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ASSESSMENT OF MACRONUTRIENT IN DIFFERENT PHYSIOGRAPHIC UNIT OF RAHAT MICRO WATERSHED

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ABSTRACT

Soils of Rahat micro watershed in Nagpur District were investigated for soil fertility status. Fourty two surface soil samples were collected through Grid soil survey for evaluation of soil macronutrient status in different physiographic unit viz. Plateau, isolated mound, Pediment and Alluvial plain. The assessed nitrogen, phosphorus, potassium content in surface soil varied from143.4 to 380.51, 10.09 to 41.09 and 200 to 402 kg ha^{-1}, respectively. As regard with available sulphur status it varies from 8.2 to 19.5 mg Kg^{-1}. Exchangeable Ca^{++} and Mg^{++} content in these soils of different physiographic unit ranges from 20.2 to 39.2 and 10.3 to 20.2 cmol (p^{+}) kg^{-1}, respectively. The soils of watershed were low in available nitrogen, moderately high in available phosphorus and potassium.

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INTRODUCTION

Soil is the most precious and natural resource of nation. To meet the growing demand of food, fiber, fuel and fodder, Soils are maintained in an excellent state of health. Soil fertility, compatibility and erodability are the elements which governs soil quality. Among these, the problem of decline in soil fertility endangers the maximum growth in productivity (Pathak, 2010). Soil fertility refers to the inherent capacity of the soil to supply nutrients in adequate amounts and in suitable proportions for crop growth and crop yield. Soil fertility is one of the important factors controlling yields of the crops (Havlin *et al.,* 2010). The trend in increasing the yield by adopting high yielding varieties has resulted in deficiency of nutrients in soils and has reflected as deficiency symptoms in plants. Hence, it is required to know the fertility (NPK) status of the soils of the State for applying the required dosage of fertilizers and planning the regional distribution of fertilizers. 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 agriculture production (Deshmukh, 2012). Because of imbalanced and inadequate fertilizer use coupled with low efficiency of other inputs, the response (production) efficiency of chemical fertilizer nutrients has declined tremendously under intensive agriculture in recent years (Meena *et al.*, 2006). Soil available nutrients status of an area using Global Positioning System (GPS) will help in formulating site specific balanced fertilizer recommendation and to understand the status of soil fertility spatially and temporally (Nigam *et al.,* 2014). Some studies on soil fertility status at representative micro watershed level have been carried out at University of Agricultural Sciences, Dharwad for a few agro ecological zones representative village/ micro watershed of northern transition zone of Karnataka and is essential in planning soil fertility management on watershed/village basis (Pulakeshi *et al.*, 2012). The proposed soils study of Rahat micro watershed, Nagpur District was planned with the objective of identifying soil fertility constraints. Also to research workers to manage the farm by making efficient use of available resources to provide base for conducting the research experiments to develop agro-technology for effective transfer to other areas having comparable soil characteristics.

MATERIALS AND METHODS

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 m^2 = 9 hector =22.5 acre). The standard analytical methods were adopted for estimating the various parameters in the laboratory for different physiographic unit of Rahat micro watershed. The various estimations made and the methods followed for these estimations were as under available Nitrogen was determined by alkali permanganate method as described by Subbiah and Asija (1956). The soil available P was extracted with Olsen's reagent 0.5 m $NaHCO_3$ of pH 8.5 by calorimetrically as per Jackson (1973). The available K was estimated by extracting the soil with neutral normal ammonium acetate by using flame photometer (Jackson, 1973). Available sulphur was estimated by Morgans extract with turbidimetric method using calorimeteras described by Chesnin and Yein (1951). Exchangeable Calcium and Magnesium wasestimated by extraction with standard NaCl solution and titration done by EDTA method as described by Richards (1954).

RESULTS AND DISCUSSION

The data presented in the Table 1 revealed that the available nitrogen content of the surface soils range from 140.5 to 380.51 kg ha^{-1}. Thus all the soils of watershed were very low to medium in available nitrogen status in different physiographic units. The highest available N 380.51 kg ha^{-1} was observed in physiographic unit of alluvial plain having double crop cultivation (sample 21), whereas lowest value 140.5 kg ha^{-1} was observed in wasteland of pediment (sample 25) physiographic unit. Similar observations also recorded by Kebede and Solomon Raju (2011) and Waikar *et al.* (2014) reported decreased from forest to grazing lands, cultivated

Table 1: Nutrient status of soils in Rahat micro-watershed

Sr.no	Topography and Landform type	No. of samples	Sample No.	N(kg ha^{-1})	P(kg ha^{-1})	K(kg ha^{-1})	S(mg kg^{-1})	Exchang.Ca and Mgcmol (p+) kg^{-1}	
								Ca^{++}	Mg^{++}
1.	Plateau Top	11							
a.	Forest	1	8	315.42	39.19	316	18.4	23.2	11.9
b.	Wasteland	4	1	165.3	14.24	215	11	21.5	11.3
			16	276.8	38.49	293	16.3	27.2	13.2
			36	274.2	26.25	272	8.8	32.4	8.8
			40	312.2	27.17	215	16.3	26.01	12.9
c.	Cultivated Double crops	3	33	289	22.34	256	11.3	20.2	13.04
			37	272.45	34.27	225	16.3	24.6	19.3
			41	325.5	35.2	297	15.2	34.4	14.8
d.	Cultivated Single crop	3	29	278.2	30.16	262	18.8	37.2	16.2
			30	245.25	37.33	254	11.3	23.19	13.18
			42	308.19	25.16	306	17.5	39.2	13.6
2.	Pediment	19							
a.	Grassland	2	2	158.17	25.98	296	18	21.1	18.9
			24	187.81	17.04	200	19.1	34.3	14.8
b.	Very gentle slope with cultivated single crop	8	3	148.02	18.98	269	8.7	20.2	13.04
			5	296.12	29.19	337	10	27.2	13.2
			10	242.9	24.17	247	10.5	26	13.8
			11	306.8	31.44	226	8.3	25	12.9
			18	173	37.13	201	18.4	22.7	12.2
			19	205.9	21.23	225	8.8	23.4	11.8
			20	275.6	37.29	228	18.5	20.2	8.2
			32	314.5	25.4	324	8.8	26.8	10.3
c.	Double crops	4	27	262	40.34	358	8.8	28.4	12.6
			28	281.21	21.16	289	12.3	39.2	13.6
			38	276.5	39.85	245	18.8	39.2	17.2
			39	204.46	21.4	231	17.5	21.1	18.9
d.	Wasteland	1	25	140.5	30.23	246	8.8	26.8	10.3
e.	Gentle slope with cultivated single crop	1	34	246	28.13	289	16.3	21.2	13.2
f.	Gentle slope wasteland	3	4	189.1	17.92	257	19.5	25.2	15.2
			9	143.4	22.9	217	10.8	26.2	13.2
			17	163.9	8.77	247	8.7	39.2	8.8
3.	Alluvial plain	12							
a.	Very gentle slope with cultivable single crops	3	6	197.95	11.57	259	8.2	25.2	13.8
			7	282	19.5	239	9.7	25	13
			15	245	10.09	246	13.2	32.4	8.8
b.	Nearly level alluvial plain	7	14	299.28	41.09	402	10.6	28.8	20.2
	with cultivated doublecrops	21	380.51	23.19	256	18.6	39.2	17.2	
			22	292.12	26.61	279	15.2	21.3	11.6
			23	207.5	21.29	201	18.5	29.2	12.4
			26	294.5	37.82	356	17.5	37.2	16.2
			31	165.5	21.1	312	15.5	28.4	12.6
			35	368.5	24.1	346	17.5	25.77	12.3
c.	Level alluvial plain with single crop	2	12	286.5	15.19	279	9.6	23.9	12.1
			13	363	38.3	398	11.5	21.2	12.2

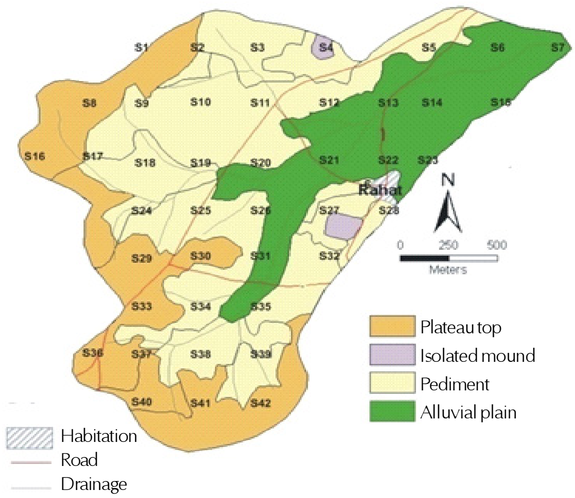

Figure 1: Legends of sampling sites (Physioigraphy of Rahat watershed)

land and woodland in that order in Doko Dembo of the hare river watershed, Ethiopia and available N was found low to medium in soils of Central Farm- B - Block of MKV, Parbhani respectively. The available phosphorus content of soils ranged from 8.77 kg ha^{-1} to 41.09 kg ha^{-1}. Highest value 41.09 kg ha^{-1} was observed in alluvial plain having double crop cultivation (sample 14). Lowest available phosphorus 8.77 kg ha^{-1} was observed in wasteland with gentle slope of pediment (sample 17). Similar finding were reported by Tripathi *et al.* (2007) and Pramod *et al.* (2013) was reported maximum available phosphorus in Kamheda (TP) and minimum in Purkaji at surface soils of Muzaffarnagar District of Uttar Pradesh along with Ganga canal command area. The available potassium content in the different physiographic unit of watershed ranged from 200 to 402 kg ha^{-1} with lowest value 200 kg ha^{-1} in grassland of pediment (sample 24) and highest value 402 kg ha^{-1} in nearly level alluvial plain having double crop cultivation (sample 14). The available K in different physiographic units varied from low to very high category. Similar observations also recorded by Dhale and Jagdish Prasad (2009) and Binita *et al.*(2009) was reported available K content similar finding as per result in sweet orange-growing soils of Jalna District, Maharashtra and recorded medium to high available potassium status in Ghataprabha left bank canal command area of north Karnataka respectively. The data on available sulphur status in soils of watershed presented in Table 1 indicated that the available sulphur in soils ranged from 8.2 to 19.5 mg Kg^{-1} having highest value 19.5 mg Kg^{-1} in wasteland of plateau top (sample 4) and lowest value 8.2 mg Kg^{-1} in very gentle of alluvial plain having single crop cultivation (sample 6). Similar observations also recorded by Srikanth *et al.* (2008).The dominance of calcium and magnesium content on the exchange complex was observed in the soils of the watershed. The exchangeable calcium content of the soils ranged from 20.2 to 39.2 cmol (p+) kg^{-1} with lowest value 20.2 cmol (p+) kg^{-1} in very gentle slope of pediment having single crop cultivation (sample 3, sample 20) and cultivated double crop of plateau top (sample 33). Highest value 39.2 cmol (p+) kg^{-1} was observed in gentle slope wasteland of pediment (sample 17); double cropped area of alluvial plain (sample 21); double cropped area of pediment (sample 28) and single cropped area of plateau top (sample 42). Exchangeable magnesium content of the soils in the area ranged from 10.3 to 20.2 cmol(p^{+}) kg^{-1} having highest value 20.2 cmol(p^{+}) kg^{-1} in alluvial plain with cultivated double crops (sample 14). Lowest value 10.3 cmol(p^{+}) kg^{-1} was observed in very gentle slope of pediment with cultivated single crop (sample 20). Similar results were reported by Sarkar *et al.* (2001), Maji *et al.* (2005), Binita *et al.*(2009) found to be high in exchangeable Calcium and Magnesium contents and Yurembam *et al.* (2015).

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