International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(2): 3623-3625

Received: 01-01-2018
Accepted: 02-02-2018

Ram Partap
a) Department of Soil Science and Agricultural Chemistry, College of Agriculture, Nagpur Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India
b) Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab, India

Vd Guldekar
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Nagpur Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Correspondence
Ram Partap
a) Department of Soil Science and Agricultural Chemistry, College of Agriculture, Nagpur Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India
b) Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab, India

Soil micronutrient variability in different physiographic unit of rahat micro watershed

Ram Partap and Vd Guldekar

Abstract
Soils of Rahat micro watershed in Nagpur District were investigated for soil fertility status. Forty two surface soil samples were collected through Grid soil survey for evaluation of soil micronutrient status in different physiographic unit viz. Plateau, isolated mound, Pediment and Alluvial plain. The evaluated Fe content in surface soils s ranged from 2.59 to 28.71 mg kg^{-1}i.e from medium to high. Mn content were varied from 8.44 to 29.67 mg kg^{-1} and found to be much higher than the critical level of 2.0 mg kg^{-1}. The Zn content of these soils varied from 0.35 to 1.30 mg kg^{-1} and ranged from low to high. Cu content of these soils varies from 2.47 to 11.42 mg kg^{-1} is higher than the critical value of 0.2 mg kg^{-1} in all soils.

Keywords: Soil Fertility, micronutrient, physiographic unit, Micro-Watershed

Introduction
Soil is a diverse complex that can be defined as a mixture of minerals and organic materials, which are capable of supporting plant life (Ayoub *et al*. 2007) [3] and (Brady *et al*. 1990) [4]. The major and minor nutrients govern the fertility of the soil and control the yields of the crops. Soil characterization in relation to evaluation of fertility status of the soils of an area or region is an important aspect in context of sustainable agricultural production (Meena *et al*. 2006) [11]. However, the capacity of a soil to produce crops is limited and the limits to production are set by intrinsic characteristics, agro-ecological settings, use and management (FAO, 1993) [5]. Micro-watershed planning has been conceived and adopted for holistic development of rainfed farming in recent years. Watershed is generally considered as geo-hydrological unit from which runoff resulting from precipitation, flows past a single point known as the outlet into either a stream or a lake or an ocean (Nigam *et al.* 2014) [12]. Millions of hectares of land worldwide are low in available micro-nutrients, and many of these deficiencies were further aggravated by the increased demands of more rapidly growing crops for available forms of micro-nutrients (Rengel, 2007) [14] and (Alloway, 2008) [1]. The solubility and availability of micro-nutrients is largely influenced by clay content, pH, SOM, CEC, phosphorus level in the soil and tillage practices (Fisseha, 1992) [6]. Macronutrients (N, P and K) and Micronutrients (Fe, Mn, Zn, and Cu) are important soil elements that control its fertility. Top soil confine humus, an important food resource for plants, which increase biological activity, soil fertility and control the air and water content of soil (Wilson *et al.* 2002) [16]. The main objective of the study is micronutrients (Fe, Mn, Zn, and Cu) in agricultural watershed.

Method and Material
The selected area Rahat village is located between: 21º04’-21º06’N latitude and 78º33’and 78º36’ E longitude with an elevation 524-525m above MSL in Katol tahsil of Nagpur district, Maharashtra. The total area of the watershed is 363.02 ha. The study area falls in the SOI toposheet No. 55 K/12. The area receives a mean annual rainfall of 1047mm.The surface soil samples at depth of 0-20 cm were collected for soil fertility analysis. The exact locations of sampling sites were decided on the basis of grid survey with the help of Geographical positioning system (GPS).Grid samplings were demarcated with grid points at 300 m x 300 m of interval (90,000 m2 = 9 hector =22.5 acre). The standard analytical methods were adopted for DTPA extractable Fe Mn, Zn, and Cu measurement on Atomic absorption spectrophotometer method using DTPA as extractant (Lindsay and Norvell, 1978) [10].

Table 1: Critical limits for available micronutrient

Sr. No	Nutrient element	Category		
		Low	Medium	High
1	DTPA-Fe (mg kg^{-1})	<2.5	2.5 – 4.5	>4.5
2	DTPA-Mn (mg kg^{-1})	<1.0	1.0 – 2.0	>2.0
3	DTPA-Zn (mg kg^{-1})	<0.6	0.6 – 1.20	>1.20
4	DTPA-Cu (mg kg^{-1})	<0.20	0.20	>0.20
5	Available B (mg kg^{-1})	<0.25	0.25 – 0.50	>0.50
6	Available Mo (mg kg^{-1})	<0.1	0.10 – 0.20	>0.20

(For available Fe, Mn, Zn, Cu, B and Mo the critical limits are taken as per given by Katyal and Rattan, 2003)[9]

Result and Discussion

Micronutrient play physiological role in plant growth and development as they mostly act as either enzymes or activators of enzymes. Hence status of micronutrient in watershed soils as under.

Available Iron

The DTPA-extractable available Fe content ranges from 2.59 to 28.71 mg kg-1 in soils of watershed show in table 2. The highest value 28.71 mg kg-1 was observed in cultivated double crop of plateau top (sample 37) whereas lowest value 2.59 mg kg-1 was observed in very gentle slope with cultivated single crop (sample 19) respectively. Considering critical limit for DTPA-Fe 2.5-4.5 mg kg-1 are found to be sufficient in available Fe content of soils (Katyal and Rattan, 2003) [9]. The wide variation was noticed in iron content between 1.20 to 54.37 mg kg-1 in Soils of Yavatmal District by Katkar *et al.* (2016) [17] and Patil *et al.* (2004) [13] also recorded micronutrient status in soils of Vidharba.

Available Manganese

The data in table 2 shows the DTPA-extractable Mn in soils of watershed. Magnitude available manganese ranges from 8.44 to 29.67 mg kg-1. The highest value 29.67 mg kg -1 was observed in cultivated single crop of plateau top (sample 29) whereas lowest value 8.44 mg kg-1 was observed in wasteland of plateau top (sample 16).Considering critical limit of 2.0 mg kg-1 given by Katyal and Rattan (2003) [9], these soils are well supplied with manganese similar observation recorded by Sharma *et al*. (2001) [15]. The DTPA-Mn status of soils ranged from 2.22 – 78.60 mg kg-1 reported by Katkar *et al.* (2016) [17] and Gajbhe *et al.* (1976) [7] also noticed available Mn content in surface soils of Marathwada ranged from 13.3 to 65.20 mg kg-1.

Available Copper

The available copper extracted by DTPA varies from 2.47 to 11.42 mg kg-1 presented in table 2. The highest value of (11.42 mg kg-1) recorded in gentle slope wasteland of pediment (sample 17) whereas lowest value of (2.47 mg kg-1) recorded in nearly level alluvial plain with cultivated double crops (sample 31). Considering critical limits of 0.2 mg kg-1 as suggested by Katyal and Rattan (2003) [9], these soils are categories as high in available copper content.

Available Zinc

The available zinc extracted by DTPA varies from 0.35 to 1.30 mg kg-1 shows in table 2. Highest value of (1.30 mg kg-1) for available zinc recorded in double of pediment (sample 38) whereas lowest value of (0.35 mg kg-1) recorded in gentle slope wasteland of pediment (sample 4). Considering critical limit of 0.6 mg kg-1 given by Katyal and Rattan (2003) [9], the soil under study are categories as a deficient in available zinc status. Similar observation was recorded by Ambegaonkar *et al.* (2007) [2], Jibhkate *et al.* (2009) [8], Yurembam *et al.* (2015) [18] and Katkar *et al.* (2016) [17] also recorded the DTPA-Zn in soils of Yavatmal district ranged from 0.10 to 4.99 mg kg-1.

Conclusion

The soils of micro watershed were medium to high in Fe content, Zn content of these soils varied from low to high, Mn and Cu content were found to be much higher than the critical level of 0.2 mg kg-1 in all soils. The study helps in understanding the future scope of growth of vegetation in the region

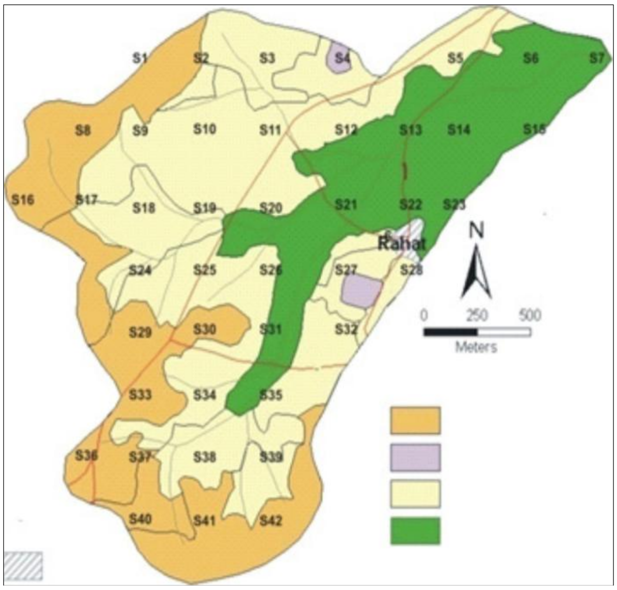

Fig 1: Legends of sampling sites (Physiography of Rahat watershed)

Table 2: Micronutrients status of soils in Rahat micro-watershed

S. No	Topography & Landform type	No. of Samples	Sample No.	Micronutrients(mg kg-1)			
				Fe	MN	Cu	Zn
1.	Plateau Top	11					
a.	Forest	1	8	8.16	23.66	11.3	0.99
b.	Wasteland	4	1	6.93	18.54	6.42	0.76
			16	8.73	8.44	10.58	1.09
			36	27	23.82	4.61	1.11
			40	9.27	14.2	4.69	1.1
c.	Cultivated Double crops	3	33	6.68	13.08	6.56	0.53
			37	28.71	21.33	8.03	0.97
			41	17.3	20.2	8.44	0.53
d.	Cultivated Single crop	3	29	21.37	29.67	8.3	0.42
			30	21.22	28.79	7.35	0.58

			42	22.02	13.97	7.07	0.68
2.	Pediment	19					
a.	Grassland	2	2	7.33	15.86	9.31	0.92
			24	16.02	13.98	7.75	0.74
b.	Very gentle slope with cultivated single crop	8	3	7.08	9.8	7.68	0.85
			5	4.94	19.8	4.87	0.97
			10	4.76	10.04	7.25	0.69
			11	5.4	11.08	8.33	0.78
			18	7.21	15.1	7.93	0.82
			19	2.59	10.2	9.31	1.1
			20	3.41	16.88	10.2	0.76
			32	17.26	28.36	4.74	1.06
c.	Double crops	4	27	8.95	9.14	4.16	0.59
			28	9.67	19.72	2.52	0.4
			38	13.16	29.58	8.32	1.3
			39	17.58	24.22	7.32	0.39
d.	Wasteland	1	25	23.26	25.46	6.82	1.09
e.	Gentle slope with cultivated single crop	1	34	11.53	9.34	2.53	1.13
f.	Gentle slope wasteland	3	4	8.64	28.84	6.94	0.35
			9	4.67	10.94	5.08	0.68
			17	14.96	20.32	11.42	0.66
3.	Alluvial plain	12					
a.	Very gentle slope with cultivable single crops	3	6	3.94	8.48	5.16	0.61
			7	5.98	11.24	9.49	0.65
			15	4.24	8.84	5.03	1.05
b.	Nearly level alluvial plain with cultivated doublecrops	7	14	4.31	29.1	11.28	1.1
			21	4.05	10.04	5.58	0.63
			22	21.23	22.56	6.92	1.1
			23	8.33	16.86	6.1	0.53
			26	20.93	18.54	7.42	0.97
			31	15.83	15.34	2.47	0.38
			35	14.41	28.83	5.2	1.02
c.	Level alluvial plain with single crop	2	12	2.64	10.9	7.22	1.07
			13	12	15.06	10.89	0.96

Reference

1. Alloway BJ. Micronutrient Deficiencies in Global Crop Production. Springer, Netherlands, 2008.
2. Ambegaonkar PR, Bharambe AP. Available micronutrient status of soils in jayakawadi command. PKV Research Journal. 2007; 31(2).
3. Ayoub AS, Mc Gaw BA, Shand CA, Mid-wood AJ. Phytoavailability of Cd and Zn in Soil Estimated by Stable isotope Exchange and Chemical Extraction, Plant and Soil, 2003; 152(2):291-300.
4. Brady NC. The Nature and Properties of Soils. Mac-Millan Publishing Company, New York, 1990.
5. FAO. Frame work for Land Evaluation. Soils Bulletin, Rome, 1993, 32.
6. Fisseha I. Macro and micronutrients distribution in Ethiopian Vertisols landscapes. Ph.D. Dissertation submitted to Institute fur Bondenkunde und Standortslehre, University of Hohenheim, Germany, 1992, 201.
7. Gajbhe MV, Lande MG, Varade SB. Soils of Marathwada, Journal Maharashtra Agricultural University. 1976; 1(2, 6):55-59.
8. Jibhakate SB, Raut MM, Bhende SN, Kharche VK. Micronutrient status of soils of Katol tahasil in Nagpur District and their relationship with some soil properties. Journal of Soils and crops. 2009; 19(1):143-146.
9. Katyal JC, Rattan RK. Secondary and micronutrients Research gaps and future needs. Fertilizer news, 2003; 48(4):9-14, 17-20.
10. Lindsay WL, Norvell WA. Development of DTPA soil test for zinc, iron, manganese and copper. Soil Science Society of American Journal. 1978; 42: 421-428.
11. Meena HB, Sharma RP, Rawat US. Status of macro and micronutrients in some soils of Tonk district of Rajasthan. Journal of the Indian Society of Soil Science. 2006; 54(4):508-512.
12. Nigam GK, Pandey VK, Tripathi MP, Jitendra Sinha. Assessment of Macro and Micro Nutrients of Soil in a Small Agricultural Watershed. International Journal of Chemical Technology Research. 2014; 6(7):3658-3664.
13. Patil DB, Bharambe PR, Deshmukh PW, Rane PV. Guldekar SV. Micronutrient status in soils of Vidharba, Technical Bulletin Dr. PDKV, Akola, 2004.
14. Rengel Z. Cycling of micronutrients in terrestrial ecosystems. Springer-Verlag, Berlin, Heidelberg, 2007, 93-121.
15. Sharma YM, Sharma BL, Khamparia RS, Dubey SB, Gupta GP. Micronutrient status in soils and plants of Rajgarh district of Madhya Pradesh. Annual Agricultural Research. 2001; 22(1):115-119.
16. Wilson SD, David T. Quadratic variation in old- field species richness along gradients of disturbance and nitrogen. Ecology. 2002; 83:492-504.
17. Katkar RN, Kharche VK, Lakhe SR, Jadhao SD, Mali DV. Mapping of Nutrients Status Using Information Technology in Soils of Yavatmal District PKV Research Journal. 2016; 40(1):43-50.
18. Yurembam GS, Chandra H and Kumar V. Status of available macro and micronutrients in the soils of someshwar watershed in almora district of uttarakhand. The Ecoscan. 2015; 9(3, 4):725-730.