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Assessment of Physico-chemical Parameters and Nutrient Availability in Soils of Arvi and Karanja Blocks of Wardha district, Maharashtra

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Abstract : The physical and chemical properties of the soil governs the kand productivity The present study focuses on soil properties and nutrient indices of soils in five different villages of Arvi and Karanja blocks of Wardha district, Maharashtra. A research programme on Leveraging Agriculture for Nutrition in South Asia (LANSA) through framing system is in progress in these villages. The soils of the site are slightly acidic to alkaline, medium to high in organic carbon, deficient in nitrogen, phosphorus and zinc, medium in iron content and sufficient in potassium, copper and manganese content.

Keywords*:* soil parameters, micronutrients, nutrient indices

Introduction

Physico-chemical properties of soils has a strong bearing on plant nutrient availability. The emerging widespread deficiency of macronutrients specifically nitrogen, phosphorus and in some cases potassium but also micronutrients has been reported in Indian soils. Deficiency of micronutrients during the last three decades has grown in both, magnitude and extent because of increased use of high analysis fertilizers, use of high yielding crop varieties and increase in cropping intensity causing decline in crop productivity and sustainability (Yadav and Meena, 2009). Thus there is an urgent need for correction of individual nutrient deficiency and for arresting its further spread. Furthermore, assessment of soil nutrient status plays pivotal role in planning and implementation of a sustainable agricultural production system. Accordingly, the present study was undertaken in five villages of Wardha district of Maharashtra, where a Farming System for Nutrition (FSN) study under a research programme on Leveraging Agriculture for Nutrition in South Asia (LANSA) is in progress. As the farming systems for nutrition envisages introduction of agricultural remedies to the nutritional maladies prevailing in an area through mainstreaming nutritional criteria in the selection of the components of a farming system (Nagarajan *et al*. 2014), an assessment of soil sample is a must for successful implementation of the study programme. This paper presents an assessment of the physico-chemical properties of soils along with their nutrient indices, to support planning of farming system interventions.

Material and Methods

Study site

The study site (Wardha district) of Maharashtra lies between 20° 28' N and 21° 21' N latitude and 78° 4' E and 79° 15' E longitudes. The district covers 6,039 sq.km accounting to 2.06 percent of the state and is characterized by hot, dry, and sub-humid bio-climate with dry summers and mild winters. The district comprises of eight tehsils or blocks *viz*., Ashti, Karanja, Arvi, Seloo, Wardha, Deoli, Hingalghat and Samudrapur. The district receives 1062.8 mm annual rainfall of which 85% is contributed by south–west monsoon but its distribution is erratic. Review of agro-ecological of the rain but its erratic distribution. Further, the extent of soil loss in the district due to erosion is estimated to be of the order of 19.6 lakh tonnes per annum (Rukmani and Manjula, 2009)

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which is well above the maximum permissible limit of 10 tonnes per hectare per annum. The district is dominated by black soils, classified into Kanhar (Heavy soils), Madhyam (Medium soils) and Bardi (Lights soils) covering 35.4, 43.0 and 20.6% , respectively.

Sample collection and analysis

A total of 55 surface soil samples (0-15cm) were collected from five villages of Wardha district *viz*., Saheli and Bitpur (Arvi block), Borgaon/Gondi, Susund, and Heti (Karanja block) during 2014-15. Collected soil samples were air dried and processed for laboratory analysis.. The sand, silt, clay in soil were analyzed by bouyoucos hydrometer method. Soil pH, EC, organic carbon (OC), available nitrogen, phosphorus and potassium were estimated by the standard procedures as described by Jackson (1973). The available micronutrients *i.e*. zinc, iron , copper and manganese in these soil samples were extracted with DTPA solution (Lindsey and Norvell, 1978) and the concentration of nutrients was determined on Atomic Absorption Spectrophotometer. The soil nutrient index was calculated according to the procedure suggested by Ramamoorthy and Bajaj (1969).

Results and Discussion

The texture, of the soil varied in different villages (Table 1). The pH of the soils ranged from 6.4 to 8.7 and EC from 0.12 to 0.46 dS m^{-1} (Table 1). The organic carbon content varied from 0.52 to 2.24 percent (Table 1). This medium to high content of organic carbon might be due to addition of organic matter mainly through crop residue, farm yard manure *etc*.

Table 1. Physico-chemical parameters of soils of Wardha district

Name of Tahsil	Name of village	Soil texture*	pH (1:2.5)		EC (dS m^{-1})		Organic carbon (g kg^{-1})	
			Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
Arvi	Saheli	l	6.90-8.70	7.31 ± 0.38	0.12-0.26	0.20 ± 0.04	0.83-1.7	1.13 ± 0.25
	Vitpur	c	6.82-8.14	7.41 ± 0.41	0.17-0.34	0.22 ± 0.06	0.95-1.84	1.32 ± 0.32
Karanja	Susund	cl, scl	7.29-7.96	7.58 ± 0.21	0.20-0.46	0.32 ± 0.09	0.64-2.24	1.24 ± 0.44
	Heti	scl, l	6.40-7.84	7.34 ± 0.44	0.12-0.43	0.26 ± 0.12	0.52-1.73	1.11 ± 0.42
	Borgaon	l, sl	6.87-7.88	7.54 ± 0.31	0.18-0.33	0.25 ± 0.05	0.76-1.78	1.29 ± 0.33

* l, loam; c, clay; cl, clay loam; scl, silty clay loam; sl, silt loam

The available nitrogen content in soils of Wardha ranged from 70.4 to 153.5 kg ha^{-1} indicating nitrogen deficiency in the area. The available P content of soils ranged from 1.4 to 31.6 ppm and 83.6 percent of soil samples were found to be deficient in phosphorus (Table 2). The available K content of soils ranged from 56.7 to 669.6 kgha^{-1} and 71 percent of the soils showed sufficiency in K content (Table 2).

Table 2. Status of major nutrients in soils of Wardha district

Name of Blocks	Name of village	Available N (kg ha^{-1})		Available P (kg ha^{-1})		Available K (kg ha^{-1})	
		Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
Arvi	Saheli	70.37-102.36	93.35 ± 9.47	1.75-4.25	2.77 ± 0.65	210.00-448.30	340.32 ± 66.23
	Vitpur	70.37-95.96	84.00 ± 10.17	1.37-7.31	3.38 ± 2.03	178.00-437.40	320.55 ± 68.47
Karanja	Susund	60.78-153.54	113.88 ± 24.04	3.87-26.87	10.13 ± 7.85	98.20-589.30	335.70 ± 133.99
	Heti	89.56-137.54	109.63 ± 13.80	1.94-31.62	14.73 ± 9.62	56.67-669.60	332.31 ± 225.65
	Borgaon	83.17-118.35	102.36 ± 10.51	4.56-17.31	9.74 ± 5.79	156.00-442.10	300.77 ± 97.40

The DTPA-Zn in soils ranged from 0.20 to 2.16 mg kg^{-1} (Table 3). About 50.9 percent of samples were deficient while 41.8 percent samples were in medium category indicating widespread deficiency of zinc in the area. The deficiency of zinc was observed in Bitpur and Saheli followed by Susund, Borgaon/Gondi, and Heti. The low availability of zinc in these soils might be due to alkaline soil reaction as zinc cations are changed largely to their oxides or hydroxides under alkaline conditions and thereby lowering the availability (Meena *et al*. 2006). The widespread deficiency of zinc in intensively cultivated districts of Maharashtra having alkaline, calcareous, black clay soils have also been reported (Patil and Kharche, 2006; Katkar *et al*., 2013; Mandavgade *et al*., 2015).

The DTPA-Fe content showed a wide range of variation (5.68 to 44.1 mg kg^{-1}) in the soils of different villages (Table 3). Majority of soil samples were moderately high to high (72.8%) whereas 21.8 percent were found to be very high in Fe content. The high Fe content in soil might be due to presence of minerals like feldspar, magnetite, haematite, and limonite which constitute bulk of trap rock in these soils (Vijaya Kumar *et al*., 2013). Few soil samples collected from Saheli and Borgaon/Gondi were found to be low in iron status (7%).

Table 3. Status of DTPA-extractable micronutrients in soils of Wardha district

Name of tehsil	village	Zn (mg kg^{-1})		Fe (mg kg^{-1})		Mn (mg kg^{-1})		Cu (mg kg^{-1})	
		Range	Mean±SD	Range	Mean ± SD	Range	Mean ± SD	Range	Mean±SD
Arvi	Saheli	0.30-0.72	0.48±0.13	5.68-29.90	16.89± 7.88	13.60-60.36	34.71±16.43	2.20-4.96	3.48±0.89
	Vitpur	0.26-0.72	0.45±0.14	9.08-32.50	19.36± 8.83	15.10-73.78	43.55± 0.66	3.04-5.80	4.18±0.86
Karanja	Susund	0.38-1.48	0.80±0.32	10.08-27.82	18.35±6.93	21.94-90.56	41.97±20.36	3.22-8.86	5.83±2.11
	Heti	0.36-2.16	0.96±0.56	11.80-44.10	23.49±10.56	20.34-109.14	54.1 ± 28.03	3.74-9.58	6.41±1.95
	Borgaon	0.20-3.02	0.84±0.77	7.70-34.40	18.06 ± 9.42	16.62-102.16	39.92±22.60	2.54-6.44	5.19±1.54

The DTPA-Cu content ranged from 2.2 to 9.58 mg kg^{-1} indicating its sufficiency in the soils, which might be due to higher biological activities in these soils and chelating effect (Jibhakate *et al*., 2009). DTPA-Mn ranged from 13.6-109.14 mg kg^{-1} suggesting its status as very high (Table 3). The relative high content of Mn in these soils could be due to the soils derived from basaltic parent material which contains higher ferromagnesian minerals (Mandavgade *et al*., 2015).

The nutrient indices (Table 4) indicate low for nitrogen (1.00), phosphorus (1.16), zinc (1.56), medium for iron (1.71) and high for potassium (2.67), copper (3.00) and manganese (3.00).

Table 4. Status of nutrient and nutrient indices in soils of Wardha district

Nutrients	Percent samples			Nutrient index value (NIV)	Rating*
	Low	Medium	High		
N	100	-	-	1.00	Low
P	83.6	16.4	-	1.16	Low
K	3.6	25.4	71.0	2.67	High
Zn	50.9	41.8	7.3	1.56	Low
Fe	36.4	56.4	7.2	1.71	Medium
Cu	-	-	100	3.00	High
Mn	-	-	100	3.00	High

*NIV: <1.66 (Low); 1.66-2.33 (Medium); >2.33 (High).

Conclusion

The soils of Arvi and Karanja blocks of Wardha district are slightly acidic to alkaline in soil reaction, non-saline, medium to high in organic carbon. These soils are deficient in nitrogen, phosphorus and zinc while medium in iron content and sufficient in potassium, copper and manganese. The assessment of nutrient is being used for suggesting improved package and practices of crop production through integrated nutrient management under the FSN study, to promote better soil health and crop productivity.

References

Jackson M.L. (1973). Soil Chemical analysis, Prentice Hall of India Private Ltd. New Delhi.

Jibhakate S.B., Raut M.M., Bhende S.N. and Kharche V.K. (2009). Micronutrient status of soils of Katol tahasil in Nagpur district and their relationship with some soil properties. *Journal of Soils and Crops* **19**, 143-146.

Katkar R.N., Lakhe S.R., Kharche V.K., Laharia G.S., Sadavarte S.G., *et al*. (2013). Micronutrient mapping in soils of Wardha district, Maharastra. *Agropedology* **23**(2), 113-117.

Lindsay W.L. and Norvell W.A. (1978). Development of DTPA soil test for Zn, Fe, Mn and Cu. *Soil Science Society of America Journal* **42**, 421-428.

Mandavgade R.R., Waikar S.L., Dhamak A.L. and Patil V.D. (2015). Evaluation of micronutrient status of soils and their relation with some chemical properties of soils of northern Tahsils (Jintur, Selu and Pathri) of Parbhani district. *Journal of Agriculture and Veterinary science* **8** (2), 38-41.

Meena H.B., Sharma R.P. and. Rawat U.S. (2006). Status of macro and micronutrients in some soils of Tonk district of Rajasthan. *Journal of the Indian Society of Soil Science* **54**, 508-512.

Patil J.D. and Kharche V.K. (2006). Micronutrients deficiency in soils of Western Maharashtra. *Indian Journal of Fertilisers* **2**, 55-58.

Nagarajan S., Bhavani R.V. and Swaminathan M.S. (2014). Operationalizating the concept of farming system for nutrition through the promotion of nutrition-sensitive agriculture. *Current Science* **107** (6), 959-964.

Ramamoorthy B. and Bajaj J.C. (1969). Available N, P and K status of Indian soils. *Fertilizer News* **14**, 24-26.

Rukmani R. and Manjula M. (2009). *Designing rural technology delivery systems for mitigating agricultural distress: A study of Wardha district.* MS Swaminathan Research Foundation, Chennai and Office of the Principal Scientific Adviser to the Government of India, New Delhi.

Shen J., Yuan L., Zhang J., Li, H., Bai Z., *et al*. (2011). Phosphorus dynamics: From soils to plant. *Plant physiology* 1 **56**, 997-1005.

Vijaya kumar M., Lakshmi G.V. and Madhuvani P. (2013). Appraisal of soil fertility status in salt affected soils of ongole division, Prakasam district of Andhra Pradesh. *Journal of the Indian Society of Soil Science* **61**, 333-340.

Yadav R.L., and Meena M.C. (2009). Available micronutrient status and their relationship with soil properties of Degana soil series of Rajasthan. *Journal of the Indian Society of Soil Science* **57**, 90-92.

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