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Assessment of Micronutrients and Macronutrients in Soil of Chandrapur Area, Maharashtra, India

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Abstract: The chemical analysis of soil has been conducted to find out soil nutrients deficiency so that farmers got maximum production and better economic benefits. It consist of collection of soil samples and determination of moisture content, bulk density, water holding capacity, PH, Electrical conductivity, Organic carbon, Nitrogen, Phosphorus, Potassium, some micronutrients like Copper, Iron, Manganese and Zinc. The evaluation of chemical analysis shows that most of soil parameter are not fulfilled to desired level and found to low fertility. Hence it is suggested that soil samples must be enriched with nutrient by organic manure or chemical fertilizers treatment to acquire optimum nutritional needs.

Keywords: Micronutrients, macronutrients, chemical analysis, fertility, soil quality

1. INTRODUCTION

The importance of physicochemical analysis of soil played a major role in agriculture. Indian economy is based on agriculture. Most of the people depend on agriculture. The optimum level of nutrients in soil gives maximum crop yield. Thus production is depends on nutrient level of soil. If nutritional health of soil declines, it alter fertility status of soil and affects in lowering crop yield and alternatively economy. Cotton, one of economically important crop is cultivated in Chandrapur and around Chandrapur of Maharashtra state, India particularly in rainy season and crop yield is mainly dependent on soil fertility and rain fed water. Its yield is severely affected by insufficiency or deficiency of soil nutrients. Therefore, chemical analysis of such soil is required to bring its nutritional health to reference range. In view of this, present study consist of chemical analysis, its evaluation to identify deficiency of nutrients to maintain soil fertility and acquire maximum crop yield[1-4].

2. MATERIALS AND METHOD

The site of study includes farmer's field in eight villages of Chandrapur district of Maharashtra namely Padoli, Anthurla, Mahakurla, Chincholi, Nagada, Ambora, Ghugus and Gadchandur. The soil samples were collected from 0-15 cm deep and code them as S_1, S_2, S_3, S_4, S_5, S_6, S_7 and S_8 respectively. The samples were grinded and passed through a 2 mm sieve and packed into polythene bag and brought into laboratory and analyzed for moisture, bulk density, texture, water holding capacity, PH, electrical conductivity, carbon, nitrogen, phosphorus, potassium, magnesium, zinc, copper and iron.

3. SOIL CHEMICAL ANALYSIS

The collected soil samples is processed in laboratory for different soil parameters. The soil PH was measured by glass electrode. Organic carbon was estimated by oxidation Walkley-Black-1934, available nitrogen alkaline potassium permanganate (Subbaiah and Asija1956), Phosphorus content by sodium bicarbonate (Olsen et al.1954), potassium content by ammonium acetate (Hanway and Heidel 1952). The other parameter is determined using usual method employed in the laboratory.

4. RESULT AND DISCUSSION

The result of soil analysis is embodied in **Table 1.** All the soil parameters relating to its fertility are discussed as under.

Temperature: It is one of important physical property of soil that affect crop yield. Soil gain temperature naturally from sun rays. It may further gain temperature due to heat of hydration when chemical fertilizer get hydrated with water when applied. The high temperature of soil decreases enzyme activity, leaves turns to yellow, poor photosynthesis and declines crop yield. All soil sample lies in normal temperature range 25-30^{0}C (**Table 1).**

PH: It is one of important parameter of soil fertility. It gives an idea about presence of water soluble nutrients in the soils. Hence PH determination is

important before type of crop chosen for soil. The requirement of PH is different for different types of crops[5-6]. The PH values in the range of 6.5-7.5 is normal at which most of nutrients are available for plant growth. If PH of soil is less than 6 then such soil is considered as acidic soil and hazards normal growth of plant. At lower PH soil nutrient is leached out by water and stunted its growth. In our study, the pH of soil samples ranged from 6.98 to 7.84 indicating alkaline nature of soil (**Table 1)**.

Texture: The soil is categorized into different kinds on the basis of particle size and expressed in the form of texture. It is related to soil water relation, aeration and root penetration. It also affect nutrient supply. All soil samples showed texture ranged from 0.28 to 0.38 mm **(Table 1).**

Bulk density: It is measure of compactness of soil particles and depends on size of soil particles. Finely divided soil particles have high bulk density. It gives an idea about easy assessment of nutrients by plants. If bulk density of soil is high, plant access nutrient easily leading to rapid growth and maximum productivity. All the soil samples lies bulk density in range of 1.18-1.48 g/cm^3 (**Table 1)**.

Moisture: The moisture contain in soil is most important for crop yield. It depends on texture of soil and organic matter. The presence of high moisture contents in soil is harmful for the crop growth. The low moisture content of soil unable to supply nutrient to crops. The moisture content in soil should be moderate range. **Table 1** shows moisture content of all soils in 7.32 to 7.64 % range.

Water holding capacity: It is one of important criteria to express quality of soil. If soil has good water holding capacity, it properly nourishes nutrients to plant for growth and if water holding capacity is too low, then it produce stress on plant growth and result in poor productivity. The soil should have good water holding capacity. The water holding capacity of soil samples varied from 44.8 to 49.2 % (**Table 1)**.

Electrical conductivity (EC): It determines health of soil. It is measure of water soluble ionic nutrients present in the soil[7].The soil is classified as normal soil when electrical conductivity is > 0.1 msm^{-1}. If EC lies in 0.1 to 0.2 msm^{-1} then such a soil has poor germination power. Further if EC is 0.2 to 0.3 msm^{-1} then such a soil is critical for the growth of salt sensitive crops and EC above 0.3 msm^{-1}, it severely harmful to plant growth. EC values ranges from 0.308 to 0.424 msm^{-1} in study area **(Table 1)** which are normal to reference range.

Carbon (OC) and organic matter (OM): It is major content of soil. It increases soil fertility, water holding capacity, water infiltration, root penetration and decreases soil erosion and influence power of holding CO_2 in atmosphere[8-9] Organic matter of soil is determined by multiplying organic carbon in percentage by 1.72. The organic matter is measure of plant and animal decaying residue in soil. All soil samples are deficient in organic matter and organic carbon **(Table 1).**

Nitrogen: It is major nutrient required for plant growth. It gives deep green coloration to plant leaves[10]. All the plant absorbs only organic nitrogen in the form of ammonium or nitrate ion. The available range of nitrogen of all soil sample lies in the range of 148 to 365 kg/Hector (**Table 1)**.

Phosphorus: It is one of important nutrient required for normal plant growth. It is used in photosynthesis for synthesis of carbohydrates and fats. It is necessary for seed germination, flowering and fruit formation [11]. The soil having phosphorus content more than 20 mg/kg is considered as suitable for good crop production. In the present study, all soil samples shows P content in the range of 14.6 to 19.4 kg/hector **(Table 1)**

Potassium: It is also one of important micronutrient of soil. It plays vital role in protein synthesis, photosynthesis. It maintain water balance of plant[12]. **Table 1** shows availability of potassium in the range of 302 to 342 kg/hector by all samples.

Manganese: It is essential micronutrient in soil and played important role in photosynthesis and enzyme catalysis. Table 1 shows available Mn ranging from 2.32 to 3.02 ppm comply with reference range (**Table 1)**.

Zinc: It is important micronutrient of soil required for catalysis of different enzymes like aldolases, carbonic unhydrase. It is required for protein synthesis and auxin production. The concentration of zinc in samples under study occurs in the range of 0.42 to 0.68 ppm (ref. range 0.6 -1.8). All the soil samples under study found to be zinc deficient except S_4 soil **(Table 1)**.

Copper: It is activator of different enzymes like tyrosinase, ascorbic acid oxidase, lactase etc. The copper and zinc is a constituent of superoxide dismutase enzyme which catalyzes dismutation of superoxide radicals. The content of copper in all soils

occurs in 0.45-0.84 ppm range **(Table 1)** meets requirement of copper for proper plant growth.

Iron: It is exists in soil in the form of ferrous and ferric ions. It is important micronutrient required for healthy plant growth. **Table 1** shows available iron content in the range of 3.24 to 4.68 ppm. All the samples in study are severely deficient in iron content except S_7 which lies in reference range just near margin. It is may be due to low organic matter, sandy texture of soils.

5. CONCLUSION

The result indicates that all soil PH are alkaline in nature and no harm on plant growth. The EC of all soils indicates no deleterious effect on crop. All the soil samples were found to have low organic carbon and low available phosphorus and low iron. Thus analysis of these soil samples gives information about its nature and fertility status. As per analysis, farmer should collect manure to fulfill carbon deficiency and chemical fertilizers rich in phosphorus to increase soil fertility and alternatively crop yields.

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Table 1: Chemical analysis of soil samples

Parameters	Units	Soil samples								Ranges[13]
		S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	
Temp.	^0C	28	27	25	29	24	30	27	29	--
MC	%	7.64	7.32	7.54	7.32	7.34	7.32	7.32	7.34	--
BD	g/cm^3	1.42	1.34	1.18	1.38	1.48	1.38	1.38	1.48	--
Text.	mm	0.36	0.28	0.38	0.38	0.28	0.38	0.38	0.28	--
WHC	%	44.8	46.8	49.2	46.6	47.2	46.6	46.6	47.2	--
PH	--	7.24	7.84	7.05	7.48	6.98	7.48	7.48	6.98	6.5-7.5
EC	msm^{-1}	0.385	0.386	0.308	0.386	0.424	0.386	0.386	0.424	0-1
OC	%	0.321	0.142	0.132	0.134	0.387	0.369	0.357	0.442	0.41-0.60
OM	%	0.552	0.244	0.227	0.230	0.665	0.634	0.614	0.760	0.70-1.03
N	Kg/Ha	324	365	268	178	148	237	219	352	281-420
P	Kg/Ha	17.2	19.4	19.4	14.6	17.2	14.6	14.6	17.2	31-50
K	Kg/Ha	308	342	308	302	326	302	302	326	181-240
Mn	ppm	3.02	2.86	2.80	2.32	2.36	2.39	2.76	2.34	2-8

Zn	ppm	0.42	0.68	0.48	0.48	0.48	0.61	0.58	0.56	0.6-1.8
Cu	ppm	0.76	0.58	0.92	0.64	0.84	0.62	0.54	0.45	0.2-0.8
Fe	ppm	3.72	3.28	3.45	3.28	3.24	4.28	4.68	3.98	4.5-18

Abbreviations: WHC=Water holding capacity, MC=Moisture content, Text.=Texture, EC=Electrical conductivity, BD=bulk density, Temp.=Temperature, %=percent, Kg/Ha=Kg/Hector, N=Nitrogen, P=Phosphorus, K=Potassium, Mg=Magnesium, Zn=Zinc, Cu=Copper, Fe=Iron