nutritional properties of pear based on this variety. The objective of this study was to determine mineral status of 29 sour cherry (Prunus cerasus L.) samples those were collected from Aegean Region of Turkey.

Bülent Topcuoğlu, is with Vocational School of Technical Sciences, Akdeniz University; Antalya, Turkey;

II. Material And Methods

A study was conducted in Aegean Region of Turkey for assessing the leaf nutrient contents of early-ripening sour cherry (Prunus cerasus L.) cultivars. Samples were collected as scion woody in August from an area between 38°45′-41°10′ N latitude and 27°50′-37°05′ E longitude. Elevation was ranged from 275 to 1150 m. A total of twenty-nine types were collected from wild and feral populations growing Aegean Region of Turkey. Trees have been marked for further visit and recollection. The samples were T-budded onto *Prunus mahaleb* seedlings in the nursery. Budded trees were planted in the experimental fields with 6x 6 m. spacing with tree replicates for each type. Routine cultural practices were performed. After three years of growth, plant leaf samples and fruit samples were collected and analyzed.

Soil characteristics of experimental soil can be summarized as; sandy loam texture, slightly alkaline reaction, low $CaCO_3$, low organic matter, high exchangeable K and Ca contents, normal levels of N and plant available P, K, Ca, Mg, Fe, Zn, Mn and Cu. These values represent the typical Aegean region soil characteristics in Turkey.

Leaf samples were taken on mid may, with five replications. Fruit samples were collected at maturity stage. Leaf and fruit samples were dried at 65 ºC for 48 h and ground for determination of plant analysis. In dried plant samples, total N were determined by Kjeldahl method. Plant tissues were digested in aqua regia (1:3 HNO_3/HCl) for mineral analysis. In wet ashed plant samples total P were determined by molibdophosphoric yellow colour method, total K, Ca, Mg, Fe, Zn, Mn and Cu were determined by atomic absorption spectrophotometry (FAAS) under optimised measurement conditions.

Statistical analyses were performed by using SPSS-16 for Windows program.

III. Results And Discussion

In this study, total quantities of plant nutrients accumulated within the leaf and fruits were used to make provisional estimates of uptake of macro and micro plant nutrients by sour cherry trees. Table 1 shows that the plant leaf mineral concentrations of sour cherry cultivars and statistic differences among the cultivars. All investigated nutrients were recorded significantly different within the cultivars. Plant leaf mineral contents of sour cherry cultivars were recorded in higher concentrations both in 1515 and 1530 cultivars for all elements. But leaf mineral contents of sour cherry cultivars were recorded in lower concentrations both in 1512 and 1519 cultivars for all elements.

Leaf nitrogen concentrations of many cultivars were recorded in nitrogen deficiency level. The concentrations of all elements except Zn were recorded in normal plants nutrient limits. Only cultivar 1519 contained Zn concentration in acceptable range according to referenced limits. Slightly alkaline reaction of experimental soil could be a cause of zinc deficiency in evaluated cultivars. This also shows that the genotypic sensitivity of these sour cherry cultivars to zinc nutrition in slightly alkaline soil conditions and to nitrogen nutrition in low soil organic matter. According to these data, it is important to planning a balanced nitrogen and zinc fertilization programme for these cultivars in low soil organic matter and slightly alkaline soil conditions.

Table 2 shows that the fruit mineral concentrations of sour cherry cultivars and statistic differences among the cultivars. As in leaf data, all investigated nutrients were recorded significantly different within the cultivars. Fruit mineral contents of sour cherry cultivars were recorded in higher concentrations both in 1507 and 1525 cultivars for all elements. But fruit mineral contents of sour cherry cultivars were recorded in lower concentrations both in 1512 and 1538 cultivars for all elements. Leaf mineral concentrations were recorded higher than that of fruit minerals. According to these data, genotype 1512 has contained the least mineral contents for all elements both in leaf and fruit tissues.

IV. Conclusion

In breeding programs priorities are generally given to traits as adaptability to environmental conditions, high yield and fruit quality or disease resistance. However, mineral nutrition may create marked effects on above mentioned characteristics. In this regard, significant differences were found among the sour cherry cultivars. Among the Sour cherry cultivars, the concentration of plant leaf nutrients in 1515 and 1530 cultivars were higher than the other investigated cultivars at the same soil conditions. A parallel study to this research conducted by authors also showed that these cultivars were taken the first place according to weighed-ranked method with regard to some characteristics such as yield, fruit size and earliness. These results could be helpful in development of reliable screening parameters for selection of high nutrient containing and high nutrient-use efficient cultivars in breeding programs.

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TABLE I. LEAF MINERAL ELEMENT CONCENTRATIONS OF 'SOUR CHERRY CULTIVARS (P. CERASUS L.) AT 120 DAYS AFTER FULL BLOOM AND THE THREE YEAR AFTER GRAFTING.

Cultivar No.	Cultivars	N	P	K	Ca	Mg	Fe	Zn	Mn	Cu
		%, dw					mg kg^{-1}, dw			
1	1507	2,21	0,34	1,84	1,90	0,65	50,4	15,8	62,4	9,6
2	1509	1,97	0,29	1,54	1,70	0,51	45,9	17,1	54,0	10,2
3	1510	2,12	0,35	1,55	1,74	0,52	41,0	15,5	58,4	8,4
4	1511	1,99	0,31	1,54	1,72	0,52	43,5	15,3	54,9	8,5
5	1512	2,60	0,37	2,05	2,25	0,67	56,7	21,0	71,4	12,8
6	1514	1,97	0,29	1,54	1,70	0,51	42,9	15,1	54,0	8,2
7	1515	1,84	0,25	1,44	1,60	0,43	40,3	14,2	47,7	7,7
8	1517	2,09	0,33	1,63	1,81	0,54	45,6	16,1	57,4	8,7
9	1518	2,48	0,35	1,86	2,06	0,62	51,9	18,3	68,4	9,9
10	1519	3,38	0,52	2,64	2,92	0,88	75,7	26,0	92,7	15,0
11	1520	1,90	0,28	1,40	1,69	0,49	40,3	14,6	52,0	7,5
12	1522	1,94	0,29	1,52	1,68	0,50	42,4	16,0	53,4	7,6
13	1523	2,06	0,33	1,63	1,91	0,52	48,2	15,0	55,7	9,2
14	1524	1,92	0,28	1,60	1,61	0,50	42,9	15,8	52,7	8,0
15	1525	2,26	0,33	1,77	1,85	0,59	46,3	17,4	62,0	9,4
16	1326	1,95	0,26	1,58	1,64	0,45	41,3	15,6	50,0	7,9
17	1528	1,94	0,29	1,52	1,68	0,53	42,4	16,0	58,4	8,1
18	1529	1,85	0,25	1,34	1,55	0,48	42,3	14,2	50,7	9,7
19	1530	1,82	0,27	1,43	1,68	0,45	37,8	12,7	48,0	7,6
20	1531	2,11	0,31	1,65	1,83	0,55	46,1	16,3	58,0	8,8
21	1532	1,80	0,27	1,44	1,65	0,45	40,3	13,2	52,7	6,7
22	1533	1,99	0,25	1,56	1,72	0,57	43,5	16,3	54,7	8,3
23	1535	2,24	0,33	1,65	1,83	0,58	46,8	17,2	61,4	9,3
24	1538	2,19	0,37	1,51	1,81	0,54	45,6	16,1	57,4	8,7
25	1539	1,87	0,28	1,71	1,58	0,49	43,8	14,0	50,0	7,6
26	1540	2,21	0,34	1,74	1,90	0,60	52,4	16,1	67,4	8,6
27	1541	1,97	0,29	1,58	1,70	0,55	46,9	15,1	55,0	8,2
28	1542	2,02	0,27	1,56	1,74	0,55	44,0	14,5	55,4	8,4
29	1543	1,99	0,29	2,03	1,82	0,56	41,5	16,3	54,5	8,1
Mean		2,09	0,31	1,65	1,81	0,50	42,6	16,1	52,4	9,7
Min-Max Values		1,82-3,38	0,27-0,50	1,43-2,64	1,58-2,92	0,47-0,88	39,8-73,7	14-26	50-92,7	7,6-14
St. Deviation		0,311	0,464	0,254	0,269	0,081	6,793	2,401	8,551	1,281
Sig. (2-tailed)		**	**	**	**	**	**	**	**	**
Mineral limits [7]		2,2-3,4	0,16-0,40	1-3	0,7-3	0,4-0,9	nls	25	nls	nls

** : Significant levels at 1 %; nls: no limitation set