Physicochemical Assessment of Soil in Amravati District of Maharashtra (India)

Vaishali Khedkar and Sangita Ingole

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India is the fourth largest global producer of agrochemicals after the US, Japan and China. Addition to the utilization of crop protection chemicals, Indian agriculture must specialise in specific solutions to reinforce crop productivity. Soil properties that are sensitive to changes in the management can be used as indicators [1]. Agriculture in Vidarbha region of eastern Maharashtra comprises of 11 districts of the Nagpur and Amravati Division. These include Yavatmal, Akola, Amravati, Wardha, Buldhana, Washim, Nagpur, Chandrapur, Bhandara, Gadchiroli and Gondia. The region occupies 31.6% of total area and holds 21.3% of total population of Maharashtra. Mainstay of agriculture here is cotton; soybean, pigeon peas and chickpeas, most of these crops are rain fed. Due to a number of reasons like low rainfall, lack of irrigation, low micronutrients in soil, etc., the productivity of cotton of the region is lower than state (15% less) and national averages (46% less!). Integrated nutrient management is one among the foremost important components of the assembly technology to sustain soil fertility and crop productivity. The combined use of organic and inorganic sources of plant nutrients not only pushed the production and profitability of field crops but also helped in maintaining the fertility status of the soil [2].

Soil testing is the only way to determine the available nutrient status in soil and the only way we can develop specific fertilizer recommendations. Soil is the unconsolidated or loose covering of fine rock particles that covers the surface of the earth. Soil properties that are sensitive to changes in the management can be used as an indicator [3]. The deficiency of nutrients has become major constraint to productivity, stability and sustainability of soils [4]. Results of physical and chemical tests provide information about the capacity of soil.

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Study area and location

The location of experiment site was Amravati district, Vidarbha is located at 20.32 to 21.46 latitude and longitude of 76.37 to 78.27 with altitude of 300 to 900 mtrs. above Mean Sea Level (MSL). Amravati district is surrounded by Wardha district towards east and north east, Yeotmal district in the south and south west direction, Washim and Akola district towards west and Betul district of Madhya Pradesh in the north and north east. Soil samples S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_9, S_{10}, were collected in the depth of 0-30 cm from the surface of soil from Amravati, Dhamngao, Chandur Railway, Chandur Bazaar, Teosa, Daryapur, Achalpur, Warud, Morshi, Bhatkuli, villages, which were taken in polythene bag. All the chemicals and reagents used for analysis were A. R. Grade from S.D Fine and Merck.

- Determination of pH: by Digital pH Meter
- Determination of alkalinity: by Conducto meter
- Determination of Organic Carbon: by Titration Method
- Determination of Copper (Cu): by Atomic Adsorption Spectroscopy.
- Determination of Nitrogen (N): by Titration Method
- Determination of Phosphorous (P): by Titration Method
- Determination of Potassium (K): by Flame Photometry
- Determination of Zinc (Zn), Iron (Fe), by Atomic absorption spectrophotometer
- Determination of Manganese Mn: by Atomic absorption spectrophotometer

Physicochemical analyses were carried out in the Laboratory of Department of Environmental Sciences, Shri Shivaji Science College, Amravati, Maharashtra. Ten samples were collected from the study area (farmer's field) in the month of February 2015. Soil samples were collected randomly at 0 to 15 cm and 15 to 30 cm depths with five plots, five samples from each plot respectively, in well sterilized polythene pouches. Soil sample were collected from farmers' fields.

In the study area pH was observed in the range 7.50 – 8.30 The Soil sample S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8 and S_9, is very slightly alkaline sample S_1, S_7, S_8, S_{10} and soil sample is medium alkaline. Nutrient availability depends highly on

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soil pH [5]. Alkalinity values were recorded in the range of 0.26 – 0.87%. The soil sample S_9 slightly high sample S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_{10}, have moderate. Organic carbon values were recorded in the range of 0.34 – 2.18%. The soil sample S_2 and S_6 has less organic carbon, sample S_1, S_3, S_4, S_5, S_7, S_8, S_{10} have moderate and sample S_9 has high percentage of organic carbon [6]. Organic matter turnover is strongly correlated with electron acceptor availability and redox conditions [7] concurred that hydrologic regime played a role in organic matter accumulation. Available nitrogen available nitrogen content in the soil sample ranged from 115.60 - 355.61 kg/hectare. The soil sample S_1, S_3, S_5, S_7, S_8, S_9 have low nitrogen content and sample S_2, S_4, S_6, S_{10} have medium range. An increase in N application has resulted in increases in shoot growth, pruning weights, leaf area, and lateral shoot length and trunk girth.

Table 1 Physicochemical assessment of soil in Amravati district of Maharashtra

Parameters	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
pH	7.76	8.08	8.23	8.21	8.30	8.07	7.72	7.50	8.15	7.76
Alkalinity	0.53	0.41	0.44	0.34	0.33	0.26	0.31	0.38	0.87	0.44
OC (%)	0.54	0.37	0.61	0.54	0.53	0.34	0.51	0.54	2.18	0.55
N (Kg/h)	126.67	294.67	232.00	355.61	115.60	254.67	219.20	119.47	150.53	344.90
P (Kg/h)	22.25	14.54	26.18	21.72	23.57	25.33	21.94	21.94	13.17	21.93
K (Kg/h)	455.67	827.00	581.00	323.71	444.00	400.76	325.47	438.67	425.63	324.17
S (ppm)	12.45	5.72	12.23	11.25	12.47	12.14	16.26	0.04	11.48	11.27
Zn (ppm)	0.48	0.92	0.52	1.06	0.47	0.77	0.45	0.42	0.44	0.45
B (ppm)	0.78	0.83	0.82	0.78	0.75	0.65	0.74	0.76	0.72	0.95
Fe (ppm)	5.17	3.38	6.03	5.05	6.30	4.13	5.12	5.07	2.40	5.05
Mn (ppm)	7.91	7.21	7.95	7.84	8.40	13.04	7.83	2.84	9.27	7.85
Cu (ppm)	2.88	2.69	3.14	2.66	3.48	3.40	2.51	2.56	2.27	2.63

Phosphorous content in the soil sample ranged between 13.17- 26.18 kg/hectare. The soil sample S_1, S_3, S_5, S_6 has high phosphorous content as compared to sample S_2, S_4, S_7, S_8, S_9 and S_{10}. P is mobile in the plants and is essential to photosynthesis, respiration and many metabolic processes [8]. Potassium content in the soil sample ranged between 323 – 827 kg/hectare. The soil samples all S_1 to S_{10} have high potassium content. Ca [9] also showed that a lack of K resulted in a decrease in crop yield and fruit weight.

The Sulpher content in soil samples ranges from 0.04 - 16.26. It is seen that soil sample S_8, S_2 have less amount of Sulpher content as compared to sample S_1, S_3, S_4, S_5, S_6, S_7, S_9, S_{10} have medium range. Soils get sulphur from three sources: airborne particles, the weathering of minerals in soils, and microbial activity [10]. Zinc (Z) The Copper content in soil samples ranges from 0.42 - 1.06. It is seen that soil sample S_4 have high amount of zinc content as compared to sample S_1, S_2, S_3, S_5, S_6, S_7, S_8, S_9, S_{10}. The boron content in the soil sample ranged from 0.65 – 0.95%. It is seen that soil sample S_1 to S_{10} have medium amount of boron. Boron is very Essential for seed and cell wall formation [11].

The iron (Fe) content in soil samples ranges from 2.40-6.30 It is seen that soil sample S_2, S_6, S_9 have less amount of iron content as compared to sample S_1, S_3, S_4, S_5, S_7, S_8, S_9, S_{10}. The manganese (Mn) content in soil samples ranges from 2.84 - 13.04. It is seen that soil sample S_8 have less amount of manganese content as compared to sample S_1, S_2, S_4, S_3, S_5, S_6, S_7, S_9, S_{10} [12] have also noticed an interaction between the two elements. Their study showed a decrease in K concentration as a result of increasing Mg concentration. The copper (Cu) content in soil samples ranges from 2.27-3.48 It is seen that soil sample S_4 have High amount of copper content as compared to sample S_1, S_2, S_3, S_5, S_6, S_7, S_8, S_9, S_{10}.

CONCLUSION

Soil analysis plays an important role in crop production and nutrient management. In the present research work, studies on soils with physical properties, chemical properties and micronutrients of soils are done. Soil samples were collected from ten different talukas locations, in Amravati district (Maharashtra) India. The soil parameters like soil moisture, pH, EC, carbon, calcium carbonate, magnesium, calcium, nitrogen, copper, potassium and phosphorous content, were analyzed in 2016. The values of pH indicated that each one samples of the soils are alkaline,

all samples were containing moderate amount of obtainable micronutrients. The physicochemical parameters of soil determine their adaptability to cultivation and therefore the level of biological activity which will be supported by the soil. The variation of values was observed in the different parameters due to the soil quality in different places. Study of physicochemical parameters is important to agricultural chemists for plants growth and soil management. It is concluded from the data; pH of all soil samples is found to be slightly alkaline. Organic carbon is good for plant growth, potassium content in all soil samples is in higher amount, so fertilizers containing nitrogen is also low are added for proper growth and development of the crops.

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