



Plant tissue analysis of Nagpur Mandarin (*Citrus reticulata* Blanco) orchards in Jhalawar district of Rajasthan

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Abstract : Analysis of Nagpur Mandarin leaf samples revealed that 22.22 per cent were found deficient, 33.33 per cent low, whereas 38.88 per cent were found optimum in nitrogen content. An examination of Nagpur Mandarin leaf samples revealed that 11.11 per cent were found optimum, 44.44 per cent in high range, however, 44.44 per cent of leaf samples were found in excess phosphorus content. Analysis of Nagpur Mandarin leaf samples revealed that 100 per cent samples of these plants were found optimum in potassium content. Analysis of Nagpur Mandarin leaf samples revealed that 16.66 per cent were in deficient range followed by 11.11 per cent in low range, 5.55 per cent were optimum, 5.55 per cent high and 61.11 per cent samples of these plants were found in excess Fe content. Analysis of Nagpur Mandarin leaf samples revealed that 33.88 per cent deficient, 44.44 per cent low and 16.66 per cent samples of plants were found optimum in Mn content. Analysis of Nagpur Mandarin leaf samples revealed that 16.66 per cent optimum, 5.55 per cent high and 77.77 per cent plant samples were found excess in Cu content. Analysis of Nagpur Mandarin leaf samples revealed that 22.22 per cent optimum and 77.77 per cent these leaf samples were found excess in Zn content. The nitrogen content in growing plants had significant and negative correlations with Mn and Cu. The Fe content in growing plants had significant and positive correlations with Mn and Cu.

Key Words : Nagpur Mandarin, Orchards, Deficient, Low, High, Excess

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INTRODUCTION

Nagpur Mandarin (*Citrus reticulata* Blanco) cultivation has become quite popular for more than three decades in Jhalawar district of Rajasthan state. Jhalawar district is one of the major Nagpur Mandarin growing belt producing one of the finest quality of mandarin in Rajasthan state over an acreage of 17000 hectares and is synonymously referred to as 'Chhota Nagpur' of our country. Owing to its high nutritive value, prolific and profuse bearing and its cultivation is on increase in every part of Jhalawar district. It is a value added horticulture crop which has bright prospects for export. Leaf nutrient status in fruit crops is an indication of growth, production and productivity of fruit crops as leaf is the principal site of plant metabolism which clearly reflects mineral nutrient content changes with regards to uptake, absorption and utilization for the plant metabolism. Jhalawar district has three

major mandarin growing tehsils viz., Jhalrapatan, Pirawa and PachPahar. Studies on nutritional survey of Nagpur Mandarin in Rajasthan are scanty inspite of their great importance and relevance. Therefore, the present investigation was conducted during December, 2008 to June 2009 with a view to gain information about their nutrient status.

MATERIALS AND METHODS

Studies were conducted in eighteen orchards of Nagpur Mandarin selected at different locations in Jhalawar district of Rajasthan. The locations are given in Table A.

In each orchard, three trees with uniform vigour and size were selected. The methodology for leaf sampling as suggested by National Research Centre for Citrus, Nagpur (2000) was followed. Composite leaf samples were taken in the month of December, 2008 from 5-7 months old leaves for Mrig flush.

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Table A: Locations of orchards surveyed in Jhalawar district	
Sr. No.	Locations
1.	Asnawer
2.	Jheetapura
3.	Junakhera
4.	Aktasa
5.	Manpura
6.	Kherla
7.	Guradia
8.	Salotia
9.	Pavkheri
10.	Samia
11.	Gadia
12.	Sunel
13.	Guradiajoga
14.	Devria
15.	Lolra
16.	Bramli
17.	Mahoria
18.	Mukumpura

The sample size was taken 50 leaves in each sample and taken from 54 trees in eighteen orchards. These samples were washed with ordinary water containing dilute (0.2%) detergent solution for about two minutes and were then dipped into single distilled water, 0.1 N HCl and double distilled water. Samples were dried in an oven at 70°C for 24 hours and ground. The leaf samples were analysed for their different nutrients. Nitrogen and phosphorous contents were determined colorimetrically by using Nessler's reagent and Vanadomolybdophosphoric acid yellow colour method (Jackson, 1967). Iron, manganese, copper and zinc in the tri acid digest of the leaves were determined in an atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Macro nutrients in leaf samples :

Data on determination of macro nutrient status of Nagpur Mandarin orchards in Jhalawar district are presented in Table

Table 1: Contents of macronutrients in leaf samples of Nagpur Mandarin collected from orchards in Jhalawar district

Locations	(% on oven dry basis)		
	N	P	K
Asnawer	1.89	0.17	2.02
Jheetapura	1.67	0.16	1.73
Junakhera	1.22	0.21	1.53
Aktasa	1.36	0.18	1.51
Manpura	0.83*	0.28	1.70
Kherla	1.57	0.18	1.51
Guradia	0.92	0.20	1.99
Salotia	1.89	0.31**	2.05
Pavkheri	1.01	0.15	1.77
Samia	1.00	0.14*	2.23**
Gadia	2.05	0.26	1.61
Sunel	1.54	0.16	1.37*
Guradiajoga	1.74	0.20	1.93
Devria	1.45	0.18	1.51
Lolra	1.71	0.27	1.39
Bramli	2.19**	0.19	1.89
Mahoria	1.76	0.17	2.23**
Mukumpura	1.51	0.26	1.70
Over all mean	1.52	0.20	1.76
Range	0.83-2.19	0.14-0.31	1.37-2.23
S.E. _±	0.15	0.03	0.18
C.V. (%)	16.73	24.67	17.20
Deficient	22.22	-	-
Low	33.33	-	-
Optimum	38.88	11.11	100
High	-	44.44	-
Excess	-	44.44	-

*Denotes minimum value, **Denotes maximum value

1. The maximum nitrogen content (2.19 per cent) was obtained at the orchard of Bramli, while minimum value of nitrogen content (0.83 per cent) was obtained at the orchard of Manpura, with their mean value 1.52 per cent. Analysis of Nagpur Mandarin leaf samples revealed that 22.22 per cent were found deficient, 33.33 per cent low, whereas 38.88 per cent were found optimum in nitrogen content. The deficient to low concentration of nitrogen in Nagpur Mandarin plants may be attributed to low nitrogen status of orchard soils (81.95 mg kg⁻¹), inadequate application of nitrogen to soil as well as to trees through foliar application. This indicates that majority of orchards were deficient to low in nitrogen content. Similar findings were reported by Arora *et al.* (1989), Singh (1982) and Ahlawat *et al.* (1984).

The phosphorus content of Nagpur Mandarin leaves ranged from minimum (0.14 per cent) at the orchard of Samia to maximum phosphorus content (0.31 per cent) at the orchard of Salotia, with their mean value 0.20 per cent. An examination of Nagpur Mandarin leaf samples revealed that 11.11 per cent were found optimum, 44.44 per cent in high range, however 44.44 per cent of leaf samples were found in excess phosphorus content. The fair phosphorus content in Nagpur Mandarin

leaves might be due to high phosphorus status of orchard soils (22.25 mg kg⁻¹) and proper uptake and utilisation by the plant tissues which are in conformity with the findings of Shrinivasmurthy and Subramaniam (1979) and Reddy *et al.* (1993).

The maximum potassium content (2.23 per cent) was obtained at the orchards of Samia and Mahoria, while minimum potassium content (1.37 per cent) was obtained at the orchard of Sunel, with their mean value 1.76 per cent. Analysis of Nagpur Mandarin leaf samples revealed that 100 per cent samples of these plants were found optimum in potassium content. The excellent content of potassium in leaves of Nagpur Mandarin fruit trees might be due to rich potassium fertility status of soil (470 mg kg⁻¹) and proper uptake and utilisation by the plant tissues. The results are in agreement with those reported by Dhillon and Dhatt (1988).

Micro nutrients (Fe, Mn, Cu and Zn) in leaf samples :

Data on determination of micro nutrient status of Nagpur Mandarin orchards in Jhalawar district are presented in Table 2. The maximum Fe content (449.26 mgkg⁻¹) was obtained at the orchard of Samia, while minimum value of Fe (43.00 mgkg⁻¹)

Table 2: Contents of micronutrients in leaf samples of Nagpur Mandarin collected from orchards in Jhalawar district

Locations	(% on oven dry basis)			
	Fe	Mn	Cu	Zn
Asnawer	300.13	41.50	70.16	69.26
Jheetapura	329.70	52.46	87.66	86.86
Junakhera	320.86	51.80	84.60	90.03
Aktasa	328.30	43.83	93.53	84.33
Manpura	343.13	46.06	88.86	92.66
Kherla	307.66	40.90	77.66	75.03
Guradia	101.20	11.96	48.90	93.46
Salotia	116.80	8.33	37.03	62.70
Pavkheri	311.53	67.03	79.30	81.23
Samia	449.26**	83.90**	132.36**	109.36
Gadia	45.00	14.30	19.80	23.96
Sunel	43.00*	50.86	12.76	21.56*
Guradiajoga	69.90	40.76	12.03	25.83
Devria	179.16	9.40	40.63	87.53
Lolra	268.80	7.40*	41.76	85.86
Bramli	213.70	7.73	41.43	113.33
Mahoria	61.70	18.53	45.53	152.56**
Mukumpura	49.33	56.00	11.93*	24.26
Over all mean	211.44	36.27	57.09	76.63
Range	43.00-449.26	7.40-83.90	11.93-132.36	21.56-152.56
S.E. _±	29.39	3.91	12.48	15.76
C.V. (%)	24.08	18.65	37.86	35.61
Deficient	16.66	33.88	-	-
Low	11.11	44.44	-	-
Optimum	5.55	16.66	16.66	22.22
High	5.55	-	5.55	-
Excess	61.11	-	77.77	77.77

*Denotes minimum value, **Denotes maximum value

Table 3 : Correlation amongst various nutrients in Nagpur Mandarin leaves

	N	P	K	Fe	Mn	Cu	Zn
N	1						
P	0.165	1					
K	0.025	-0.145	1				
Fe	-0.424	-0.301	-0.022	1			
Mn	-0.526*	-0.454	0.048	0.497*	1		
Cu	-0.542*	-0.386	0.179	0.926**	0.548*	1	
Zn	-0.205	-0.301	0.409	0.453	-0.118	0.564	1

* and ** Indicate significance of value at P=0.05 and 0.01, respectively

¹) at the orchard of Sunel, with their mean value 211.44. Analysis of Nagpur Mandarin leaf samples revealed that 16.66 per cent were in deficient range followed by samples in 11.11 per cent in low range, 5.55 per cent were optimum, 5.55 per cent high and 61.11 per cent samples of these plants were found in excess Fe content. The low to rich iron status of iron in Nagpur Mandarin leaves might be due to high range 0.42 to 31.77 mgkg⁻¹. The results of present investigations are in agreement with those reported by Chouhan and Cahoon (1987) and Sharma and Bhandari (1995).

The maximum Mn content (83.90 mgkg⁻¹) was obtained at the orchard of Samia, while minimum Mn content (7.40 mgkg⁻¹) was obtained at the orchard of Lolra, with their mean value 36.27. Analysis of Nagpur Mandarin leaf samples revealed that 33.88 per cent deficient, 44.44 per cent low and 16.66 per cent samples of plants were found optimum in Mn content. The poor status of manganese in Nagpur Mandarin leaves might be due to poor uptake and absorption by the plant tissues despite good status of manganese (83.32 mgkg⁻¹) in soils of orchard surveyed. Similar findings were reported by Reuther (1973), Sharma and Bhandari (1995) and Bell *et al.* (1995).

The Cu content of Nagpur Mandarin leaves ranged from minimum (11.93 mgkg⁻¹) at the orchard of Mukumpura, whereas maximum Cu content (132.36 mgkg⁻¹) at the orchard of Samia, with their mean value 57.09. Analysis of Nagpur Mandarin leaf samples revealed that 16.66 per cent optimum, 5.55 per cent high and 77.77 per cent plant samples were found excess in Cu content. The fair copper content in Nagpur Mandarin leaves might be due to rich status of copper 83.32 mgkg⁻¹ in soils of orchards surveyed. The results of present investigations are in agreement with those reported by Gazzar *et al.* (1979), Singh (1982), Chouhan and Cahoon (1987) and Oliverira and Tsuneta (1987).

The maximum Zn content (152.56 mgkg⁻¹) was obtained at the orchard of Mahoria, while minimum value of Zn content (21.56 mgkg⁻¹) was obtained at the orchard of Sunel, with their mean value 76.63. Analysis of Nagpur Mandarin leaf samples revealed that 22.22 per cent optimum and 77.77 per cent these leaf samples were found excess in Zn content. The excellent content of zinc in leaf samples of Nagpur Mandarin might be due to rich status (2.35 mgkg⁻¹) of orchard soils. Similar findings

were reported by Gazzar *et al.* (1979).

Correlation co-efficients were worked out between the various contents of Nagpur Mandarin leaves are given in Table 3.

The nitrogen content in growing plants had significant and negative correlations with Mn ($r = -0.526^*$) and Cu ($r = -0.542^*$) whereas it has non-significant correlations with nutrients like P, K, Fe and Zn.

The phosphorus content in growing plants had nonsignificant correlations with N, K, Fe, Mn, Cu and Zn and also potassium has non-significant correlation with N, P, Fe, Mn, Cu and Zn.

The Fe content in growing plants had significant and positive correlation (at 5 per cent level of significance) with Mn ($r = 0.497^*$) and Cu ($r = 0.926^*$). The Mn content in growing plants had significant and positive correlation with Cu ($r = 0.548^*$).

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