Status of micro and secondary nutrients in deep black soils of Narsinghpur district of Madhya Pradesh

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ABSTRACT - For determining the status of micro and secondary nutrients, 200 soil samples were collected from deep Black soil zone of five tehsils of Narsinghpur district (M.P.). The analysis shows there is large variation in pH, electricalcanductivity, organic carbon content in the region and nutrient contents also vary in different tehsils of Narisinghpur district. The Zn, Cu content increase as organic carbon increased but unaffected due to pH, but Fe and Mn contents decreased with the increase in soil pH.

Key words - Nutrient, Variation, Organic carbon, Soil

Plants grow by absorbing nutrients from soil. The makeup of soil and its acidity determine the extent to which nutrients are available to plants. Nutrients needed in relatively large quantities are called macronutrients and those needed in relatively small quantities are called micronutrients. These are baron, copper, iron, chlorine cobalt, zinc and sulphate in several cases cause low yields and reduced crop growth. Even often use of NPK fertilizers have been reported which is the result of micronutrients imbalances. Chhabra *et al.* (1996) reported that Zn and Fe decreases in the soil with pH of the increasing soil. Similarly Shipmate *et al.* (2003) reported effects of soil properties by nutrient contents.

EXPERIMENTAL METHODOLOGY
Collection of samples :
200 soil samples were collected from five Tehsils of Narsingpur district. The collected samples were air dried and crushed with a wooden mortar and pestle up to the size of 2mm, then analyzed for physico-chemical properties and nutrients contents.

Physico-chemical properties:
Soil pH :
Soil pH was determined by glass electrode pH meter in 1:2 soil water suspensions (Jackson,1973).

Electrical conductivity:
Electrical conductivity was measured in the supernatant liquid of 1:2 soil water suspensions by conductivity meter (Jackson, 1973).

CaCO₃:
Analysis of soil calcium carbonate content was done using rapid titration method (Jackson, 1973).

Organic Carbon:
Rapid titration method (Walkley and Black, 1934).

Nutrient analysis:
Micronutrients : Zn, Cu, Fe, Mn
Micronutrient: DTPA extraction method (Lindsay and Norvell, 1978) with the help of Atomic Absorption

Spectrophotometer.

S: $CaCl_2$ extractable – S by turbidimetric method (Williams and Steinbergs,1959)

EXPERIMENTAL FINDINGS AND ANALYSIS

Delineation work was undertaken to evaluate the status of available micro, secondary nutrients in deep black soils of Narsinghpur district, Madhya Pradesh. For this, 200 surface soil samples (0-15) were collected from Narsinghpur districts using GPS. The Narsinghpur district is spread between Longitudes – 22 42 24.276^{0}N to 23 10 47.022^{0}N and Latitude – 78 31 18.804^{0}E to 79 36 11.964^{0}E.

Soil pH varied from 6.4 to 8.6 with a mean value of 7.7, in the district of Narsinghpur as a whole. Electrical conductivity of these soils ranged from 0.07 to 0.32 dSm^{-1} with a mean value of 0.16 dSm^{-1}, calcium carbonate content in these soils varied from 7.5 to 97.5 g kg^{-1} with a mean value 50.1 g kg^{-1} soil, organic carbon content ranged from 1.0 to 9.2 g kg^{-1} with a mean value

of 4.1 g kg^{-1} soil.

For the entire Narsinghpur district, available zinc content in soils varied from 0.08 to 2.25 mg kg^{-1} with a mean value of 0.67 mg kg^{-1} of soil. Available Cu content in soils varied from 0.51 to 11.8 mg kg^{-1} with a mean value of 3.99 mg kg^{-1} of soil in the district. Available Fe content in soils varied from 2.4 to 35.8 mg kg^{-1} with a mean value of 8.4 mg kg^{-1} of soil and Mn content in soils varied from 0.8 to 25.7 mg kg^{-1} with a mean value of 8.1 mg kg^{-1} of soil in the district as a whole. While available S content in soils varied from 1.5 to 30.9 mg kg^{-1} with a mean value of 14.5 mg kg^{-1} of soil. Zn Fe and S deficiency in soil was observed in 59, 18.5 and 39.5 per cent samples, respectively.

Zinc and Cu content correlated significantly positively with organic carbon, whereas, remained unaffected due to increase of soil pH or $CaCO_3$ content.

Fe and Mn correlated significantly negatively with soil pH but were not influenced due to either $CaCO_3$ or organic

Table 1: Physico-chemical properties of soils of district Narsinghpur

Tehsil / No. of samples	Texture Range	pH Range (mean)	E.C. (dSm^{-1}) Range (mean)	CaCO3 Range (mean)	O.C. (g kg^{-1}) Range (mean)
Gadarwara 49	sl-c	6.4 – 8.5 (7.6)	0.10 – 0.22 (0.15)	11.7 – 87.7 (52.0	1.0 - 7.3 (3.8)
Gotegaon 48	sl-c	6.6 – 8.6 (7.8)	0.07 – 0.25 (0.15)	15.0 – 75.0 (48.6)	1.1 – 9.2 (4.6)
Kareli43	sl – c	6.7 – 8.5 (7.8)	0.11 – 0.25 (0.16)	15.0 – 97.5 (47.4)	1.0 – 7.6 (4.7)
Narsinghpur 44	sl – c	6.5 – 8.5 (7.6)	0.10 – 0.21 (0.16)	7.5 – 90.0 (48.9)	1.0 – 6.3 (3.4)
Tendukheda 16	sl – c	7.0 – 8.2 (7.9)	0.15 – 0.32 (0.23)	22.5 – 90.0 (58.6)	1.3 – 6.3 (3.8)

Figures in parenthesis indicate mean values

Table 2 : Distribution of available zinc and copper content in soils of district Narsinghpur

Tehsil / No. of samples	Zn (mg kg^{-1}) Range (mean)	PSD*	Cu (mg kg^{-1}) Range (mean)	PSD*
Gadarwara 49	0.22 – 2.11 (0.68)	59.2	0.70 – 4.90 (2.82)	0.0
Gotegaon 48	0.08 – 1.70 (0.62)	66.7	1.14 – 9.50 (6.04)	0.0
Kareli 43	0.16 – 2.20 (0.68)	55.8	0.87 – 9.60 (4.24)	0.0
Narsinghpur 44	0.28 – 1.56 (0.67)	54.5	0.51 – 8.90 (2.91)	0.0
Tendukheda 16	0.28 – 1.56 (0.73)	56.3	0.78 – 11.8 (3.70)	0.0
District 200	0.08 – 2.25 (0.67)	59.0	0.51 – 11.8 (3.99)	0.0

Table 3 : Distribution of available iron, manganese and sulphur content in soils of district Narsinghpur

Tehsil / No. of samples	Fe (mg kg^{-1})		mn (mg kg^{-1})		S (mg kg^{-1})	
	Range (mean)	PSD*	Range (mean)	PSD*	Range (mean)	PSD*
Gadarwara 49	2.6 – 35.8 (9.3)	18.4	3.2 – 17.6 (8.5)	0.0	3.4 – 29.8 (17.2)	26.5
Gotegaon 48	3.0 – 27.0 (8.7)	8.3	4.2 – 21.6 (8.8)	0.0	1.5 – 29.4 (11.5)	47.9
Kareli 43	2.4 – 23.0 (8.0)	14.0	0.8 – 18.2 (7.3)	0.0	1.5 – 27.4 (14.1)	44.2
Narsinghpur 44	2.6 – 23.7 (7.6)	27.3	3.4 – 25.7 (8.3)	2.3	1.5 – 30.9 (18.0)	29.5
Tendukheda 16	2.6 – 22.5 (8.1)	37.5	2.9 – 15.5 (6.7)	0.0	1.5 – 29.4 (10.6)	68.8
District 200	2.4 – 35.8 (8.4)	18.5	0.8 – 25.7 (8.1)	0.5	1.5 – 30.9 (14.5)	39.5

Figures in parenthesis indicate mean value *Per cent sample deficient

Table 4 : Relationship of micronutrients and sulpher content with soil properties

Soil properties	Nutrients content (mg kg^{-1})				
	Zn	Cu	Fe	Mn	S
pH					
R	0.0036	0.0154	-0.3173**	-0.4054**	0.0763
Y=a+bx	0.646+0.003x	3.361+0.082x	36.278-3.627x	34.4723.428x	3.304+1.461x
CaCO₃					
R	-0.0216	-0.0168	-0.0145	-0.0563	-0.0572
Y=a+bx	0.687-0.0004x	4.086-0.002x	8.853-0.004x	8.644-0.010x	15.723-0.024x
Organic cabon					
R	0.1911**	0.3564**	-0.0078	0.0392	0.0503
Y=a+bx	0.0503+0.041x	1.956+0.500x	8.499-0.024x	7.772+0.087x	13.500+0.254x

* and ** indicate significance of values at P=0.05 and 0.01

carbon content.

S content did not correlate significantly with either pH, CaCO₃ or organic carbon content.

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