

# Phosphorus and Iron Induced Zinc Deficiency in Mandarin (*Citrus reticulata*) of Kodagu, India

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## INTRODUCTION

The cultivation of Coorg Mandarin (*Citrus reticulata*) in Kodagu, Karnataka, India declined from 12000 ha in the 1980s to 3000 ha two 2 decades later. This might be due to micronutrient disorders, especially Zn deficiency leading to a decline in yield and quality (Chadha 1982). The paradox of the situation is that the soils (alfisols) were acidic with a high amount of organic matter (1.5 – 2%), a high level of available Zn and without any tree  $\text{CaCO}_3$ . Thus, this study was initiated to understand the cause of low Zn uptake by mandarin oranges.

## METHODS

A survey was conducted in the Mandarin orchards of Kodagu in Karnataka, India in 2002. Young mature leaves were collected from shoots that were four to seven months old. Soils were sampled from the top layer (0 – 20 cm depth) at a distance of 1 – 1.2m from mandarin tree trunks identified as the active root zone. The sampled leaves were acid washed and analysed for Ca, Fe, K, Mg, Mn and Zn. The soil samples were dried and analyzed for available Fe, Mn, P and Zn and in 0.005M DTPA extracts, and for pH and Organic Matter (OM) content. Soil parameters were correlated with leaf- Zn to examine the factors that might be causing low Zn concentrations in mandarin leaves.

## RESULTS AND DISCUSSION

The results of the orchard survey are presented in Table 1.

**Table 1. Leaf and soil nutrient status of Mandarin orchards of Konkan.**

Orchard No	Soil Characteristics						Leaf nutrient status	
	pH	Organic Matter	Zn	Mn	Fe	P	Zn	Mn
				mg kg <sup>-1</sup>				
1	5.2	3.0	2.2	2.7	24.1	17.4	8	81
2	5.5	1.4	1.0	24.9	31.1	28.0	13	36
3	5.5	1.4	1.6	6.8	39.0	29.0	21	65
4	5.2	2.0	0.8	2.1	39.0	128.0	21	73
5	5.9	2.6	2.1	6.2	32.7	53.0	8	12
6	5.7	2.1	1.2	1.5	29.2	23.0	14	81
7	5.3	3.4	2.9	5.2	23.6	58	6	31
8	4.5	2.0	3.5	8.3	28.8	27	8	25
9	5.0	1.6	4.2	20.8	25.7	163	14	37
10	5.3	1.5	2.7	43.7	37.1	23	7	31
11	4.9	5.1	3.3	21.6	24.1	25	14	37
12	4.5	2.1	1.3	36.6	21.8	77	10	38
	5.2	2.3	2.2	15.0	29.6	54.2	11.6	46

The results indicate that the soils of the surveyed Mandarin orchards were acidic ( pH 4.9-5.2), high in available Zn ( $2.2 \text{ mg kg}^{-1}$  Zn) and moderate in OM (2.3%). Even though these soil parameter would facilitate higher Zn uptake rates, the plants showed insufficient growth, visible Zn-deficiency symptoms and low leaf-Zn ( $11.6 \text{ mg kg}^{-1}$ ). Reasons for the low Zn uptake might be the high available P, Fe and Mn concentrations ( $54.1$ ,  $29.6$  and  $5.0 \text{ mg kg}^{-1}$ , respectively), which are known to be antagonistic to uptake at the root surface and to translocation. The chronic Zn deficiency contributed to the decline and resulted in the decrease (Bojappa and Bhargava, 1993).

#### **REFERENCES**

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