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Soil Fertility Status of Pedapuluguvaripalem Village of Guntur District, Andhra Pradesh

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ABSTRACT

An investigation was carried out to study the fertility status of soils of Pedapuluguvaripalem village, Guntur district, Andhra Pradesh. The pH of the soils varied from 7.0 - 8.8 in surface and 8.1 to 9.2 in sub surface samples. Electrical conductivity (EC) values of 0.30 to19.25dS m^{-1} were observed in different locations. The soils were found to be low to medium in organic carbon(OC) (0.08 to 0.66%), low in nitrogen (nutrient index (NI)<1.67), medium in phosphorus(NI 1.67-2.33) and high in potassium (NI>2.33). The soils were sufficient in available manganese, iron and copper but were deficient in zinc.

Key words : Micronutrients, N, P, K, Nutrient status, Nutrient index.

Pedapuluguvaripalem is a typical coastal village in Guntur district, AP, where rice is the major crop. In general coastal soils vary in their productivity and need proper attention to improve the yields. Maintenance of fertility of the soils is of utmost concern to obtain higher yields as plant growth removes nutrients continually from the soils resutting in deficiencies of some nutrients. Studies on fertility status of the location help in adopting suitable nutrient management practises, in different soils. Hence the present investigation was undertaken to asses the fertility status of soils of Pedapulugu varipalem village.

MATERIAL AND METHODS

Fifty soil samples were collected from twenty five sites representing the village. The first 30 cm layer was considered as surface and 30 to 50cm layer as sub-surface sample. Soil samples were air dried and ground to pass through 2mm sieve. The pH and EC were determined by glass electrode pH meter and Wheatstone Bridge conductivity meter, respectively. Organic carbon was estimated by rapid titration method of Walkley and Black (1934). Phosphorus was extracted by Olsen's extractant (Olsen *et al*., 1954) and estimated by Murphy and Riley method as described by Watnable and Olsen (1965) using spectrophotometer. Mineralisable N and available potassium were estimated by alkaline permanganate method (Subbiah and Asija, 1956) and flame photometer method (Jackson, 1973), respectively. Available mironutrients were extracted by DTPA reagent and estimated using atomic absorption spectrophotometer (Lindsay and Norvell,1978). The nutrient index values for available nutrients were calculated as described by Parker *et al*. (1951).

RESULTS AND DISCUSSION

The analytical data of the surface and sub-surface samples are presented in Table 1. The pH of the soils varied from neutral to strongly alkaline (7.0 to 8.8) in surface and slightly to strongly alkaline (8.1 to 9.2) in sub-surface layers. The EC of the soils varied from 0.30 to 19.25 dSm^{-1} in surface and 0.52 to 14.98 dSm^{-1} in the sub-surface layers. This variation could be due to the texture, upward and downward movement of soil solution resulting in irregular deposition of salts. The organic carbon varied from low to medium (0.27 to 0.66 %) in surface layers and low (0.08 to 0.42 %) in sub-surface layers. The surface soils were relatively high in O.C. content than sub-surface, which might be due to the regular addition of organic residues (Varaprasad Rao *et al*., 2008)

The available nitrogen content varied from 119 to 247 kg ha^{-1} in the surface and 59 to 145 kg ha^{-1} in the sub-surface layers. Similarly available

Table 1. Analytical data of the surface soil samples of the study area

S.No	pH	EC (dSm^{-1})	Organic Carbon (%)	Available Nutrients ($kg\ ha^{-1}$)			Available Nutrients (ppm)			
				N	P_2O_5	K_2O	Zn	Cu	Fe	Mn
1a	7.0	0.49	0.42	185	90.10	470	0.50	5.36	6.90	4.30
1b	9.2	1.61	0.29	116	20.50	1344	0.26	5.00	4.08	3.93
2a	7.1	0.41	0.42	181	82.06	483	0.56	5.20	6.68	4.26
2b	9.2	1.60	0.15	113	20.51	1356	0.30	5.16	2.96	3.85
3a	7.0	0.42	0.44	179	81.21	476	0.54	5.90	7.16	4.62
3b	9.1	1.62	0.20	109	24.50	1380	0.30	5.14	4.78	2.58
4a	7.5	0.44	0.35	180	80.50	456	0.52	6.40	6.30	4.71
4b	9.0	1.64	0.10	112	22.82	1208	0.24	5.34	3.06	2.38
5a	7.7	0.43	0.32	247	85.00	295	0.82	2.10	8.68	6.82
5b	9.1	0.68	0.10	103	26.80	322	0.12	1.40	8.10	5.66
6a	7.4	0.42	0.33	242	81.94	292	0.82	2.98	8.70	6.42
6b	9.2	0.65	0.11	98	20.51	313	0.14	1.00	8.38	5.71
7a	7.5	0.42	0.34	246	82.06	290	0.80	2.90	8.56	5.12
7b	9.1	0.66	0.12	100	25.65	309	0.10	0.60	8.20	4.37
8a	7.7	0.54	0.58	122	65.60	241	0.30	1.98	35.36	14.79
8b	8.1	2.88	0.22	75	23.34	403	0.30	1.60	11.16	7.75
9a	7.8	0.51	0.56	121	56.42	239	0.36	2.02	48.48	19.97
9b	8.2	2.71	0.21	72	20.52	417	0.34	1.68	14.96	7.78
10a	7.7	0.48	0.55	119	49.16	248	0.32	2.08	20.60	13.19
10b	8.2	2.40	0.20	68	15.39	422	0.30	1.74	9.54	7.63
11a	7.8	0.43	0.27	153	20.51	288	0.14	2.50	20.80	11.71
11b	8.8	4.93	0.15	112	12.31	268	0.26	2.40	10.16	7.75
12a	7.8	0.41	0.28	147	20.51	292	0.12	2.66	15.72	9.40
12b	8.9	4.78	0.16	102	10.26	270	0.20	2.26	8.88	7.36
13a	7.7	0.40	0.29	149	23.08	290	0.18	2.56	15.22	8.75
13b	8.8	4.87	0.17	109	11.39	265	0.28	2.36	8.14	6.66

phosphorus and potassium in surface and sub-surface samples varied from 17.68 to 113.35 and 232 to 875, 10.26 to 85.29 and 219 to 1380 kg ha^{-1} respectively. Nitrogen showed decreasing trend from surface to sub-surface, phosphorus was more in subsurface of few samples (20-22), whereas potassium exhibited higher values in sub-surface layers in most of the samples except a few. The overall rating for nitrogen, phosphorus and potassium was obtained by calculating the nutrient indices (Table 2). The nutrient index for surface and subsurface of nitrogen was less than 1.67, hence it was rated as low, which indicated soils are low in available nitrogen. Low nitrogen status in the soils could be attributed to low amount of organic carbon in the soils (Prasuna Rani *et al*., 1992). The surface samples recorded phosphorus N.I. values of greater than 2.33, while sub-surface samples recorded less than 1.67, hence they were rated as high and low, respectively. The total samples were rated as medium in phosphorus as the nutrient index was between 1.67 and 2.33, which indicated soils were medium in phosphorus. The nutrient indices for potassium in both surface and subsurface samples were greater than 2.33, hence they were rated as high. Intense weathering, application of K fertilizers and upward movement of potassium from lower depth by capillary rise of ground water might have resulted in high concentration of potassium.

The DTPA extractable Zn varied from 0.12 to 0.96 ppm in the surface and 0.10 to 0.42 ppm in sub-surface layers. Considering 0.80 ppm as critical limit (Lindsay and Norvell, 1978), 12 per cent of the soil samples were sufficient, whereas the remaining were deficient in zinc. Available copper varied from 2.02 to 10.18 ppm in the surface and 0.44 to 5.52

Table 1. Analytical data of the surface soil samples of the study area

S.No	pH	EC (dSm^{-1})	Organic Carbon (%)	Available Nutrients ($kg\ ha^{-1}$)			Available Nutrients (ppm)			
				N	P_2O_5	K_2O	Zn	Cu	Fe	Mn
14a	8.0	19.25	0.62	244	96.50	840	0.56	4.16	3.86	6.80
14b	8.1	14.60	0.42	141	73.86	1176	0.30	4.90	2.56	6.43
15a	8.0	18.07	0.61	250	113.35	875	0.68	4.24	4.52	5.75
15b	8.2	14.98	0.40	145	85.29	1275	0.32	4.76	2.52	5.00
16a	8.1	17.40	0.60	240	97.45	860	0.76	3.96	2.62	5.57
16b	8.1	12.53	0.39	139	75.92	1250	0.42	3.80	2.30	4.37
17a	7.2	4.80	0.65	213	61.55	672	0.82	10.18	19.74	6.43
17b	8.5	4.92	0.36	122	32.82	1176	0.28	5.52	4.16	5.02
18a	7.1	4.78	0.66	213	58.90	649	0.90	9.12	18.08	6.00
18b	8.4	4.98	0.38	121	30.77	1176	0.34	5.22	5.64	5.82
19a	7.2	4.72	0.65	194	57.24	643	0.96	8.08	19.48	6.32
19b	8.5	4.80	0.35	110	30.77	1250	0.41	4.76	5.92	5.70
20a	8.7	0.61	0.33	159	20.51	241	0.22	2.40	24.68	11.61
20b	9.1	1.28	0.13	84	25.64	228	0.18	2.00	21.56	9.64
21a	8.8	0.63	0.36	148	19.69	232	0.20	2.58	20.80	10.40
21b	9.2	1.31	0.10	78	27.46	225	0.16	1.16	18.86	10.23
22a	8.6	0.62	0.29	150	17.68	236	0.23	2.20	16.98	9.97
22b	9.0	1.29	0.08	87	23.44	219	0.16	1.52	14.72	9.54
23a	8.8	0.32	0.30	178	35.90	588	0.24	2.34	11.84	4.41
23b	8.2	0.54	0.13	59	20.51	530	0.14	1.30	4.34	8.37
24a	8.7	0.30	0.29	175	36.82	586	0.28	3.08	11.02	4.86
24b	8.1	0.52	0.14	62	20.51	524	0.16	0.52	4.12	6.20
25a	8.8	0.31	0.32	165	32.82	592	0.26	2.22	10.98	4.62
25b	8.3	0.53	0.14	72	20.51	531	0.14	0.44	3.78	7.30

ppm in the sub-surface horizons. Copper was sufficient in 60 per cent of surface and 56 per cent of sub-surface samples.

The available iron content varied from 2.62 to 48.48 ppm in the surface and 2.30 to 21.56 ppm in sub-surface. According to the critical limit of 4.5 ppm (Lindsay and Norvell, 1978), 84 per cent of the soil samples were sufficient in iron. Available manganese ranged from 2.38 to 19.97 ppm and was found to be sufficient in both surface and sub-surface samples (critical limit – 2 ppm). All the available micronutrients showed positive correlation with organic carbon and negative correlation with pH (Table 3). The positive correlation with organic carbon could be due to the release of nutrients through decomposition or chelating action of several organic compounds improving the availability of nutrients. The negative correlation with pH might be due to their fixation as their insoluble carbonates or hydroxides (Vijay Kumar *et al.*,1996).

To conclude, the rice growing soils of Pedapuluguvaripalem village, Guntur district were low in nitrogen, medium in phosphorus, high in potassium and deficient in zinc. The productivity of the soils can be improved by supply of nutrients through integrated use of organic and inorganic sources.

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Table 2: Nutrient indices of surface and sub-surface samples (Macro and micronutrients)

Soil type	No. of samples	Available nutrients		No. of samples in each category			Nutrient index	Fertility status
		Range	Mean	L	M	H		
Available Nitrogen								
Surface	25	119-247	183	25	0	0	1	Low
Subsurface	25	59-145	102	25	0	0	1	Low
Total	50	59-247	153	50	0	0	1	Low
Available phosphorus								
Surface	25	17.68-113.35	65.51	6	4	15	2.36	High
Subsurface	25	10.26-85.00	47.63	11	10	3	1.60	Low
Total	50	10.26-113.35	61.80	17	14	18	1.98	Medium
Available potassium								
Surface	25	232-875	553.5	0	12	13	2.52	High
Subsurface	25	219-1380	799.5	0	9	16	2.64	High
Total	50	219-1380	799.5	0	21	29	2.58	High
Available zinc			Above critical level			Below critical level		
Surface	25	0.12-0.96	0.54	8		19 (76)		
Subsurface	25	0.10-0.42	0.26	0		25 (100)		
Total	50	0.10-0.96	0.53	8		44 (88)*		
Available copper								
Surface	25	2.02-10.18	6.1	24		1 (40)		
Subsurface	25	0.44-5.52	2.98	14		11 (44)		
Total	50	0.44-10.18	5.31	38		12 (24)		
Available iron								
Surface	25	2.62-48.48	25.55	23		2 (8)		
Subsurface	25	2.30-21.56	11.93	19		6 (24)		
Total	50	2.30-48.48	25.39	42		8 (16)		
Available manganese								
Surface	25	4.2-19.97	12.08	25		0		
Subsurface	25	2.38-10.23	6.30	25		0		
Total	50	2.38-19.97	11.17	50		0		

*Figures in parenthesis indicate per cent

Table 3. Simple correlation coefficients (r) between different soil properties

Variable	' r ' value
Zn Vs OC	0.70
Cu Vs OC	0.61
Fe Vs OC	0.26
Mn Vs OC	0.15
Zn Vs pH	-0.68
Cu Vs pH	-0.45
Fe Vs pH	-0.15
Mn Vs pH	-0.10

Vs = verses OC: Organic Carbon

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