MICRONUTRIENTS STATUS IN SOIL UNDER COMMAND AREA OF UPPER KUNDALIKA PROJECT BEED DISTRICT (MAHARASHTRA)

Environmental Science

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ABSTRACT

An increase in cropping intensity coupled with shift from traditional varieties to that of nutrient demanding fertilizer responsive high yielding varieties of field crops comprising cereals, pulses, oilseed, cotton and long duration crops like Sugarcane and fruit crops has led to the large scale mining of nutrient from soil. This is particularly true in case of the situations where these crops are grown without adequate and balanced fertilization thereby causing depletion and wide spread deficiencies of most of the major and micronutrients. The physico-chemical characteristics like pH, EC, content of organic carbon and calcium carbonate are important as these affect on availability of nutrients in soil and thereby on crop growth and production. The soil must supply the nutrients that are essential for plant growth

and necessary component of human and animal food for sustainable agriculture. The availability of nutrients is highly influenced by pH of soil. Organic matter is the indicator of organic carbon status in soil. Organic matter acts as buffering agent and after decomposing produce organic acids and CO2 which helps to dissolve the minerals in soil. To know the present status of soil in the study area, 25 sampling stations were selected from irrigated farmland in winter season. The important physico-chemical properties and micronutrients status of soil were evaluated during present investigation such as pH, EC, CaCO3, OC, and micronutrient like Fe, Cu, Mn and Zn etc. The study revealed that there was depletion in organic carbon, Iron & Zinc. The deficiencies of these nutrients affect on yield of crop.

INTRODUCTION:

A rapid increasing global demand for food means, we have no alternative but to significantly and sustainably increase agricultural productivity to provide food, feed, fiber and fuel. United Nations suggest that the world population by 2050 could reach 8.9 billion, but in alternative scenarios could be as high as 10.6 billion or as low as 7.4 billion Today, at least one billion people are chronically malnourished or starving. The bad news beyond the impacts on people, plants and animals of that kind of deforestation: there isn't that much land available. At most, we might be able to add 100 million hectares to the 4.3 billion already under cultivation worldwide. So, how can agriculture be intensified to feed a growing population while addressing environmental concerns? Simply, yields on existing lands increase.To meet the growing demand for food, fiber and fuel, high yielding cultivars were introduced. These high yielding crop cultivars were highly responsive to fertilizers. Thus, slowly the soils were exhausted of their nutrients. Application of major nutrients (nitrogen, phosphorus and potassium) became common; therefore the crops started responding to micronutrient fertilizers. Concerted efforts have been made through the All India Coordinated Research Project on Micronutrients to delineate the soils of India regarding the deficiency of micronutrients. At present about 48.1pcr cent of Indian soils arc deficient in diethylene-triamine-penta-acetate (DTPA) extractable zinc, 11.2 percent in iron, 7 percent in copper and 5.1 percent in manganese Apart from the deficiency of these micronutrients, deficiencies of boron and molybdenum have also been reported in some areas (Gupta, 2005).

MATERIALS AND METODS:

In order to assess the physical, chemical properties and status of Micronutrients in soil from irrigated farmlands and their relationship, and to identify and delineate areas of micronutrients deficiencies. Twenty five sampling stations were selected from command area under the upper Kundalika project (74^0 54' to 76^0 57' E, 180 28' to 19^0 28' N) for study in winter season. Soil samples were processed and analyzed for pH and EC by employing the method given by Jackson (1973), Organic carbon by Walkely and Black (1934) , Calcium carbonate by Piper (1966), The DTPA extractable Fe, Cu, Mn& Zn were extracted with diethlene triamine penta acetic acid (DTPA) solution (Lindsay and Norvell (1978) and analysed. By AAS.

Results and discussion:

pH : The data on physico-chemical properties of soils grouped under winter season (Table 1) revealed that, out of 25 soil samples, 24 soil samples were neutral in reaction (pH 6.5 - 7.5) and 1 soil samples were alkaline in reaction (7.5 - 8.9). The pH varied from 7.01 to 7.51 with a mean value of 7.39. Out of 25 soil samples (92%) soil samples were found neutral in reaction and (8%) soil samples were alkaline in reaction. The values indicated that, soils of study area were neutral to alkaline in soil reaction. The relative high content of pH in this soil might be due to presence of high degree of base saturation. Padole and Mahajan (2003) reported that the pH of swell shrink soil of Vidharba region was ranged from 7.1 to 8.0. The low pH might be due to when (H+) ion form predominant absorbed cations on soil colloids make the soil acidic. These results are in accordance with the result reported by Waikar *et al.* (2003).

EC: The EC of these soils winter varied from 0.156 to 0.761 dSm^{-1} with a mean value of 0.33 dSm^{-1}. Thus all the soils grouped under winter season were in normal EC. The data indicated that the soils of study area were safe limit in EC. The low EC in these soils might be due to proper management of soil and there by leaching of salts take place from surface to surface. These results are in confirmatory with results reported by Joshi and Kadrekar (1988) in salt affected soil of Maharashtra. Similar finding were also reported by Mali *et al.* (2012) in soils from Barhanpur, Maharashtra and also Waikar *et al.* (2003).

organic carbon :

The organic carbon content of soils grouped under winter ranged from 0.11 to 1.00 g kg^{-1} with a mean value of 0.46 g kg^{-1}. Out of 25 soil samples, 64, 28 and 8 per cent were low, medium and high in organic carbon content, respectively. The high content of organic carbon might be due to addition of organic matter through either artificially or naturally and its subsequent decomposition. These results were in confirmatory with results reported by More *et al.* (1987) in soils from salt affected area of Purna command area in Marathwada region. Whereas low to medium content of organic carbon in soil resemblance with poor management and higher temperature. Bacchewar and Gajbhiye (2011) reported that the organic carbon content in soil of Latur district, Maharashtra ranged from 0.21 to 1.28 per cent with an average of 0.75 per cent and also by Raut and Mali (2003).

$CaCO_3$: The $CaCO_3$ in the soil under winter season varied from 0.20 to 7.80 g kg^{-1} with an average value of 3.11 g kg^{-1}. From the data it was revealed that, soils from study area were non-calcareous to calcareous in nature. The data indicated that the soils of study area were low to medium in $CaCO_3$ content. The low to medium $CaCO_3$ content in these soils might be due to fact that the presence of $CaCO_3$ in powdery form and hyperthermic temperature regime of study area. Padole and Mahajan (2003) reported that the $CaCO_3$ content of swell shrink soils of Vidharbha region (Maharashtra) were ranged from 1.34 to 15.56 per cent. Sharma *et al.* (2003) reported that the $CaCO_3$ content of calcareous and saline-alkaline soils of East U.P. were ranged from 0.25 to 4 per cent and also by Bacchewar and Gajbhiye (2011).

DTPA Fe: The data presented in (Table 1) indicated that the DTPA extractable Fe content of these soils were ranged from 1.01 to 3.630 mg kg^{-1} with an average value of 1.77 mg kg^{-1}. Out of 25 soil samples grouped under winter 22 samples was low (<2.5 mg kg^{-1}), 03 samples were medium (2.5 to 4.5 mg kg^{-1}) and none of the samples were high (> 4.5 mg kg^{-1}) in DTPA extractable Fe content.

The soils of study area were found low to medium in DTPA Fe content. This low to moderate DTPA Fe content in soil may be due to absence of mineral like feldspar, magnetite, Hematite and Limonite which together constitute bulk of trap rack in these soils. It is also due uptake by high yielding crop varieties under intensive cropping. Malewar and Ismail (1999) reported that the DTPA Fecontent of Marathwada soils were ranged from 0.36 to 25.15 mg kg-1. Dhange *et al.* (2000) reported that DTPA - Fe of soils of Shevgaon Tahsil of Ahmadnagar district Maharashtra were ranged between 2.22 to 9.06 ppm. Gupta (2005) reported that 11.2 per cent of Indian soils are deficient in DTPA extractable iron.

DTPA Zn: The data revealed that the DTPA extractable Zn content in soils of study area were ranged from 0.217 to 0.811 mg kg^{-1} with a mean value of 0.44 mg kg^{-1}.

Table 1. Physico-chemical properties and micronutrient status of soils from irrigated farmland during Winter Season-2013-14.

Sr. No.	Sam. No.	pH	EC dSm^{-1}	$CaCO_3$ %	OC %	Micronutrients (mg/kg)			
						Fe	Cu	Mn	Zn
1	S-1	7.31	0.157	0.20	0.47	1.810	3.006	1.428	0.438
2	S-2	7.39	0.156	5.60	0.49	1.802	3.001	3.001	0.301
3	S-3	7.31	0.281	1.80	0.39	1.001	1.801	2.141	0.491
4	S-4	7.43	0.391	1.60	0.66	1.603	4.612	1.501	0.439
5	S-5	7.34	0.201	1.30	0.61	2.001	3.006	3.013	0.667
6	S-6	7.21	0.233	1.40	0.26	3.180	2.210	2.141	0.811
7	S-7	7.51	0.203	7.80	0.81	1.684	3.911	1.013	0.617
8	S-8	7.35	0.183	7.30	0.26	2.111	1.613	3.613	0.221
9	S-9	7.26	0.602	5.10	0.56	2.220	2.413	4.979	0.333
10	S-10	7.07	0.382	7.30	1.00	1.560	2.011	2.301	0.389
11	S-11	7.35	0.381	2.60	0.71	1.001	1.613	3.910	0.312
12	S-12	7.38	0.563	2.40	0.11	1.021	1.127	4.998	0.500
13	S-13	7.34	0.543	5.90	0.61	1.001	2.301	5.078	0.431
14	S-14	7.36	0.264	0.40	0.10	2.471	2.912	1.871	0.461
15	S-15	7.21	0.283	1.90	0.59	1.021	2.618	2.619	0.217
16	S-16	7.01	0.761	1.60	0.21	1.603	2.981	2.713	0.290
17	S-17	7.42	0.242	7.50	0.38	1.810	2.611	2.341	0.811
18	S-18	7.51	0.368	1.20	0.51	3.630	2.510	2.610	0.510
19	S-19	7.12	0.261	0.80	0.20	1.471	2.470	1.071	0.365
20	S-20	7.39	0.318	0.40	0.30	3.001	2.611	1.710	0.503
21	S-21	7.21	0.391	1.60	0.56	1.102	1.801	2.141	0.402
22	S-22	7.07	0.382	1.40	0.26	1.560	2.011	2.301	0.389
23	S-23	7.31	0.381	2.60	0.66	1.810	2.210	1.871	0.431
24	S-24	7.01	0.203	2.40	0.47	1.689	2.413	1.013	0.461
25	S-25	7.34	0.201	5.60	0.39	1.021	1.613	1.071	0.290

Out of 25 soil samples, 20 samples were in low (< 0.60 mg kg^{-1}), 5 samples were medium (0.60 to 1.12 mg kg^{-1}) and none of the sample showed high in DTPA extractable Zn content. DTPA Zn content in soils of study area were low to medium. Majority of these soils were marginal or poor in DTPA Zn content. This might be due to fact that under alkaline

condition, the zinc cations are changed largely to their oxides or hydroxide and their by lower the availability of zinc. Kadao *et al.* (2002) reported that banana growing soils of Wardha district, Maharashtra, the DTPA extractable Zn content varied from 0.15 to 0.58 mg kg^{-1}. Nazif *et al.* (2006) reported that soils of district Ithimber (Azad Jammu and Kashmir) the DTPA extractable Zn ranged from 0.74 to 2.08 mg kg^{-1}. The low content of DTPA Zn might be due to low organic matter and high $CaCO_3$ content in these soils.

DTPA Mn: The DTPA extractable Mn content of these soils were varied from 1.013 to 5.078 mg kg^{-1} with a mean value of 2.50 mg kg^{-1}. Out of 25 soil samples, 9 samples were low (< 5 mg kg^{-1}), 15 samples were medium (2 to 5 mg kg^{-1}) and 1 samples were high (> 5 mg kg^{-1}) in DTPA extractable Mn content. The data on DTPA Mn content in soils of study area were low to high. The high status of DTPA Mn in the soils might be due to the fact that lower oxidation (reduced) status of DTPA Mn are more soluble than higher oxidation state at normal pH range of soil. Oxidation of divatent Mn^{++} to trivalent, Mn^{++} by certain fungi and bacteria, also some organic compounds synthesised by micro organism or released by plants as root exudates have oxidizing or reducing power. These result in confirmatory with Tekale *et al.* (1977). Saraswat *et al.* (2005) reported that DTPA extractable Mn of this soil was ranged from 2.4 to 6.4 mg kg^{-1}.

DTPA Cu : The DTPA extractable Cu contents in soils of study area grouped under winter were ranged from 1.613 to 4.612 mg kg^{-1} with an average value of 2.46 mg kg^{-1}. All soil samples 25 showed high content of DTPA extractable Cu. The soil of study area were 99.66 percent high in DTPA Cu content. The high content of DTPA Cu in these soils was might be due to presence of Cu minerals like Cuprites and Chalcocite etc. in the parent material. Dhage *et al.* (2000) reported that DTPA Cu content in the soil of Shevgaon tahsil of Ahmednagar district, Maharashtra were ranged from 2.04 to 11.38 mg kg^{-1}. Balpande *et al.* (2007) found that the DTPA Cu contents in grape growing soils of Nasik district of Maharashtra were ranged from 1.16 to 22.00 mg kg^{-1}. Kirmani *et al. (2011)* reported that soils of Budgam district of Jammu and Kashmir the available Cu content ranged from 0.98 to 14.36 ppm with mean value of 6.15 ppm.

Conclusion :

The present study revealed that DTPA Cu content is high, DTPA Mn content is low to medium and DTPA Fe and DATPA Zn content is low. From the above observation it is clear that low productivity of the soil of uppar Kundlika command area may be due to low value of Fe and Zn which are essential for plant growth.

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