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Distribution of Micronutrients and Sulphur in Profiles of Some Soil Series in Amdavad District

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Periodical assessment for the micronutrient contents in the soils of Gujarat revealed an overall improvement in their status over the years (Dangarwala *et al.* 1994). It was also observed that among different districts, the Amdavad soils exhibited a considerable increase in available Fe, Mn and Cu contents, besides showing a decline in Zn deficiency. Hence, it was thought worthwhile to see the vertical distribution of these micronutrients and also sulphur in these soils. The information on serieswise distribution of micronutrient and sulphur contents in most of the soils of Gujarat to series level is quite meagre. Hence, the present investigation reports a depthwise distribution of micronutrient cations and sulphur in six representative soil profiles from the prominent series occurring in the district.

Six typical pedons of soil series viz., Kathlal (*Ktl*), Oganaj (*Ogn*), Silaj (*Slj*), Ranodar (*Rnd*)), Rakhiyal (*Rkl*) and Dehgam (*Dgm*) in Daskroi and Dehgam talukas were sampled in collaboration with the Soil Survey Division, Department of Agricultural, Nadiad. The soils of different series belong to the order of inceptisols except those of *Ogn*, which are Entisols. Soils of *Ktl, Dgm, Rkl* and *Rnd* are members of deep fine loamy mixed hyperthermic Fluventic Ustochrepts. They have been developed over mixed alluvium which is baseltic and sedimentary in nature. The *Ogn* pedon is a member of deep coarse loamy, mixed (calcareous) hyperthermic family of Typic Ustifluvents, whereas soils of *Slj* are members of deep fine loamy mixed hyperthermic family of Typic Ustochrepts. The soils of *Ogn* series exhibit sandy loam texture throughout the profile.

Soil samples of < 2 mm size were used for various laboratory determinations. The salient physico-chemical properties of the soils were determined by adopting standard procedures and their mechanical fractions according to International Pipette method. The available micronutirent cations, viz., Fe, Mn, Zn and Cu were extracted with DTPA-$CaCl_2$ solution (Lindsay & Norvell, 1978) and determined by using Atomic Absorption Spectrophotometer. The available sulphur, phosphorus and potassium contents were determined by extracting the soil with 0.15% $CaCl_2$, 0.05 M $NaHCO_3$ and neutral 1 N NH_4OAc, respectively. Earlier studies have

indicated that soils poor in organic C, available P_2O_5 and K_2O contents with high soil pH are relatively more prone to Zn deficiency. Similarly the deficiency of S is felt to a greater extent when the soils are having poor status with respect to available phosphate, available potash and organic C contents as well as when the pH of the soils was of the low order. The pH of all the soils barring those of *Slj* series irrespective of the depth was slightly alkaline in range (around 8.0), whereas those of exceptions were near neutrality. Similarly, almost all the soils were found to be having low soluble salts except those belonging to *Rnd.* series, wherein EC varied between 0.62 and 1.15 mmhos/cm. The contents of organic C in soils of different layers of profiles of *Ktl, Ogn, Slj,* and *Rnd* series varied narrowly between 0.08 and 0.24 per cent, while those of *Rkl* and *Dgm* series had around 0.3 to 0.5 per cent. The availability of phosphate in soils was low to high (12.8 to 67.9 kg/ha), while that of potash was generally medium (220 to 324 kg/ha).

Sulphur availability in soils of different profile-layers did not show any definite trend; and most of them could be rated as deficient according to the critical concentration of 12 mg kg^{-1} soil. The available S content ranged from 4.3 to 30.1 mg kg^{-1} in surface soils (Table 1). Significant correlation observed between available S and EC ($r = 0.76^{**}$) indicates that sulphate ions contribute to the extent of nearly 58 per cent of the accumulation of soluble salts. Likewise, generally most of the soils under investigation showed marginal status with respect to available Zn and Fe, whereas availability of Mn and Cu could be rated as fairly adequate (Table 1).

A perusal of data given in Table 1 also indicated that in general, the DTPA-Zn showed declining trend with increase in the soil depth. Almost, identical trends were noticed for DTPA-extractable Fe and Mn, while such consistency was not found in case of Cu. However, exceptionally high or low values of the element at some depth from that of the normal trend might be due to either irregular distribution of the nutrient for some inexplicable reasons or unknown contamination of the respective samples. The results also revealed that soils belonging to *RKl* and *Ktl* series could be considered as moderate in available Fe content based on critical concentration of DTPA-Fe (5.0 mg kg^{-1} soil), whereas rest of the soils of different series as deficient to marginal.

It appears that DTPA-Fe is negatively influenced by the content of soil organic carbon ($r = -0.37^{**}$). Organic matter influences nutrient availability of a soil either due to fixation or release through solubilization. Hence, positive and negative associations are encountered between the two depending upon other soil parameters. In general, it gives negative correlation, as little excessive quantity of organic matter may reduce temporarily the availability of nutrients especially of trace elements. The soils of *Slj* series throughout the profile had shown very high DTPA-Mn content (Table 1). The higher Mn availability of the soils of this series could be attributed to nearly neutral reaction of those soils (pH 7.2 to 7.4), as the DTPA-Mn had shown negative and highly significant correlation ($r = -0.57^{**}$) with soil pH. Similar results also have been reported by several workers (Tripathi *et al.,* 1994, Kumar *et al.,* 1994).

TABLE 1

Physico-chemical properties of soil series of Amdavad district.

Sr. No.	Name of series	Depth (cm)	Textural class	Particle size distribution (%)				pH (1:2)	EC dSm^{-1}	Org. C (%)	Av. P_2O_5 kg ha^{-1}	Av. K_2O (kg ha^{-1}	Av. S (ppm)	Micronutrient cations (ppm)			
				Clay	Silt	Coarse sand	Fine sand							Fe	Mn	Zn	Cu
1.	Kathlal (Ktl)	0-18	Ls	12.8	15.4	70.9	0.9	8.1	0.45	0.17	43.2	220	4.3	2.9	4.9	1.80	1.1
		18-39	Sl	18.2	26.0	54.6	1.2	8.0	0.24	0.24	11.8	201	11.5	6.6	19.8	0.50	1.6
		39-75	Sl	17.7	23.9	55.5	2.9	7.8	0.11	0.11	17.3	182	7.4	6.3	16.6	1.40	1.4
		75-112	Sl	18.8	25.0	55.2	0.8	7.8	0.13	0.13	14.8	191	2.7	6.6	21.5	0.14	1.2
		112-150	Sl	19.8	20.2	54.9	4.5	7.8	0.08	0.08	17.1	191	5.5	5.8	13.2	0.34	1.2
2.	Rakhiyal (Rkl)	0-20	Sl	27.6	21.2	48.7	2.4	7.7	0.30	0.42	32.2	324	9.1	6.5	10.8	0.94	2.2
		20.78	Scl	23.5	25.6	49.2	1.8	7.8	0.14	0.21	34.5	157	3.7	9.2	24.7	0.70	1.0
		78-116	Scl	24.2	21.0	2.1	2.7	7.9	0.19	0.44	18.4	132	4.3	9.3	8.5	0.08	0.9
		116-150	Scl	17.6	17.1	63.0	2.4	8.1	0.18	0.46	18.4	128	5.9	6.1	6.5	0.06	0.7
3.	Dehgam (Dgm)	0-20	Sl	18.8	17.7	60.3	3.3	7.6	0.42	0.50	27.6	302	11.5	6.0	7.2	0.50	0.8
		20-44	Cl	29.6	22.6	45.8	2.1	7.7	0.36	0.34	18.4	236	11.1	6.0	14.6	1.24	1.5
		44-80	Cl	35.5	26.3	35.0	3.2	8.1	0.44	0.35	16.1	216	15.6	6.2	16.5	0.28	1.4
		80-124	Cl	38.8	24.9	34.2	2.1	7.5	0.21	0.30	16.1	201	9.1	5.4	8.3	0.56	1.0
		124-150	Cl	39.0	26.8	31.0	3.2	7.6	0.20	0.21	16.1	186	10.9	5.9	14.8	0.36	1.1
4.	Oganaj (Ogn)	0-18	Sl	17.8	20.1	60.5	1.6	8.1	0.37	0.17	67.9	221	7.3	6.3	6.7	0.98	0.8
		18-46	Sl	19.3	22.7	56.6	1.4	8.2	0.41	0.15	42.1	152	1.3	4.8	10.3	0.40	1.0
		46-73	Sl	17.1	23.9	56.4	2.7	8.3	0.34	0.20	42.1	118	2.0	5.4	8.7	0.24	0.7
		73-105	Sl	16.9	23.9	55.9	3.3	8.1	0.35	0.12	30.6	113	11.5	5.7	8.8	0.16	0.7
		105-150	Sl	16.8	25.2	56.4	1.6	8.0	0.37	0.13	76.7	123	14.5	3.6	6.2	0.36	0.8
5.	Silaj (Slj)	0-15	Sl	19.9	23.0	54.9	2.2	7.3	0.40	0.16	23.1	275	10.0	6.9	75.2	0.80	1.5
		15-50	Sl	23.9	22.3	50.1	4.3	7.2	0.30	0.14	29.2	201	3.7	5.2	66.5	0.36	1.6
		50-87	Scl	25.3	23.2	49.6	1.9	7.4	0.33	0.12	14.4	201	1.1	3.9	38.2	0.56	1.1
		87-115	Scl	26.3	25.8	44.7	3.2	7.2	0.26	0.11	49.3	201	5.5	5.2	36.7	0.50	1.1
		115-150	Scl	28.6	25.4	45.9	1.0	7.4	0.26	0.10	46.8	211	4.9	3.4	41.1	0.38	0.9
6.	Ranodar (Rnd)	0-20	Scl	25.0	23.9	46.8	4.4	8.0	1.15	0.13	12.8	294	30.1	5.1	15.9	0.78	1.3
		20-48	Scl	28.2	23.9	45.6	2.3	8.0	0.62	0.15	18.0	191	11.5	4.8	7.6	0.48	1.5
		48-73	Cl	27.6	30.1	32.8	7.5	7.9	0.73	0.12	49.8	211	19.9	3.9	8.1	0.78	1.5
		73-114	Cl	30.9	35.2	31.4	2.5	7.8	1.05	0.17	42.8	206	24.5	4.2	7.4	0.60	1.9
		114-150	Cl	32.7	37.5	26.9	2.9	7.5	1.00	0.11	55.6	191	20.2	4.0	5.7	0.45	1.0

Ls = Laomy sand; Sl = Sandy loam; Scl = Sandy clay loam; Cl = Clayey.

The results confirmed the earlier reports by Dangarwala *et al.* (1994). However, the available contents of Fe and Zn were not under sufficiency range in all the soils. Moreover, subsequence soils were also by and large deficient to marginal in Zn and Fe. Besides, the micronutrients, the soils were found deficient in available S also. The results, therefore, suggest relatively greater need of sulphur fertilization for crops especially oilseeds grown on these soils to obtain higher yields. Further, the crops might also exhibit deficiency symptoms of Fe and Zn, if not properly managed by making judicious use of Fe and Zn fertilizers. Deficiencies of Mn and Cu are not likely in these soils. Liberal addition of organic matter is desirable.

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REFERENCES

Dangarwala, R. T. Patel, K. P., Valsamma George, Patel, K. C., Ramani, V. P. and Patel, M. S. (1994). Micronutrients and sulphur research in Gujarat. *Tech-Bull.* pp. 1-164.

Kumar, A., Datta, S. P., Singh, R. P., Singh, K. P. and Sarkar, A. K. (1994). Available sulphur and micronutrients status of dominant soil series of South Chotanagpur in Bihar. *J. Indian Soc. Soil Sci.*, **42** : 649.

Lindsay, W. L. and Norwell, W. A. (1978). Development of a DTPA soil test for zinc, iron, manganese and copper, *Soil Sci. Soc. Am. J.*, **42** : 421.

Tripathi D., Singh, K. and Upadhyay, D. P. (1994). Distribution of micronutrients in some representative soil profiles of Himachal Pradesh. *J. Indian Soc. Soil Sci.*, **42** : 143.