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SOIL SCIENCE

Study of Micronutrient Status in Soil of Solapur District

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ABSTRACT

The aim of this study was to evaluate available micronutrient (Fe, Cu, Zn, Mn and B) status and their relationship with soil properties. In this work the status of micronutrient in soil of Solapur district area, Maharashtra, India is described The present study is mainly focused on testing of soil samples in Solapur district to determine their level of micronutrients and to provide information to the farmers regarding micronutrients availability in soil. The increment in nutrient supply beyond a certain limit resulting in the decreased yield of plants is often be associated with the production of specific toxic effects .The incidence of micronutrient deficiencies in soil and plants is increasing due to high and multiple plant. Extensive micronutrient deficiencies lead to decline in factor productivity even with balanced NPK fertilization. Although the crop response to micronutrients application varies with soil type, crops and genotype, agro-climatic conditions and severity of deficiency, an enormous response to micronutrient fertilization has been reported in a wide variety of crops including horticultural crops across the country.

Highlights

- The present investigation was carried out for determine the status of DTPA-Fe, Cu, Zn and B in relation with chemical properties in soils of Solapur district for this purpose representative soil samples were collected from different villages of Solapur District. These soil samples were analyzed for soil properties and micronutrient fertility status of soil

Keywords: Micronutrient, Total Content of Soil, Analysis of soil, Soil quality, Soil nutrients

Soil is vital resources in which proper use depends on the country and the socio-economic development of its people. Macronutrients (N,P, and K) and micronutrients (Zn, Fe, Cu and Mn) are essential for healthy plant growth. N,P, K are needed in large amounts and Zn, Fe, Cu and Mn are needed in smaller amounts. Both macronutrients and micronutrients are naturally obtained by the roots from the soil. Correlation analysis was carried out by using bivariate correlation using Pearson's method. This was carried out for macronutrients and micronutrients dataset and it indicates geochemical complexity in the region with less negative correlation of all parameter[1]. The micronutrients in soil are very important for plant growth, soil fertility, animal nutrition and productivity[2]. The functions of the micronutrients are enzyme action, cellular organization, metabolically active compounds, structural components etc.[3]. The increase in the amount of nutrient supply beyond limit resulting toxic effects which decreases yield of crops[4]. The micronutrient deficiencies in soil and crop are due to large crop production[5]. The micronutrients in soil generally found in different chemical forms and the main sources of micronutrients in soils are rock weathering and atmospheric deposition of dust particles, volatile compounds etc.[6]. An available micronutrient contents were leached out from soil by different extraction methods[7]. The micronutrient status in soils of some part of India was described[8]-[23]. In this paper, the micronutrients status in soil and micronutrients deficiencies and toxicities are discussed. Even though the role of micronutrients in the balanced plant nutrition is

vital, information regarding their status in the most of soils is insufficient.

As result, fertilizer recommendation for crops in the country is mainly for macronutrients yet. But, continuous application of only macronutrients may cause for rapid depletion of other nutrients such as micronutrients. In view of this, a study was conducted at Solapur district to assess the status of some micronutrients. These micronutrients were extracted by using Mehlich-III multi-nutrient extraction method and their concentrations were measured by using AAS[24]-[26]. Content of micronutrients and their ability to supply to crop vary widely depending upon soil types, nature of crops grown, ecology and agro climatic variability. Total levels of micronutrients are rarely indicative of plant availability, hence, rational management of micronutrient fertility and toxicity requires an understanding of how plant-available soil micronutrients vary across the soils. The effects of mineral and organic fertilization on the contents of Fe, Cu, Zn, Mn, B and Mo in soil and in the soil solution as well as on availability of these elements for crops were investigated in the long-term field trial. Generally three different types of the soil found in this reason of Solapur district. The different types of soil from 110 villages of Solapur district were collected for study as described in the literature[24].

Soil Characteristics

The soils of the district can broadly be classified into three types:

1. Black
2. Coarse Gray
3. Reddish

According to topography the District is divided in three natural zones.

1. **Eastern Zone:** This comprises of Barshi, North Solapur, South Solapur and Akkalkot Talukas. The soil is medium to deep black and of rich quality. Jawar, Bajra and Pulses are the main crops of this zone.
2. **Central or Tansitional Zone:** Mohol, Mangalwedha, eastern part of Pandharpur and Madha Taluka are covered by this zone. Like to moderate soil and uncertain rainfall marks this zone. Both *Kharip* and *Rabbi* crops are grown in this part.
3. **Western Zone:** Karmala, Sangola and Malshiras Talukas and western parts of Pandharpur comes under this zone. Shallow and poor type of soil, not retentive of moisture marks this part. Scanty and uncertain rainfall. Rabbi crops mainly grown in Karmala, Pandharpur and Madha Talukas while Kharip crops like Bajra and Groundnut are grown in Sangola and parts of Malshirastalukas.

MATERIALS AND METHODS

Study Area

The Solapur district is bounded by 17º05′ North latitudes to 18º 32′ North latitudes and 74º42′ East of76º 15′ East longitudes. The total geographical area of Solapur district is 14895 Sq.K.m. divided into eleven tahsils. The Population is 32.4 lakhs in eleven tahsils of District (Censes 2001). It is bounded from the North by Osmanabad district and Ahmednagar district, on the North-East by Satara district and at the South & East it has common boundary of Karanataka state. Temperature is high in summer season. Rainfall varies from East to West between range of 200 to 600millimeters. The rivers like Bhima, Sina, Man, Nira, Bhogawati and many other smaller tributaries drain in the district. Banana, Cottan, Jawar, Sugarcan, Grain, Grapes, Bajari, Wheat, The soil of the district is mainly of Deccan Trap Volcanic origin.

Sample Collection

The study was designed to determine the status of micronutrients in agriculturally fertile soils of District Solapur. Represented soil samples were collected with wooden tools to avoid any contamination of the soils. Four to six pits were dug for each sample. From each pit sample was collected at a depth 0-30cm. A composite sample of about 1kg was taken through mixing ofrepresented soil sample. All composite samples were dried, ground with wooden mottle and passed through 2mm sieve. After sieving all the samples were packed in the polythene bags for laboratory investigations.

Analysis of Soil Sample

Soil samples (0-15 cm) were collected from different sites covering 110 villages, keeping in view the physiographic characteristic in different cross sections of the area as well as variation in soil texture. Soils were completely air dried and passed through 2mm sieve and stored in properly labeled plastic bags for analysis. The processed soil samples were analyzed for basic soil parameters (pH, EC, OC and OM) and the available Fe, Mn, Cu and Zn in soil samples were extracted with a DTPA solution (0.005M DTPA + 0.01 M CaCl2 + 0.1M triethanolamine, pH 7.3 as outlined by Lindsay and Norvell[11]. The concentration of micronutrients in the extract was determined by atomic absorption spectrophotometer (ECIL, AAS-4129).

RESULTS AND DISCUSSION

Concentration variations of micronutrient

To study this, there were 2362 surface soil samples collected from growing fields of Solapur tehsil. The soils were analyzed for physico-chemical properties and status of available micronutrients.

The results shows that majority of the soil sites were alkaline in nature with medium amount of organic matter and lime content. Considering textural classes most of the sites were sandy loam. The soil pH range from 6.88 to 8.06 (average 7.56). The organic matter content ranged from 0.65 to 2.07% (average 1.18%). The lime content ranged from 1.00 to 9.37% (average 4.18%) as reported in Table 1.

Table 1: Range and average values of Physio-Chemical properties of tested soil samples of district Solapur

Sl. No.	Physio-chemical Properties	Range	Average
1	Soil pH	6.88-8.06	7.56
2	Organic Matter %	0.65-2.07	1.18
3	Lime %	1.00-9.37	4.18
4	Sand %	31.12-81.12	64.39
5	Silt %	8.56-46.00	22.99
6	Clay %	8.88-26.88	12.95

By comparing the extractable micronutrients (Iron, Copper, Zinc and Manganese) and hot water soluble Boron content with the established criteria of Soltanpour, 1985 and Johnson and Fixen, 1990. The range and average value of micronutrient in soil of 110 villages of the studied area are presented in Table 2.

Table 2: Range and average values of Micronutrients of tested soil samples of district Solapur

Sl. No	Micronutrients in ppm	Range	Average
1	Fe	3.5-5.5	4.5
2	Cu	1-3	2
3	Zn	0.3-0.9	0.6
4	Mn	1-3	2
5	B	0.3-0.7	0.5

All the soil sites were found high in Iron, Copper and Manganese contents, it was found that 3.34% samples had high, 70 % samples had medium and 26.66% samples had low in Zinc content. Boron was found low in 80% sites and medium in 20% sites as presented in Table 3.

Table 3: Critical soil test values of AB-DTPA extractable Copper, Iron, Manganese, Zinc and HWS B *Johnson and Fixen, 1990 and ** Soltanpour, 1985.

Sl. No.	Micronutrients	Nutrient Content (mg kg^{-1})		
		Low	Medium	High
1	HWS Boron	<0.5	0.5-1	>1
	AB-DTPA-DTPA Extraction Method			
2	Iron	<3.0	3.0-5.0	>5.0
3	Copper	<0.3	0.3-0.5	>0.5
4	Zinc	<0.9	0.9-1.5	>1.5
5	Manganese	<0.6	0.6-1.0	>1.0

CONCLUSION

Most of the soil sample shows the slightly alkaline nature and low value of N and P. The potassium was medium range in almost soil. Excess of phosphorus will not have direct effect on the plant but may show visual deficiencies Zn, Fe and Mn, whereas, due to the excess of potassium plants will exhibit typical Mg and possibly Ca deficiency symptom due to a cation imbalance. The excess amount of micronutrient shows a bronzing of leaves with tiny brawn spots on the leaves. The data reveals that in location point where the soil are deficient in N, P, & K which requires addition of extra fertilizer and manures to make it suitable plantation and for increasing plant growth. In contrast to deficiency of micronutrients in soil may cause decline in crop yields and total

productivity in future. As par the nutrient index value, soil factors such as pH, EC, OC and CaCO3 were contributed lower fertility status in relation to availability of micronutrients. Strategies involving the soil application of micronutrients by seed treatment, foliar sprays or use of organic manures can adopt to sustain an optimum yield ofcrop. The soils of Solapur district are neutral to alkaline in soil reaction, safe in electrical conductivity, medium in organic carbon content and calcareous in nature. According to the concept of soil nutrient index soils are deficient in Zinc and Boron while sufficient in Copper, Manganese and Iron content.

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