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Advances in Applied Science Research, 2016, 7(3):175-178

ISSN: 0976-8610
CODEN (USA): AASRFC

Assessment of macro and micro nutrients in alkaline soil from Satpuda region Orange Belt, Maharashtra, India

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ABSTRACT

Most of the essential elements are found in liberal quantities in the mineral soils. The present study deals with the assessment of macronutrients i.e. N, K, Ca, Mg, P, S and micronutrients i.e. Zn, Fe, Cu, Mn from satpuda region of orange belt, Maharashtra, India. Soil samples collected from different locations of the orange belt. The availability of nitrogen according to alkaline permanganate method and phosphorus by olsens method was found to be 243 – 287 Kg/Hector and 13.2 - 15.3 Kg/Hector respectively. Potassium was found to be in medium rang. Organic carbon as a measure of available Nitrogen found to be 0.5 %. The data reveals that the soils are rich with K, medium with P and low with N.

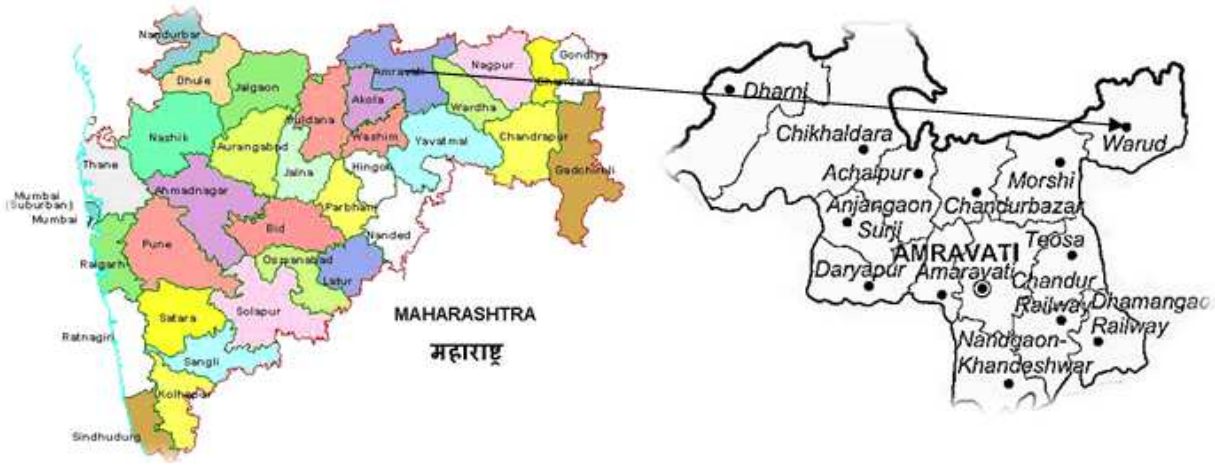
Keywords: Macronutrients, Micronutrients, Soil Analysis.

INTRODUCTION

Warud is well known city for California of vidarbha for world class quality of orange. The north side of warud is surrounded by satpuda hill ranges. Soil here is black and most suitable for cotton and oranges. The mineral nutrients like macro and micro has unique importance in plants such as cell elongation, metabolism, O_2 evolution, N_2 fixation, respiration to constitute chlorophyll contain. Soil is a diverse complex that can be defined as a mixture of minerals and organic material, which are capable of supporting plant life[1-2]. There are 17 essential nutrients which are required for plant growth. Study of macro and micronutrients is important to agricultural chemist for plants growth and soil management [3-4]. However, micronutrients like Fe, Mn, Zn, Cu are only easily accessible in acidic situation. Sometimes these nutrients also cross the toxic limit and high concentrations leads to toxic effects on plants. Sometimes the micronutrient status also changes due to cropping pattern and fertilizer practices. The organic matter contain in the soil is very small and varies from only about 3 -5 % by weight in the top soil. Organic matter is store house of the nutrients in a soil. Besides these organic matters is responsible for most desirable surface soil structure, promotes a greater proportion of larger sizes, and improves water holding capacity and also aeration status of the soil.

The main objective of the study is assessed of macronutrients and micronutrients in satpuda region of orange belt. The study helps in understanding the future scope of growth of orange and cotton in this region.

Study Area-
Warud is a tahsil place of Amravati district (Maharashtra State) surrounded by satpuda hills. This area is known for oranges, Cotton and Turmeric. Economical source of the peoples in this region is mainly depends upon the crops of orange, cotton, turmeric and to increase the yield of crop soil analysis must be carried out.



MATERIALS AND METHODS

Collection of soil sample:
Different location was selected for sampling and five samples were collected from different depth. The depth was used because it is believed that pollution decreases with increase in depth. The soil sample were collected into lebelled sterile polyethylene bags and taken in ice-packed cooler to the laboratory for physico-chemical analysis.

Preparation of soil sample for analysis:
Each sample meant for physico-chemical analysis was air dried for five days and then sieved to ensure homogeneity using a 2mm size sieve.

Metal analysis:
Analytical grade reagents are used for the preparation of reagents. Glassware were washed thoroughly with detergent and then with deionised water. The extraction of heavy metals was done by using one gram of each of air dried soil sample digested in 10 ml 1:1 concentrated HNO_3. The mixture was evaporated to near dryness and then cooled. The procedure was repeated with a 15 ml solution of 1:1 concentrated HCl. The extract were filtered with whatman filter paper and then made up to 100 ml volume with 2% HNO_3. Solution of the sample were analysed by using atomic absorption spectrophotometer using water as a blank.

Table 1. Details of soil samples at different locations point

Sr. No.	Area	Sample code	Depth (cm)
1	Hiwarkhed	AK-I	15-25
2	Jarud	AK-II	15-25
3	Shendurjana-ghat	AK-III	15-25
4	Rawala	AK-IV	15-25
5	Warud	AK-V	15-25

Table 2. Laboratory methods used for chemical analysis of soil

Sr. No.	Particulars	Method used
1	pH	pH-metry
2	Conductance	Conductometry
3	Nitrogen	Alkaline permanganate method
4	Phosphorous	Olsen`s Method
5	Potassium	Flame photometric method
6	Magnesium	Titration
7	Calcium	Titration
8	Zn, Fe, Cu. Mn	Atomic absorption Spectrophotometric method
9	Organic carbon	Titration
10	Alkalinity	Titration

pH: Dissolve the dried fine powder of soil in deionised water [1:5]. Keep it overnight with constant stirring and measure the pH by pH cum potentiometer from Equip-Tronics Model number EQ-631.

Electrical Conductivity: Dissolve the dried fine powder of soil in deionised water [1:5]. Stir it overnight hours at 1000 rpm and measure the conductance by systronic conductivity meter- 304.

Available nitrogen: Alkaline permanganate method is used for the determination of available nitrogen as described by Subbiah and Asija[5]. The procedures involve distilling the soil with alkaline potassium permanganate solution and absorb the ammonia liberated in boric acid which is then titrated with Standard sulphamic acid.

Available phosphorus: Ascorbic acid method described by Olsen[6] was used for the determination of available phosphorous in soil.

Available potassium: Take 5 gram of soil powder and add neutral normal ammonium acetate and extract the potassium by shaking at 1000 rpm followed by filtration. The availability of potassium was carried out as described by Jackson[7] with the help of flame photometer.

Micro nutrient: Lindsay and Novell[8] used for the determination of micro nutrients. It was done by using DTPA (Diethyl Triamine Penta Acetic Acid) which was found useful for separating soils into deficient and non deficient categories for Zn, Cu, Mn, and Fe by using atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

pH and Electrical Conductance:
The pH is the important parameter to measures the ratio of H^+ ions to OH^- base ions in the soil. From the table number-1, it is observed that, pH value is ranges from 7.05 to 8.96 in the different soil sample. The pH of the soil samples was found to be 50 % alkaline nature, 50 % of soil samples was shown slightly acidic. The minimum value of pH was found to be 7.05 in sample AK-III from the depth 25 cm and maximum was 8.96 in sample A.K-IV from the 15 cm depth. The conductance is ranges from 0.23 to 0.48 µS. The minimum value of conductance was found to be 0.23 µS in the sample A.K-IV in 15 cm depth while the maximum conductance fount to be 0.48 µS in the sample A.K.-I from 25 cm depth.

Macro nutrients of soil samples:
From the table no. 3 the availability of Nitrogen in different soil samples were ranged 234 to 287 kg/hect. Presence of Nitrogen is an essential part for carbohydrate, fats, oil and also an essential ingredient of proteins. The deficiency of nitrogen shows uniform yellowing of older leaves including veins, leaves that will eventually turn brown and die. The excess of nitrogen shows plants will be dark green in colour and new growth will be succulent. The availability of Phosphorous in different soil was ranged in between 12.76 to 15.34 kg/hect. It is essential for the development of meristematic tissues at the growing points. If there is deficiency of phosphorous in soil then the growth of plant would be slow. The value of potassium was ranged in between 385 to 477 kg/hect. Potassium deficiency shows yellow stars on lower leaves. Organic carbon was found to be in the range 0.334 to 0.52%. The value of TDS was found to be in between 174 to 187 mg/l. The alkalinity was found in between 156 to 339 ppm.

Calcium is most important for the growth process. Calcium was found in the ranged 0.40 to 0.53%. Calcium deficiency shows yellow/brown spot, surrounded by sharp brown outline edge. Magnesium was found in the ranged 8.63 to 10.29 %. If there is a deficiency of magnesium in soil then it direct effect on plant leaves. Leaves of the plant becomes pale leaves, which then develop an interveinal chlorosis, sometimes reddish or purple spot will appear on the leaves.

Macro nutrients of soil samples:
The value of zinc content was found to be in the range 0.11 to 0.60 ppm. in different soil samples. In the deficiency of zinc upper leaves will show chlorosis on midrib. The value of iron content was found to be in the range 2.44 to 8.63 ppm in different soil sample. The excess iron shows a bronzing of leaves with tiny brown spots on the leaves while iron deficiency shows yellow spot on leaves. The value of copper nutrient was found to be ranged from 0.56 to 1.51ppm in different soil samples. The deficiency of copper shows yellow leaves including veins and tending towards whiteness. The value of manganese content was found to be ranged from 3.55 to 11.45 ppm in different soil samples. The deficiency of manganese shows interveinal yellowing of young leaves.

Table 3. Macro nutrient properties of soil

Sr. No	Sample	Depth (cm)	Chemical Properties											
			Colour	pH	Moisture (%)	Conductance (µS)	N (kg/hect)	P (kg/hect)	K (kg/hect)	OC (%)	Ca (%)	Mg (%)	TDS (mg/l)	Alkalinity (ppm)
1	AK-I	15	Brown	7.61	3.22	0.45	243	13.23	460	0.46	0.41	8.98	187	230
		20	WB	7.58	3.46	0.44	234	12.82	468	0.44	0.40	8.94	186	243
		25	WB	7.55	3.57	0.48	236	12.76	471	0.41	0.40	9.93	187	245
2	AK-II	15	Black	8.74	4.83	0.31	257	14.17	432	0.50	0.53	9.58	177	321
		20	Brown	8.21	4.98	0.37	250	13.91	441	0.48	0.52	9.57	176	334
		25	WB	8.21	5.12	0.39	249	13.89	443	0.46	0.51	9.52	179	339
3	AK-III	15	White	7.18	5.18	0.33	243	15.32	448	0.47	0.54	9.23	176	234
		20	Reddish	7.10	5.31	0.38	241	15.13	447	0.45	0.53	9.19	174	240
		25	White	7.05	5.41	0.37	240	15.06	449	0.44	0.52	9.18	175	244
4	AK-IV	15	Black	8.96	4.26	0.23	287	13.84	387	0.41	0.48	10.29	187	189
		20	Red	8.87	4.36	0.28	285	13.87	385	0.39	0.45	10.25	186	198
		25	WR	8.12	4.51	0.27	284	13.85	385	0.34	0.44	10.21	186	200
5	AK-V	15	White	7.55	5.65	0.42	265	15.33	474	0.52	0.51	8.64	182	156
		20	White	7.49	5.73	0.44	263	15.34	477	0.48	0.52	8.64	183	162
		25	Brown	7.25	5.79	0.45	261	15.32	477	0.46	0.52	8.63	184	165

Where WB = Whitish Black, WR = Whitish Red

Table 4. Micro nutrient properties of soil

Sr. No.	Sample	Depth (cm)	Chemical Properties				
			Colour	Zinc (ppm)	Iron (ppm)	Copper (ppm)	Manganese (ppm)
1	AK-I	15	Brown	0.11	3.55	0.87	3.55
		20	WB	0.23	3.67	0.94	3.56
		25	WB	0.30	3.68	0.97	3.58
2	AK-II	15	Black	0.42	6.43	1.44	5.48
		20	Brown	0.45	6.66	1.50	5.53
		25	WB	0.51	6.68	1.51	5.60
3	AK-III	15	White	0.43	8.45	0.56	7.04
		20	Reddish	0.40	8.59	0.58	7.11
		25	White	0.43	8.63	0.57	7.13
4	AK-IV	15	Black	0.60	2.44	0.69	11.44
		20	Red	0.48	2.87	0.59	11.45
		25	WR	0.44	2.89	0.59	11.44
5	AK-V	15	White	0.54	4.66	0.89	9.44
		20	White	0.46	4.75	0.71	9.48
		25	Brown	0.47	4.79	0.70	9.49

Where WB = Whitish Black, WR = Whitish Red

CONCLUSION

Study has been carried out by using soil of different depth from Satpuda region of orange belt. Soil of this area was found to be in different colours while depth of soil has its own importance. Soil was found to be alkaline in nature having low value of electrical conductance. The availability of phosphorous was found to be in the limit range. Nitrogen was found to be less while potassium was found to be more than limit which requires addition of extra fertilizer and manures to make it suitable plantation and for increasing plant growth. Micro nutrients were in the limited range which is suitable for plant growth.

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