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Analysis of Soils from Latur District, Maharashtra

G. R. Nagargoje

Assistant Professor, Department of Chemistry, Shivaji Mahavidyalaya, Renapur, Dist. Latur-413527, Maharashtra, India

Abstract: ***In the present study it was preferred to investigate the soil samples for its physico-chemical analysis of some parameters and micronutrient status of DTPA-Fe, Mn, Cu and Zn in soils fromlatur district area of Marathwada region. Fifteen representative samples were collected and analyzed for soil properties and fertility status. The results obtained that the study area soils are neutral to alkaline in soil reaction, electrical conductivity in safe range, low to high in organic carbon content and non-calcareous to calcareous in nature. Considering soil nutrient index values these soils are deficient in DTPA- Zn while Sufficient in DTPA-Fe, Cu and Mn.***

Keywords: Soil analysis, Micronutrients, Physico-chemical, Nutrient Index

1. Introduction

Scientifically soil is the part of the earth's crust in which plants are anchored. The micronutrient are essential for the proper biochemical transformations within the plant body, so as to yield the desired end products, Zn is essential for protein and auxin production, Cu is a constituent of cytochrome oxidase, Fe helps in photosynthesis while Mn is essential for photosynthesis, carbon assimilation and nitrogen metabolism. Soil fertility is one of the important factors controlling yield of the crops soil characterization in relation to evaluation of fertility status of the soil of an area or region is an important aspects in context of sustainable agricultural production because of imbalanced and inadequate fertilizer use couples with low efficiency of other inputs, the production efficiency of chemical fertilizer nutrients has declined tremendously under intensive agriculture in recent years (Yadav and Meena, 2009). Due to these in view and also lack of information on micronutrients status to identify the emerging micronutrient deficiency or toxicity in the soils, therefore Fifteen representative samples were collected to investigate the soil samples for its physico-chemical analysis of some parameters and micronutrient status of DTPA-Fe, Cu, Mn and Zn in soils from latur district.

2. Material and Methods

Latur district is in the south-eastern part of the Maharashtra state and situated on the Maharashtra Karnataka boundary. The entire district of Latur is situated on the Balaghat plateau, 540 to 638 mtrs from the mean sea level. Total fifteen representative soil samples were collected in the depth of 0-20 cm from the surface of soil from different villages in Latur area in the year 2018. The soil samples were preserved in polythene bags for further analysis. The chemicals and reagents used for analysis were of A.R. grade from S.D Fine and Merck.pH values were determined using Equiptronics pH- meter as described by Jackson (1967). For this 20 g soil sample was mixed with 40 ml distilled water in 1: 2 ratio. The suspension was stirred intermittently with glass rod for 30 minutes and left for one hour. The combine electrode was inserted into supernatant and pH was recorded. pH value as a measure of the hydrogen ion activity of the soil water system and expresses the acidity and alkalinity of the soil. It is a very important property of soil as it determines the availability of nutrients, microbial activity and physical condition of soil. Electrical conductivity (EC) expresses ion contents of solution which determine the current carrying capacity thus giving a clear idea of the soluble salts present in the soil. The electrical conductivity of a soil samples was determined on an Equiptronics digital electrical conductivity bridge for which 20g soil was added in 40ml distilled water. The suspension was stirred intermittently for half an hour and kept it for 30 minutes without any disturbances for complete dissolution of soluble salts. The soil was allowed to settle down and then conductivity cell was inserted in solution to take the reading to record the EC values. Organic matter is useful in supplying nutrients and water to the plants and also provides good physical conditions to the plants. The quantity of organic carbon in the soil was estimated by using modified Walkey - black method (Walkey and black, 1934) as described by Jackson (1967). 1g finely ground dry soil sample was passed through 0.5mm sieve without loss and was taken into 500ml conical flask to this 10ml of 1N $K_2Cr_2O_7$ and 20ml con. H_2SO_4 were added and the contents were shaken for a minute and allowed to set aside for exactly for 30 minutes and then 200ml distilled water, 10ml phosphoric acid and 1ml diphenylamine indicator were added. The solution was titrated against standard ferrous ammonium sulphate (Mohr's salt) till colour changes from blue violet to green. The blank titration was also carried without soil. Micronutrients like Cu, Zn, Fe, and Mn are estimated by using Atomic Absorption Spectrophotometer employing standard methods (Trivedy and Goel, 1984). Micronutrients include iron, manganese, zinc, copper, boron, chlorine and molybdenum. The term refers to plant's needs, not to their abundance in soil. They are required in very small amounts but are essential to plant health in that most are required to speed up plant's metabolisms. They are generally available in the mineral component of the soil and the method commonly used for determination of available micronutrients in soil samples is by Lindsay and Norvell (1978) This method consists of use of DTPA (Diethylenetriaminepenta acetic acid) which has been widely accepted for the simultaneous extraction of micronutrients like Zn, Cu, Fe Mn in neutral and alkaline soils. The soil nutrient index was calculated according to the procedure given by Ramamoorthy and Bajaj (1969)

3. Result and Discussion

The results of physic-chemical parameters and Micronutrient status of soil samples from latur district are presented in table 1. The colour of soil sample was observed visually and it was found to be black for all the samples. The pH of soil ranging from 7.1 to 8.50 with an average value of 7.65.The values of pH showed that they lie in the alkaline side of the pH scale. The pH range of 6 to 8 is useful for the growth of plants. Electric conductivity of soil ranging from 0.12 to 0.50 $dsm^{-1}$with average value of 0.30 dsm^{-1}.The value of conductivity is the measure of ions present in the sample. The conductivity values can vary with the chemical properties of soil, if the soil is contaminated by chemicals. The organic carbon content was ranging from 3.2 to 7.5 g kg^{-1} with an average value of 5.40 g kg^{-1}. 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 Waikar et al. (2004). The free $CaCO_3$ content was ranging from 45.3 to 67.5 g kg-1 with a average value of 57.47 g kg-1. These soils are indicating non-calcareous to highly calcareous nature. In the soils under study the concentrations of DTPA-Fe ranging from 5.59 mg kg^{-1} to 10.21 mg kg^{-1} with an average value 7.72 $mgkg^{-1}$.This high DTPA-Fe content in soil may be due to presence of minerals like Feldspar, Magnetite, Hematite and Limonite which together constitute bulk of trap rock in these soils (Vijayakumar et al. 2013).

Table 1: Micronutrient status and Physico-chemical parameters of soil samples from latur district

Sample No	Fe ($mg\ kg^{-1}$)	Mn ($mg\ kg^{-1}$)	Cu ($mg\ kg^{-1}$)	Zn ($mg\ kg^{-1}$)	pH	EC (dSm^{-1})	OC ($g\ kg^{-1}$)	$CaCO_3$ ($g\ kg^{-1}$)
1	5.59	6.48	2.41	0.45	7.6	0.31	6.1	60.2
2	7.78	7.29	1.55	0.39	8.1	0.36	3.2	61.1
3	7.58	10.6	2.21	0.31	7.4	0.19	6.5	51.6
4	10.11	7.41	1.42	0.32	7.5	0.36	4.1	52.9
5	9.46	12.1	2.17	0.38	7.6	0.35	5.5	60.4
6	7.61	9.65	1.36	0.42	7.3	0.12	6.7	53.2
7	7.58	7.54	2.32	0.31	7.1	0.21	5.8	45.3
8	9.12	12.5	2.01	0.39	8.5	0.5	5.4	59.8
9	5.64	12.2	1.98	0.48	7.4	0.35	7.5	67.5
10	6.99	8.84	1.52	0.41	8.2	0.41	5.1	66.5
11	7.51	10.9	1.52	0.35	7.1	0.21	5.9	59.4
12	7.75	8.22	2.02	0.31	7.8	0.29	3.7	55.2
13	6.35	8,75	1.25	0.45	7.5	0.16	4.9	60.2
14	10.21	12.18	2.11	0.35	8.1	0.32	5.5	55.1
15	6.55	12.52	2.12	0.77	7.6	0.46	5.1	53.7
Total Average	**7.72**	**9.88**	**1.86**	**0.40**	**7.65**	**0.30**	**5.4**	**57.47**

DTPA-Mn has oxidation influenced by both chemical and microbiological factors. Its activities have many enzyme reactions involved in the metabolism of organic acids Mn function along with Fe (Lindsay and Norvell, 1978) in formation of chlorophyll. Table 1 shows the range of the Mn content in the soils from the area from6.48 mg kg^{-1} to 12.52 mg kg^{-1} with an average value 9.88 $mgkg^{-1}$.The DTPA-Cu is an essential micronutrient for normal plant growth. As DTPA-Cu is strongly bound to soils it is very immobile and hence the plant roots are frequently higher in Cu concentration than other plant tissues. In the soils under study the concentrations of DTPA-Cu range from 1.42 mg kg^{-1} to 2.41 mg kg^{-1} with an average value 1.86 $mgkg^{-1}$The higher amount of DTPA-Cu in surface layer might be due to higher biological activities and chelating effect (Kadao et al. 2002; Jibhakate et al. 2009).The DTPA-Zn content in the soils ranging from0.31 to 0.77mg kg^{-1} with an average value of 0.40 mg kg^{-1}.This low content of DTPA-Zn in these soils might be due to fact that under alkaline conditions, the zinc cations are changed largely to their oxides or hydroxides and thereby lower the availability of zinc. The similar results were also reported by Meena et al. (2006)

Soil Nutrient Index Value: As per the NIV developed by the Ramamoorthy and Bajaj (1969) the nutrient index value for soils of latur district are deficient in DTPA- Zn while Sufficient in DTPA-Fe, Cu and Mn

4. Conclusions

The Conclusion can be drawn that the soils from latur district neutral to alkaline in soil reaction, safe in electrical conductivity, low to high in organic carbon content and non-calcareous to calcareous in nature. According to the concept of soil nutrient index soils of latur district are deficient in DTPA- Zn while Sufficient in DTPA-Fe, Cu and Mn content.

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