

MINERAL NUTRITION OF CITRUS TREES

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Abstract

Visual observation shows the wide spread deficiency of N, P, K, Zn, and Fe in citrus orchards. To monitor the status of N, P, K and micronutrients status in soil and plants, a survey was conducted in Sargodha district to collect soil and plant samples from citrus orchards during 2002. Two hundred eighty six citrus orchards were surveyed for this purpose. The analysis results of soil indicated that 20% soil samples were deficient in OM, 67% in P and 2 % in K. Similarly the plant analysis indicated that 45% plant samples were deficient in P and 30% in K. From micronutrients, Zn was deficient in soil in 82% cases, B 38%, Mn 17%, Cu and Fe in 1% cases. Analysis of spring growth samples after 5-7 months from non bearing twigs showed that 91% orchards were deficient in Zn whereas the other micronutrients were well supplied. It was, therefore, proposed to apply these nutrients on regular basis and with good management.

INTRODUCTION

In Punjab, citrus and mango are the major fruits that are grown and exported. Citrus is a tropical plant but in Pakistan is grown in region where summer and winter temperature variation is large and faces extreme seasonal variation. Moreover, high pH and presence of free lime in soil cause nutritional disorder due to immobilization of micronutrients in soil (Siddique et al., 1992). Under tropical climates to check their vegetative growth and to induce uniform flowering the farmers withhold fertilizer and irrigation. Unlike tropical climate, under our climate low temperature during winter stop the growth and plant remains under stress and flower uniformly. It has been observed that citrus sprouting during fall (September to October) shows severe yellowing that persists up to spring (February to March) and summer. During spring plant put flowers and new growth. This yellowing is due to deficiencies of Zn and Fe (Siddique and Rashid, 1993). This phenomenon is very common in Pakistan on citrus plant. It is also known as lime

induced iron chlorosis. Die back of shoots is another common problem in citrus, which is initially a combine effect of micronutrients (Cu, Zn) deficiency and later on taken over by fungus (Ereivan and Keraca, 1979 and Shyam, 1997).

MATERIALS AND METHODS

A survey of citrus orchards was conducted in Sargodha district during August and September, 2002. Sargodha district comprised of Sargodha, Bhalwal and Shahpur tehsils was divided into 234 equal locations. From each location one citrus grower was interviewed to seek the information regarding the practices being followed for citrus production to sort out the possible reasons of its yield decline. During the interviews the information was gathered about the use of fertilizer, intercropping and pest attacks. The farmers interviewed were 114 from tehsil Sargodha, 105 from tehsil Bhalwal and 67 from tehsil Shahpur.

In addition two composite soil samples were taken from 5-7 individual samples from each site from depth of 0-15 and 15-

Table 1: Fertilizer recommendation for citrus

Nutrient	Dose g/plant	Time of Application
Nitrogen (N)	750	Whole P, K, Zn, and half N were applied at the end of Feb and remaining half N during July.
Phosphorus (P)	500	
Potash (K)	500	
Zinc (Zn)	50	

30 cm. One representative plant sample taken from 20-25 trees were also collected. The soil and plant samples were properly labeled, air/oven dried, ground and stored in plastic bottles for analysis. For P, K and micronutrients (Zn, Cu, Fe and Mn) soil was extracted with AB-DTPA extractant (Soltanpour and Workman 1979). Plant samples were digested with HNO₃ and HClO₄ (Rayan et al; 1999) and determined by Atomic Absorption Spectrophotometer. For B determination, the soils were extracted with HCl (Rashid et al., 1984) and determining by using Spectrophotometer (Mills and Jones 1996). Data were compiled and classified into deficient (Low), medium and high concentration.

RESULTS & DISCUSSION

The perennial fruit plants like citrus require nutrition regularly for maintenance and fruit development, but most of the growers do not use the balance nutrition. A survey conducted of citrus growing area

of Sargodha district showed that only 11% growers used NPK, 62% NP and majority of growers (83%) used nitrogen. Only 17% growers used FYM for fruit production without applying any fertilizer. The use for micronutrients is practically zero. About 60% farmers do intercropping mainly with wheat and legumes for fodder in orchards (Nadeem et. al., 2004). However, recommended doses of nutrients for citrus orchards are given in Table 1.

Nutritional Deficiency in Citrus Orchards

For nutritional survey of citrus growing area (District Sargodha) total 334 orchards were surveyed for soil and plant samples collected from tehsils Bhalwal, Sargodha and Shahpur. Out of soil samples 20% were deficient in organic matter, 67% in P and 2% in K (Table 2) whereas in the case of plant samples 45% were deficient in P and 30% in K.

So far as micronutrients are concerned,

Table 2: Macronutrients status of soil and plant under citrus orchards in Sargodha.

Soil			
Parameter	Unit	Range	Deficient
Organic matter	%	0.04-1.60	20
P	mg kg ⁻¹	0.009-22.39	67
K	“	24-469	2
Plant			
P	mg kg ⁻¹	0.038-0.222	45
K	“	0.59-2.90	30

82% soil samples were deficient in Zn, 17% in Mn, 1% in each Cu and Fe and 62% in boron. On the other hand 94% plant samples were deficient in Zn and 13% in boron. Others nutrients were well supplied (Table 3).

From one year study it was concluded that citrus orchards are deficient in NPK along with micronutrients like Zinc (Zn) and Boron (B). Visual symptoms of Iron deficiency were common which are not reflected in plant analysis and need further investigation to determine the reason. Similar observations were reported by Kohli et al., 1997, Sarivastava et al., 1995 and Sarivartava and Singh, 1999B.

Physico Chemical Characteristics of Citrus Fruit

A large quantity of citrus is now exported to other countries that need quality. Good quality fruit are compact, shiny with smooth skin with average size between 75 to 85 cm. The fruits harvested in early December, had 45% juice, 7.5% total sugar, 3.4% reducing sugar and 4.1% non reducing sugar, 11% TSS, 1.3% acidity, pH 3.5 and 39 mg/100g vitamin C.

Nutrient Uptake By Citrus Tree

A tree giving about 80-100 kg fruit removes about 21 g P, 220 g K, 70 mg Cu, 175 mg Zn, 1042 mg Fe and 91 mg Mn. Similarly some more nutrition is required for putting new growth. It indicates that the citrus tree removes a small quantity of nutrients from soil and its need for P and micronutrients are not high (Koo, 1982, Chahil et al; 1991) but the problem is their availability, therefore it is necessary to apply these nutrients on regular basis and with good management.

Table 3: Micronutrient (AB-DTPA extractable) status of soil and plants in citrus orchards of Sargodha district

Soil				
Element	Total Samples	Range (mg kg⁻¹)	Mean (mg kg⁻¹)	Deficiency (%)
Copper	334	0.24-6.2	2.20	1
Zinc	334	0.06-4.7	0.71	82
Iron	334	0.55-24.1	7.40	1
Manganese	334	0.25-8.9	3.00	17
Boron	333	0.04-1.30	0.67	62
Plant				
Element	Total Samples	Range (mg kg⁻¹)	Mean (mg kg⁻¹)	Deficiency (%)
Copper	286	5-23	9.8	0
Zinc	286	8-25	14.2	94
Iron	286	73-383	216.2	0
Manganese	286	19-94	41.6	0
Boron	190	10.6-80.7	36.20	13

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