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Micronutrient Status and Nutrient Index of Soils of Katepurna and Kurankhed Blocks of Central Demonstration Farm, Wani-Rambhapur

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ABSTRACT: *Soils of Katepurna and Kurankhed block of Central Demonstration Farm, Wani-Rambhapur were investigated for their chemical properties and micronutrient status of surface soils. All the soils under study were slightly alkaline to moderately alkaline in reaction, EC value for these soils within safe limit. The organic carbon content in these soils is low to medium and soil of farms is moderately calcareous to calcareous due to presence of $CaCO_3$. The soils of Katepurna block contain available micronutrients i.e. Fe, Mn, Zn, Cu the range of 3.61 to 8.72 mg kg^{-1}, 2.33 to 8.34 mg kg^{-1}, 0.46 to 1.43 mg kg^{-1}, 0.46 to 1.82 mg kg^{-1} respectively and Kurankhed block soils contains 3.25 to 8.11 mgkg^{-1}, 2.69 to 8.73 mg kg^{-1}, 0.45 to 1.41 mg kg^{-1}, 0.48 to 1.93 mg kg^{-1} Fe, Mn, Zn and Cu respectively. The NIV calculated for micronutrients status show high NIV for iron, copper and manganese and for zinc Katepurna shows the low and Kurankhed block shows medium NIV.*

The stagnation in crop productivity has been found due to deficiency of some micro and secondary nutrients. Hence, micronutrients have assumed increasing importance in crop production under modern agricultural technology. Micronutrients are essential plant mineral nutrients taken up and utilized by crops in very small quantities. Introduction of high yielding varieties in Indian agriculture in former decades compelled the farmers to use high doses of chemical fertilizers which were also free from micronutrients. Limited use of organic manures as well as recycling of crop residues are some important factors having contributing towards accelerating exhaustion of micronutrients from soil. Deficiency of micronutrients has become major constraint top to productivity, stability and sustainability in many soils. Although wide spread Zn, Cu, Fe and Mn deficiency has been observed in the soils of arid and semi-arid regions the information with respect to micronutrient availability is lacking. Therefore, an attempt was made in the present to assess the micronutrient status of soils of Katepurna and Kurankhed Blocks of Central Demonstration Farm, Wani-Rambhapur.

MATERIAL AND METHODS

Katepurna and Kurankhed blocks of Central Demonstration Farm, Wani-Rambhapur were surveyed for sampling sites. Sites were decided by grid method of soil sampling. Field map of Katepurna and Kurankhed block for sampling having scale 1 cm= 80 m have been used. The sample grid map is laid out on the map with 0.7 x 0.7 cm scale to divide the field in equal size square blocks of 60 x 60 m on the field. Hence, the whole Katepurna and Kurankhed block is divided into 43 and 40 intersection areas respectively. These intersection areas are used as sampling sites and samples are collected from each intersection area. The surface soil samples at depth of 0-15 cm were collected for chemical analysis. Then location details (i.e. Latitude, Longitude and Altitude) are recorded with the help of GPS. Then these samples were analysed for pH, Electrical conductivity, (1:2.5 soil water suspension), organic carbon was determined by wet oxidation method (Walkley and Black 1934) using diphenylamine indicator. Free $CaCO_3$ content was determined by rapid titration method (Piper, 1966). The DTPA- Extractable micronutrient cations of the soil were determined as per the methods described by Lindsey and Norvell (1978). Nutrient index for the micronutrients of the Katepurna and Kurankhed Blocks was calculated as per formula given by (Ramamurthy and Bajaj, 1969).

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RESULTS AND DISCUSSION

Chemical properties of Soil

The pH of the soils of Katepurna block ranges from 7.65 to 8.65 indicating slightly to moderately alkaline in reaction. In Kurankhed block it ranges from 7.73 to 8.39. The highest pH value of 8.65 recorded in soils of Katepurna block. The EC ranges from 0.14 to 0.25 dSm^{-1} in Katepurna block. In Kurankhed block it ranges from 0.14 to 0.26. As regards the variation observed in respect of electrical conductivity of surface soils no definite trend was observed. This range of EC value shows that all the soils are non-saline in nature and suitable for healthy plant growth. The EC value <1.0 indicate that these soils are free from hazard of soluble salts as prescribed by Richards (1954) and Jackson (1967). The organic carbon in soils of Katepurna block ranges from 2.5 to 4.9 g kg^{-1}. Kurankhed block soil shows the similar results. The soils are low to medium in organic carbon content in both the blocks. The data reveals that all the soils under study contain free lime and this might be reason why these soils are moderately alkaline in reaction. The magnitude of free lime content in farm soils ranges from 6.62 to 12.37 percent in Katepurna block and in Kurankhed block it ranges between 6.12 to 10 percent. It indicates that these soils are moderately calcareous to calcareous in nature.

Table 1
Chemical properties of Blocks

A) Katepurna Block

Grid.No	*pH*	*EC(dSm^{-1})*	*OC(g kg^{-1})*	*$CaCO_3$(%)*
1	8.65	0.16	4.3	11
2	8.32	0.19	4.7	10.87
3	8.38	0.18	4.6	10.25
4	8.34	0.20	4.2	9.73
5	8.3	0.17	4.3	9.87
6	8.09	0.16	4.8	9.62
7	8.17	0.18	4.4	9.25
8	8.07	0.19	4	9.5
9	8.22	0.20	3.7	9.75
10	8.14	0.18	3.9	10.25
11	8.18	0.21	3.5	10.62
12	8.16	0.19	3.6	9.87
13	8.05	0.19	3.9	10
14	8.03	0.14	4	10.37
15	8.01	0.25	4.2	10.62
16	8.04	0.23	4.7	11.12
17	8.02	0.21	4.9	11.5
18	8.08	0.15	4.8	11.87
19	7.79	0.16	4.6	11.62
20	7.75	0.19	4.3	12
21	7.65	0.17	4	12.37
22	7.79	0.18	3.6	12.25
23	7.93	0.17	3.7	11.77
24	7.96	0.20	3.3	11.62
25	7.73	0.17	3	10.87
26	8	0.18	3.2	10.25
27	7.74	0.17	2.8	9.87
28	8.03	0.19	2.5	9.25
29	8.18	0.14	2.6	9.12
30	8.1	0.18	2.8	9
31	8.19	0.24	2.5	8.75
32	8.07	0.16	2.6	8.5
33	8.24	0.20	3	8.62
34	8.11	0.24	2.8	8.12
35	7.96	0.14	3.3	7.62
36	7.79	0.15	3.7	8
37	7.99	0.18	3.3	8.37
38	8.12	0.17	3.9	7.62
39	8.07	0.25	4.2	6.62
40	7.98	0.16	4.4	7.25
41	7.76	0.14	4	7.37
42	7.95	0.19	4.3	7
43	8.37	0.14	4.6	6.87
Range	7.65-8.65	0.14-0.25	2.5-4.9	6.62-12.37
Mean	8.05	0.18	3.78	9.75

B) Kurankhed Block

Grid.No	*pH*	*EC (dSm-1)*	*OC(g kg-1)*	*$CaCO_3$ (%)*
1	8.18	0.17	4.8	6.5
2	8.32	0.15	4.9	6.12
3	8.21	0.20	4.4	6.25
4	8.14	0.14	4.9	6.62
5	8.39	0.18	4.2	6.87
6	8.17	0.17	3.9	6.62
7	8.06	0.14	3.5	7
8	8.12	0.21	3.2	7.25
9	8.18	0.18	3.3	6.87
10	8.05	0.23	3	6.12
11	8.13	0.14	3.5	7.62
12	8.05	0.26	3.7	8.12
13	7.98	0.21	3.9	8.75
14	7.81	0.20	3.3	8.5
15	8.14	0.19	4	8.25
16	7.87	0.18	4.2	8.62
17	7.93	0.14	4.3	9.25
18	7.99	0.16	4.8	9.12
19	8.27	0.15	4.9	9.87
20	7.81	0.17	4.7	9.75
21	7.93	0.16	4.4	8.62
22	8.31	0.14	3.6	10
23	8.23	0.15	4	9.62
24	8.13	0.19	3.9	8.25
25	8.27	0.17	3	7.62
26	8.17	0.14	2.8	8
27	8.36	0.20	2.5	7.62
28	8.08	0.21	3.1	7.5
29	8.27	0.19	3.3	6.87
30	7.93	0.24	2.5	7.25
31	7.98	0.14	2.8	6.62
32	8.06	0.17	4.6	6.5

33	7.91	0.26	4.9	6.12
34	7.78	0.15	4.3	6.25
35	7.95	0.19	4.6	7.25
36	7.73	0.17	4.7	6.62
37	7.75	0.18	4.9	8.75
38	7.89	0.21	4.3	9
39	8.26	0.24	3.9	9.87
40	8.07	0.22	4	10
Range	7.73-8.39	0.14-0.26	2.5-4.9	6.12-10
Mean	**8.07**	**0.18**	**3.93**	**7.81**

Micronutrient status in soils

Available Iron

The data in Table 2 shows the DTPA extractable Fe in soils of Katepurna and Kurankhed block. Available Fe content in soils of Katepurna block ranges between 3.61 to 8.72 mg kg^{-1} and Kurankhed blocks soils ranges from 3.25 to 8.11 mg kg^{-1}. Considering critical limit for DTPA –Fe 2.5-4.5 mg kg^{-1} as given by Katyal *et al*. (2003) these soils are found to be sufficient in available Fe content. Similar observation reported by Jibhkate*et al*. (2009).

Available Manganese

The data in Table 2 shows the DTPA extractable Mn in soils of Katepurna and Kurankhed Block. Magnitude of available manganese content in soils ranges from 2.33 to 8.34 mg kg^{-1} for Katepurna block and for Kurankhed block it ranges from 2.69 to 8.73 mg kg^{-1}. Considering critical limit of 2.0 mg kg^{-1} given by Kattyal *et al.* (2003) these soils are well supplied with manganese similar observation recorded by Jibhkate *et al*. (2009) and Chinchmalatpure*et al.* (2000).

Table 2
Micronutrient status of soil of blocks.

A) Katepurna block

Grid No.	*Available Micronutrients (mg kg^{-1})*			
	Zn	*Fe*	*Cu*	*Mn*
1	0.49	3.63	1.27	3.33
2	0.57	3.83	1.26	3.27
3	0.51	3.72	1.80	2.35
4	0.54	3.86	1.72	4.21
5	0.52	3.89	1.62	3.45
6	0.56	3.67	1.59	3.24
7	1.28	5.16	1.68	2.33
8	1.21	4.64	1.67	4.22
9	0.72	5.27	1.27	4.56
10	0.68	4.95	1.23	4.55
11	0.59	5.24	1.63	4.89
12	0.56	4.62	0.46	4.63
13	1.43	3.61	1.26	4.53
14	0.49	4.34	1.19	4.23
15	1.32	4.39	1.82	3.66
16	1.27	5.61	1.81	3.38
17	1.13	5.62	1.27	2.75
18	1.28	5.46	1.26	2.91
19	0.49	4.75	1.33	2.36
20	0.64	4.71	1.28	3.23
21	0.51	4.62	0.59	2.75
22	0.48	5.06	0.47	4.63
23	0.51	4.71	1.56	4.56
24	0.54	5.06	1.51	4.99
25	0.61	3.61	1.28	6.33
26	0.49	6.73	1.47	5.69
27	0.51	7.13	1.59	8.34
28	0.47	5.76	1.60	8.29
29	0.52	6.95	1.13	6.36
30	0.56	4.64	1.16	6.13
31	0.72	6.05	1.63	6.50
32	0.46	5.27	1.59	6.39
33	0.60	5.72	1.31	6.36
34	0.58	5.86	1.27	6.05
35	0.49	4.27	1.23	2.83
36	0.72	4.39	1.17	4.56
37	0.75	8.28	1.68	5.55
38	0.77	4.72	1.57	4.46
39	0.80	3.94	1.63	3.61
40	0.79	4.08	1.59	2.55
41	0.60	6.16	1.57	4.27
42	0.59	6.46	1.36	3.58
43	0.51	8.72	1.21	2.33
Range	0.46-1.43	3.61-8.72	0.46-1.82	2.33-8.34
Mean	0.69	5.10	1.39	4.40
Low	25 (58%)	0 (0 %)	0 (0 %)	0 (0 %)
Medium	12 (28%)	15 (65 %)	0 (0 %)	0 (0 %)
High	6 (14%)	28 (35 %)	43 (0 %)	43 (0 %)

B) Kurankhed block

Grid No.	*Available Micronutrients (mg kg^{-1})*			
	Zn	*Fe*	*Cu*	*Mn*
1	0.56	7.56	1.38	2.69
2	0.54	7.33	1.24	2.72
3	0.49	4.56	1.27	4.05
4	0.45	4.33	1.26	2.9
5	0.47	3.99	1.93	5.16
6	0.69	3.56	1.72	6.02
7	0.75	3.25	1.62	6.21
8	0.64	3.56	1.59	7.39
9	0.59	4.2	1.68	7.13
10	0.71	4.55	1.67	8.53
11	0.64	4.33	1.4	7.83
12	0.61	5.66	0.53	6.27
13	0.56	4.33	0.56	6.06
14	0.52	4.66	0.48	5.86
15	1.13	4.33	1.64	6.73
16	0.73	7.23	1.56	5.72
17	0.71	8.11	1.52	5.63
18	1.41	8.1	1.46	4.08
19	0.77	4.33	1.58	3.05
20	0.63	6.33	1.68	2.82
21	0.51	6.31	1.64	3.35
22	0.54	6.23	1.26	4.06
23	0.52	6.22	1.45	6.16
24	0.56	6.21	1.46	5.89
25	1.28	6.45	1.37	6.04
26	1.21	6.99	1.42	8.72

27	0.72	3.78	1.24	8.39
28	0.68	4.36	1.46	8.61
29	0.45	8.1	1.34	8.73
30	0.56	8.11	1.38	6.75
31	1.41	6.33	1.42	6.76
32	0.49	5.45	1.48	8.06
33	1.32	6.21	1.54	3.83
34	1.27	6.99	1.48	2.77
35	1.13	3.89	1.36	4.89
36	1.28	3.84	1.39	3.86
37	0.49	8.11	1.33	3.37
38	0.64	8	1.32	2.85
39	0.51	7.33	1.43	4.46
40	0.73	6.99	1.47	6.05
Range	0.45-1.41	3.25-8.11	0.48-1.93	2.69-8.73
Mean	0.75	5.76	1.40	5.51
Low	16 (40 %)	0 (0 %)	0 (0 %)	0 (0 %)
Medium	16 (40 %)	14 (35 %)	0 (0 %)	0 (0 %)
High	8 (20 %)	26 (65 %)	40 (100%)	40(100%)

Available Zinc

The data on available zinc presented in Table No. 2. The available zinc extracted by DTPA varies from 0.46 to 1.43 mg kg^{-1} for Katepurna block and for Kurankhed block it ranges from 0.45 to 1.45 mg kg^{-1}. Highest value of (1.45 mg kg^{-1}) for available zinc recorded in Kurankhed block and lowest value of (0.45 mg kg^{-1}) also recorded in Kurankhed block in general magnitude of available zinc. These soils are also found to contain low to high zinc in their soils. Considering critical limit of 0.6 mg kg^{-1} given by Katyal *et al*. (2003), the soil under study are categories as a deficient in available zinc status. Similar observation was recorded by Gajbhiye *et al*. (1993), Ambegaonkar*et al*. (2007) and Jibhkate *et al*. (2009).

Available Copper

The data on available copper presented in Table 2. The Katepurna block and Kurankhed block shows high availability of Copper. The available copper extracted by DTPA varies from 0.46 to 1.82 mg kg^{-1} for Katepurna block and for Kurankhed block it ranges between 0.48 to 1.93 mg kg^{-1}. The highest value of (1.93 mg kg^{-1}) recorded in Kurankhed block and lowest value (0.46 mg kg^{-1}) recorded in Katepurna block. Considering critical limits of 0.2 mg kg^{-1} as suggested by Katyal *et al*. (2003), these soils are categories as high in available copper content. Similar results were reported by Jibhkate*et al*. (2009) Murthy *et al*. (1997).

Nutrient Index Value (NIV)

Nutrient Index Values calculated for the micronutrients as per critical limits for available micronutrient given by Katyal J.C. and R.K. Rattan (2003) are presented in Table 3. The soils are classified for its micronutrient content, the soils of Katepurna and Kurankhed are classified as low to high for Zinc, medium to high for Iron and high for manganese and available copper. Nutrient index calculated for micronutrients shows the values 1.55 for Zinc, 2.65 for Iron and 3 for both copper and manganese in Katepurna block and for Kurankhed block nutrient index values shows 1.80 for Zinc, 2.65 for Iron and 3 for Copper and Manganese. Accordingly the soils of Katepurna block show low nutrient index value for available zinc, high nutrient index values for available Iron, Manganese and Copper. In case of Kurankhed block the medium nutrient index for available Zinc and high nutrient index for Iron, Manganese and Copper.

Table 3
Nutrient Index of Katepurna and Kurankhed Blocks

S.N.	*Nutrient*	*Katepurna Block*		*Kurankhed Block*	
		NIV	*Category*	*NIV*	*Category*
1	Fe	2.65	High	2.65	High
2	Mn	3	High	3	High
3	Zn	1.55	Low	1.80	Medium
4	Cu	3	High	3	High

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