GAU Research Journal **37** (1) : 23-25 January 2012

Delineation of sulphur deficient soil in Banaskantha district (Gujarat)

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Received : 15 July, 2010

ABSTRACT

Soil samples (0-15 cm depth) from Banaskantha district of north Gujarat were collected and analysed for determination of status of available sulphur in soil. On an average, the available sulphur was ranged from 5.24 to 60.17 mg kg^{-1} in soil with a mean value of 19.01 mg kg^{-1}. Out of 240 surface soil samples (0-15 cm depth), 30.0, 32.1 and 37.9 per cent samples were observed as deficient, medium and sufficient categories, respectively.

Key words : Delineation, sulphur, deficient

Sulphur recognized as fourth important plant nutrient after N, P and K and is gaining considerable importance in quality crop production in context of Indian agriculture, particularly when there is more and more use of non-S containing fertilizers as well as less use of organic manures. Sulphur deficiency in crops is gradually becoming widespread in different soils in several states of India (Tandon 1991). Eighty eight districts in India were reported to be deficient in sulphur in early 1980s, increasing to 120 by 1990 and at present this number is close to 250. Sulphur deficiency is prevailing in various states of India ranging from 15 to 84 per cent (Tewatia *et al.* 2006). Widespread sulphur deficiency in soils of different parts of Gujarat has also been reported by Patel *et al.* (2001). No detailed information is available on the status and delineation of sulphur in soils of Banaskatha district. This study aims to delineate sulphur deficient areas of Banaskantha district of Gujarat.

MATERIALS AND METHODS

In order to delineate the sulphur deficient area in soils of Banaskantha district of north Gujarat, 220 representative surface soil samples (0-15 cm) were collected from 12 talukas (20 villages in each taluka) of Banaskantha district during 2009. The soil samples were air dried, sieved through 2 mm sieve and analysed for important chemical properties using standard chemical procedure outlined by Jackson (1973). The soil samples were analysed for sulphur (heat soluble Williams and Steinbergs, 1959) by adopting turbidimetric methods (Chesnin and Yien, 1950).

RESULTS AND DISCUSSION

The important chemical properties of soil and content of available sulphur presented in the Table 2. The soils of Banaskantha district are sandy to sandy clay loam in texture and alkaline in reaction. These soils are low to medium in organic carbon, available nitrogen, available phosphorus and medium to high in available potassium. Available sulphur content ranged from 5.24 to 60.17 mg kg^{-1} in the surface soil with a mean value of 19.01 mg kg^{-1}, The values of available sulphur are in aggrement with those reported by Reddy and Mehta (1970), Patel and Patel (2008) and Singh *et al.* (2009). Plant roots absorb sulphur in the form of SO_4^{-2} from the soil solution. Keeping in view this fact the soil may be classified as deficient (< 10 mg kg^{-1}), medium (10 - 20 mg kg^{-1}) and sufficient (> 20 mg kg^{-1}) categories (Hariram and Dwivedi, 1994). According to this classification, out of 240 surface soil samples (0-15 cm depth), 30.0, 32.1 and 37.9 per cent samples were observed as deficient, medium and sufficient categories, respectively (Table 2).

The maximum deficiency was observed in Tharad and Vav taluka, while maximum sufficiency was observed in Danta and Kankarej talukas of district This was

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Table 1 Chemical characteristics of soils in Banaskantha district

Name of Taluka	E.C. (dSm^{-1})	pH	Organic carbon (%)	Available nutrients (Kg/ha)		Available sulphur (mg kg^{-1})		
				P_2O_5	K_2O	Range	Mean	S.D.
Palanpur	0.04 - 0.40	7.56 - 8.85	0.08 - 0.52	20.62 - 63.58	142.5 - 345.4	5.89 - 28.90	17.54	5.86
Danta	0.06 - 0.39	7.02 - 8.41	0.16 - 1.92	18.90 - 70.46	170.7 - 927.4	9.16 - 60.86	29.54	13.30
Vadgam	0.08 - 0.35	7.55 - 8.12	0.09 - 0.66	15.47 - 42.96	134.4 - 533.6	6.54 - 32.07	17.86	8.24
Amirgadh	0.07 - 0.37	7.18 -7.85	0.10 - 0.83	17.18 - 60.14	119.6 - 459.6	6.54 - 34.68	18.74	8.41
Deesa	0.10 - 0.41	7.40 -8.05	0.10 - 0.53	15.47 - 61.86	114.2 - 462.3	7.77 - 29.45	16.07	7.01
Dhanera	0.10 - 0.72	7.47 -8.60	0.05 - 0.48	12.03 - 51.55	159.9 - 346.8	5.89 - 30.76	17.11	8.20
Dantiwada	0.08 - 0.28	7.39 -8.05	0.12 - 0.64	18.90 - 44.68	155.9 - 384.3	7.85 - 30.76	18.13	7.09
Kankarej	0.15 - 1.13	7.35 - 8.12	0.08 - 0.55	20.62 - 58.43	204.3 - 576.6	5.24 - 60.86	23.29	13.19
Tharad	0.20 - 0.77	7.72 -8.60	0.03 - 0.40	10.31 - 41.24	200.3 - 322.6	6.87 - 30.76	13.97	6.82
Bhabhar	0.12 - 1.21	7.40 -8.30	0.05 - 0.45	17.18 - 53.27	170.7 - 412.6	7.20 - 62.17	20.66	14.10
Deodar	0.13- 0.70	7.35 -8.20	0.03 - 0.77	20.62 - 60.14	201.6 - 590.0	7.85 - 46.76	21.20	10.98
Vav	0.20 - 1.20	7.75 -8.25	0.04 - 0.75	10.31 - 46.40	190.8 - 583.3	5.51 - 41.23	13.87	9.32
Overall Mean	0.04 -1.21	7.02 - 8.85	0.03 - 1.92	10.31 - 70.46	114.2 - 927.4	5.24 - 62.17	19.01	10.39

probably due to leaching losses of SO_4^{-2} in coarse textured soils.

From the data, it was found that more than 62 per cent soils of the Banaskantha district are deficient or below sufficient level (> 20 mg kg^{-1}), while remaining 32 per cent soils of the district are found sufficient in available sulphur. Thus the study suggests that there is a need for sulphur fertilsation in more than 62 per cent of the soils of the district. Similar deficiencies were reported by Maliwal (1986), Patel and Kalyansunderam (1988), Patel *et al.* (2001) for soils of Gujarat. Tandon (1986) also reported that the soils of Banaskantha are prone to sulphur deficiency. Similar type of results were also reported by Raina and Tanawade (2005), Jat and Yadav (2006) and Tewatia *et al.* (2006) for different soils of India.

Table 2 Talukawise sulphur (heat soluble) deficient soil samples of Banaskantha district (0-15 cm)

Name of Taluka	No. of samples	Deficient (<10 mg kg^{-1})	Medium (10-20 mg kg^{-1})	Sufficient (>20 mg kg^{-1})
Palanpur	20	03	11	06
		(15)	(55)	(30)
Danta	20	01	05	14
		(05)	(25)	(70)
Vadgam	20	06	07	07
		(30)	(35)	(35)
Amirgadh	20	05	07	08
		(25)	(35)	(40)
Deesa	20	08	06	06
		(40)	(30)	(30)
Dhanera	20	07	07	06
		(35)	(35)	(30)
Dantiwada	20	05	07	08
		(25)	(35)	(40)
Kankarej	20	04	04	12
		(20)	(20)	(60)
Tharad	20	10	07	03
		(50)	(35)	(15)
Bhabhar	20	06	07	07
		(30)	(35)	(35)
Deodar	20	05	05	10
		(25)	(25)	(50)
Vav	20	12	04	04
		(60)	(20)	(20)
Total	240	72	77	91
		(30.0)	(32.1)	(37.9)

* figure in parenthesis shows per cent of samples

REFERENCES

Chesnin, L. and Yien, C.H. 1950. Turbidimetric determination of available sulphates. *Proceding Soil Science America*, **15** : 149-151.

Hariram and Dwivedi, K.N. 1994. Delineation of sulphur deficient soil groups in the central alluvial tract of Uttar Pradesh. *Journal of Indian Society of Soil Science*, **42** (3): 284-286.

Jackson, M.L. 1973. Soil Chemical Analysis. Prentice Hall of India Pvt Ltd. New Delhi. pp. 327-350.

Jat, J.R. and Yadav, B.L. 2006. Different forms of sulphur and their relationship with properties of Entisols of Jaipur District (Rajasthan) under mustard cultivation. *Journal of Indian Society of Soil Science*, **54** (2): 208-212.

Maliwal, G.L.1986. Response of groundnut to fertilizers with special reference to Saurashtra region. In soil Fertility & Fertilizer Use, Vol. 11, IFFCO, New Delhi. pp.27-35

Patel, A.T. and Kalyansundaram, N.K.1988. Research Highlights, Dryland Agriculture, GAU, Sardarkrushinagar.

Patel, K.P., Singh, M.V. ; Patel, K.C. and Ramani, V.P. 2001. Micronutrient Project, ICAR, GAU, Anand Bulletin- 4 pp. 25-27.

Patel, J.C. and Patel, K.C. 2008. Profile distribution of different forms of sulphur in prominent soil series of South Gujarat. *An Asian Journal of Soil Science*, **3** (1): 24-31.

Raina, A.K. and Tanawade, S.K. (2005). Delineation of sulphur deficient area of Maharashtra and crop responses to sulphur application. *Indain Journal of Fertilizer*, **1** (7): 61-67.

Reddy, C.S. and Mehta, B.V. (1970). Fraction of sulphur in some soils of Gujarat to evolve a suitable method for assessing available sulphur status. *Indian Journal of Agricultural Science*, **40** (1): 5-12.

Singh, S.P ; Singh, R.; Srivastava, P.C. and Singh, P. (2009). Different forms of sulphur in soils of Udham Singh Nagar district, Uttarakhand and their relationship with soil properties. *Agropedology* **19** (1) : 68-74.

Tandon, H.L.S. (1986). Sulphur research and agril. production in India (2nd eddition, August-1986), Fertilizer Development and Constitution Organisation, New Delhi. pp. 1-20.

Tandon, H.L.S. (1991). Sulphur research and agricultural production in India (3rd ed.). Fertilizers Development and Consultuntions Organisation, New Delhi. pp. 1-20.

Tewatia, P.K. ; Choudhary, R.S. and Kalwe, S.P. (2006). Proceedings of TSI-FAI-IFA Symposium cum Workshop on Sulphur in Balanced Fertilization. New Delhi pp.17-18.

Williams, C.H. and Steinbergs, A. (1959). Soil sulphur fractions as chemical indices of available sulphur in some Australian Soils. *Australian Journal of Agricultural Research*, **10**: 340-352.