Nutrient Status of Coastal and Inland Saline-Sodic Soils and their Relationship with Soil Properties

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Several soil testing laboratories are working in the country to provide information to farmers on the manurial needs of their normal soils, but no effort has been made to assess the saline- sodic soils which are considered potentially fertile. An attempt has been made to study the available nutrient status (N, P_2O_5, K_2O, Zn, Fe, Mn & Cu) and organic carbon content of saline-sodic soils of Saurashtra and their relationship with soil properties.

76 surface sample (0-15 cm) of Saline-Sodic soils varying from silty loam to clayey in texture from coastal and interior areas covering from Vallabhipur to Maliya on the coast and Amreli, Liliya and Lathi talukas for interior area of Saurashtra, Gujarat were collected during May, 1983 and analysed for different nutrients and soil properties.

TABLE 1

Range and average of chemical characteristics and nutrient status of irrigated surface saline-sodic soils of coastal and inland areas of Saurashtra.

Indices	*Range*	*Average*	*S. Em.*
Chemical characteristics			
ECe (dsm^{-1})	3.0-37.0	20.0	0.987
pH_2	7.6-9.4	8.5	0.051
SAR_{SE}	2.4-39.7	21.1	2.438
ESP	13.4-58.5	36.0	1.237
Nutrient status			
Organic carbon (%)	0.21-1.23	0.72	0.029
Available N ($kg\ ha^{-1}$)	188-439	313.50	8.066
Available P_2O_5 ($kg\ ha^{-1}$)	15.4-99.8	48.20	5.744
Available K_2O ($kg\ ha^{-1}$)	120-2262	841.00	51.026
DTPA extractable nutrients			
Iron (ppm)	0.77-11.26	6.02	0.187
Zinc (ppm)	0.12-5.38	1.06	0.109
Copper (ppm)	0.60-6.10	2.30	0.845
Manganese (ppm)	2.57-31.30	14.30	0.216

ECe and pH_2 were determined using solubridge and pH meter with glass electrode. SAR and ESP was calculated as per formula given by Richard (1954). Available N, P_2O_5, K_2O and organic carbon were determined as per methods described by Jackson (1966). DTPA extractable micro-nutrients were determined by Atomic Absorption spectrophotometer, shimadzu Model 640.

The data on range and average values for different chemical characteristics, major and micro nutrients status are presented in Table 1. The data revealed that the total salt concentration ranged from 3.0 to 37.0 ds/m while pH from 7.6 to 9.4. The exchangeable sodium percentage varies from 13.4 to 58.5. Thus the result showed that normal, saline, sodic and saline-sodic soils are exist.

The available N was low to medium while available P_2O_5 and K_2O were low to high. The medium to high status of available P_2O_5 and K_2O and organic carbon may be due to the fact that farmers are invariably applying FYM in the field for cultivating the crops.

The DTPA extractable zinc and manganese were low to high, Fe was low to medium while copper was high. The results are in confirmity with Zende and Raman (1978) and Srivastava and Srivastava (1992).

The correlation coefficient values between soil properties and nutrient status for surface are presented in Table 2. The ECe of soil was positively correlated with DTPA extractable Zn ($r = 0.454^{xx}$) and Cu ($r = 0.385^{xx}$) while no correlation was observed with organic carbon, available N, P_2O_5 and K_2O and also with DTPA extractable Fe and Mn. The sodium absorption ratio of saturation extract was positively correlated with Cu ($r = 0.232^{x}$) although at a low level of significance in the surface soils. The correlation with organic carbon, available N, P_2O_5 and K_2O and DTPA extractable Fe, Mn and Zn was not observed.

The available nitrogen ($r = 0.285^{xx}$), potash ($r = 0.476^{xx}$) were negatively correlated with ESP while available P_2O_5 was positively correlated ($r = 0.246^{x}$). Similarly, Chhabra *et al.* (1981) reported positive relationship between ESP and Olsen's extractable P. The pH_2 was negatively correlated with organic carbon ($r = 0.474^{xx}$), available N ($r = 0.420^{xx}$), while positive correlation was observed with available P_2O_5 ($r = 0.256$). These results showed that available nitrogen content decreased significantly with increase in pH and ESP. Similar result was observed by Chawla (1969). The positive correlation of available P_2O_5 with pH_2 was also observed by Gupta *et al.* (1989) who have reported increase in water soluble P with alkalinity via-a-vis pH.

Zinc is negatively correlated with pH ($r = 0.327^{xx}$). This showed that the availability of zinc decreased with the increase in pH of soil. The decrease in availability of zinc with an increase in pH may be due to the decreased solubility of zinc (Camp, 1945, Lindsay, 1972 and Swarup, 1992). Similar observations were recorded by Nair and Mehta (1959), Vittal and Gangwar (1974) and Srivastava and Srivastava, 1992).

The pH had also negatively correlated with Mn ($r = 0.225^{x}$). This is because of the concentration of divalent Mn in the soil solution of a given soil is dependent on soil pH and on its oxidation reduction potential. In alkali soils the divalent Mn undergo rapid atmospheric oxidation to form insoluble manganese dioxide and

TABLE 2

Correlation coefficient values between soil characteristics and available nutrients in coastal and inland problematic soils of Saurashtra.

Soil characteristics	Organic carbon	Available macro nutrients			DTPA extractable nutrients			
		N	P_2O_5	K_2O	Fe	Zn	Cu	Mn
ECe	0.220	0.188	0.145	0.017	–0.097	0.454**	0.385**	0.213
SAR_{SE}	–0.145	–0.093	0.054	0.203	0.058	0.054	0.232*	–0.019
ESP	–0.147	–0.285**	0.246	–0.476**	0.181	–0.018	0.208	0.187
pH_2	–0.474**	–0.420**	0.256*	–0.025	0.113	–0.327**	–0.042	–0.225*

* Significant at P = 0.05

** Significant at P = 0.01

other manganese oxides (Ponnamperuma, 1972). Similar result was observed by Brar *et al.* (1980), Swarup (1985a).

The results of the present investigation revealed that the availability of nitrogen in soil is decreased with the increase in ESP and pH while phosphorus availability increased (Gupta *et al.* 1989). Therefore, the nitrogen requirement will be more in sodic soils. The soil testing laboratories may keep this point in view while recommending N-fertilizers for sodic soils.

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