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Soil Micronutrient Status of Upper Kundalika Command Area, Beed District Maharashtra

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Abstract:

Many times use of poorer quality of waters has led to the deterioration of the soils. The groundwater charged with high concentration of salts, often representing disproportionate amount of bicarbonate (HCO_3) and sodium (Na^+) ions cause adverse effect on the soils. In order to adjudge any adverse effect on the quality of the soil in the study area, some of the important physico-chemical and micronutrients status of the soil which were considered and evaluated during present investigation are Ph, EC, $CaCO_3$, OC, Fe, Cu, Mn and Zn. Twenty five sampling stations were selected for study in rainy season. Soil organic carbon contents were the highest. The study revealed that there was depletion in soil organic carbon and zinc contents.

Key words: Physico-Chemical, Kundalika, Micronutrients, Salt, and Soil.

Introduction:

Many times use of poorer quality of waters has led to the deterioration of the soils. The groundwater charged with high

concentration of salts, often representing disproportionate amount of bicarbonate (HCO_3) and sodium (Na^+) ions cause adverse effect on the soils. There are two major categories of soil i.e. zonal and drift. The zonal soil occurs usually in relatively flat or undulating areas formed as result of weathering (Patil, et.al. 2014). The studies on the effect of irrigation water on the soil properties have been carried out by several workers (Hausenbuiller *et.al*., 1960; Singh., et.al., 1967; Yaron and Thomas, 1968; Singh and Sharma, 1970; Paliwal and Maliwal, 1971; Madhav Rao *et.al*., 1979). Therefore, in order to adjudge any adverse effect on the quality of the soil in the study area. Saline soils contain sufficient soluble salts but possess usually low pH (less than 8.5). The amount of exchangeable sodium is low i.e. < 15% of total exchange capacity. Such soils observed in flocculation condition could leach excess salts below the root zone during irrigation (Mahida, 1981). The soils when contain excess of exchangeable calcium (Ca^{2+}), the soil is known as saline soil (Daji, 1985). The term saline is however, used by USDA (1954) in connection with soils for which the conductivity of saturation extract is more than 4 mmhos/Cm^{-1} at 25^0C and ESP is less than 15. The process of accumulation of salts leading to the formation of saline soils is known as salinization. The pH value of a normal soil can be considered as an index of its exchangeable cation saturation (USDA, 1954). Hence, the availability of many plant nutrients depends on the pH of the soil. The nutrients like iron (Fe), zinc (Zn), copper (Cu), manganese (Mn) etc. are available more in acid than in alkaline soils (Hassan, 2012).

Material and Methods:

Analysis of the samples was carried out in rainy season throughout the 4 months during the year 2013-2014. Each parameter was analysed monthly. In order to undertake accurate estimation of soil quality, soil analysis were done for

the parameters like pH, EC, $CaCO_3$, OC, Fe, Cu, Mn, Zn. These analyses were carried out by referring the standard procedures according of APHA, AWWA, and WPCT, 1995, Trividy, and Goel (1986) and NEERI (1986) and as per American society of Agronomy (Anonymous, 1965) and for micronutrients, jackson (1958) Avilable Fe, Mn, Zn, and Cu were extracted using DTPA (Lindsay and Norvell 1978) and estimated by Atomic Absorption Spectrophotometer. In the study, the overall structure of the study area is taken into consideration while selecting the sampling cities.

Results and discussion:

pH:

In the present study for all soil samples the pH was observed to be above 7.0 except samples no. 21, 22 and 23. It ranged from 6.92 (Sample No.-21) to 7.57 (Sample No.-18) (Table No.1 and Fig.No. 1) reflecting saline nature of the soils. According to USDA (1954) the alkaline soils having pH 8.5 to 10.0 are considered as alkali soils, and those having less than 8.5 are saline soils. Using these criteria, the soil from the study area can be classified as saline soils as they have pH less than 8.5, all the samples in rainy season for the year 2013-14. The range 5 to 7.5 most of the elements are available to the plant (Manish., 2014). Increase in soil pH has significant effect on seed germination (Reddy, 1991). The nutrients like iron (Fe), zinc (Zn), Copper (Cu), manganese (Mn) etc. are available more in acidic than in alkaline soils. In alkaline and calcareous soils, the availability of potassium (K), phosphorus (PO4), iron (Fe) and many minor elements is reduced and hence, the addition of fertilizers carrying these elements is necessary for such soils. Thus, the pH of soil plays a very important role in maintaining the soil fertility (Ghorade, 2013).

EC (dsm^{-1}):

Soil salinity is a measure of the total amount of soluble salt in soil. As salinity levels increase, plants extract water less easily from soil, aggravating water stress conditions. High soil salinity can also cause nutrient imbalances, result in the accumulation of elements toxic to plants and reduce water infiltration if the level of one salt element sodium is high. The EC is characterized mainly by cations (Na^+, K^+ Ca^{2+} and Mg^{2+}) and anions like Cl^-, SO_4^{2-} along with bicarbonate, phosphate, nitrate etc. The EC is also used as an index of grading the soil type along with ESP and pH of the soil (USDA, 1954). The EC value of saturated soil paste up to 1 mmhos/Cm^{-1} and above that is considered to be saline soils (USDA, 1954). The EC is measure of soluble salts present in the soil solutions and gives indication whether the soil is suitable to raise a particular crop on that field. In the present study the EC values of the soils in the study area vary from 0.124 (Sample No.-8) to 0.626 $dsm^{-1.}$ (Sample No.-16) (Table No.1 and Fig.No. 1). It indicate that the soil of the study area were low in soluble salt concentration which is well within the safe limit of EC range, designated for normal soils.

$CaCo_3$ (gm/kg):

The calcium carbonate affects the productivity of crop because it fixes most of the essential nutrient elements. Calcium carbonate high or low it may due to physiographic location of the area, which come under low laying areas where the deposition of transported CaCo3 material may be observed. In the present study $CaCo_3$ varied from 0.2 (Sample No.-20) to 8.0 mg/gk (Sample No.-7). (Table No.1 and Fig.No. 1).

OC (gm/kg):

Organic carbon is responsible to determine the fertility and the productivity of soil. The organic carbon content in the soil

varied from 0.14 (Sample No.-12) to 1.26 mg/gk (Sample No.-10). (Table No.1 and Fig.No. 1).

Fe (mg/kg):

In the present study iron content in the soil varied from 0.050 (Sample No.-11) to 3.838 mg/kg. (Sample No.-17). In this area iron is low and deficient in the soils. The value of iron below the critical limit. The low value of iron may be due to calcareousness of the soil (Bandopadhyay and Adhikari, 1975). (Table No.1 and Fig.No. 1).

Cu (mg/kg):

In the present study Cu content in the soil varied from 0.102 (Sample No.-11) to 5.418 mg/kg. (Sample No.-1). The values of Cu were above the critical limit for the black soil region. It suggest that the soils are well supplied with Cu and did not to bother about the availability of these nutrients in that particular soils. (Table No.1 and Fig.No. 1).

Mn (mg/kg):

In the present study Mn content in the soil varied from 0.642 (Sample No.-4) to 5.784 mg/kg. (Sample No.-8). The values of Mn were above the critical limit for the black soil region. It suggest that the soils are well supplied with Mn and did not to bother about the availability of these nutrients in that particular soils. Some of the soils show higher amount of Mn which may be due to low amount of $CaCo_3$. Similar observations were reported by Lodha and Baser (1971). Patil and Singte, (1982) and Manish Thakare (2014). (Table No.1 and Fig.No. 1).

Zn (mg/kg):

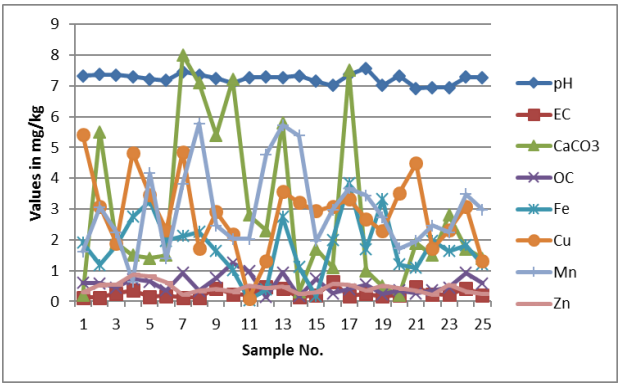
In the present study Zn content in the soil varied from 0.224 (Sample No.-7 & 22) to 0.878 mg/kg. (Sample No.-4).The Zn value which is below the critical limit (0.6 ppm) of Maharashtra

soils. Zinc is very low and deficient in these soils. (Table No.1 and Fig. No. 1).

Table No. 1: Physico-Chemical and Micronutrient status of soil Samples in Rainy season during the year 2013-14.

Sample No.	pH	EC dsm^{-1}	$CaCO_3$ gm/kg	OC gm/kg	Micronutrients (mg/kg)			
					Fe	Cu	Mn	Zn
1	7.33	0.133	0.2	0.61	1.906	5.418	1.626	0.304
2	7.37	0.131	5.5	0.59	1.186	3.088	3.062	0.530
3	7.35	0.263	1.9	0.45	1.820	1.890	2.240	0.554
4	7.30	0.360	1.5	0.72	2.748	4.824	0.642	0.878
5	7.22	0.151	1.4	0.65	3.260	3.456	4.156	0.818
6	7.18	0.178	1.5	0.36	1.980	2.310	1.392	0.618
7	7.46	0.129	8.0	0.93	2.126	4.858	3.816	0.224
8	7.35	0.124	7.1	0.34	2.260	1.714	5.784	0.352
9	7.24	0.422	5.4	0.76	1.642	2.906	2.470	0.398
10	7.09	0.242	7.2	1.26	1.024	2.178	2.032	0.324
11	7.27	0.226	2.8	0.99	0.050	0.102	2.032	0.504
12	7.28	0.476	2.3	0.14	0.386	1.312	4.772	0.434
13	7.27	0.431	5.8	0.94	2.748	3.580	5.726	0.478
14	7.32	0.139	0.3	0.17	1.118	3.212	5.378	0.250
15	7.15	0.204	1.7	0.74	0.170	2.944	1.966	0.306
16	7.02	0.626	1.1	0.27	2.004	3.092	2.984	0.578
17	7.37	0.185	7.5	0.40	3.838	3.324	3.674	0.538
18	7.57	0.257	1.0	0.55	1.704	2.682	3.438	0.360
19	7.01	0.163	0.5	0.24	3.318	2.286	2.736	0.512
20	7.33	0.210	0.2	0.36	1.198	3.504	1.716	0.424
21	6.92	0.463	1.9	0.27	1.094	4.488	1.966	0.352
22	6.94	0.242	1.5	0.36	1.980	1.714	2.470	0.224
23	6.94	0.226	2.8	0.45	1.642	2.312	2.240	0.530
24	7.29	0.431	1.7	0.93	1.820	3.088	3.478	0.324
25	7.27	0.204	1.4	0.59	1.198	1.312	2.984	0.250

Fig. No. 1: Physico-Chemical and Micronutrient status of soil. Samples in Rainy season during the year 2013-14.



Conclusion:

The micronutrient status after observing the value of Cu and Mn are above critical limit whereas Zn and Fe are found to be low in these soils. From the above observation it is clear that the low productivity of the soils of upper Kundalika command area may be attributed to the very low values of Zinc and Iron which are essential elements for the plant growth.

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