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Status of DTPA-extractable Fe in soils of Mehsana District, Gujarat

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Abstract
The present study were carried out to determine DTPA-extractable Fe status in soils of Mehsana district of Gujarat, three hundred and seventy one surface soil samples (0-15cm) were randomly collected from 10 talukas of Mehsana district of Gujarat. All the collected soil samples were analyzed for DTPA-extractable Fe as per standard procedures. The DTPA- extractable Fe, was in the range of 3.12 to 14.68 mg kg^{-1} with a mean value of 6.74 mg kg^{-1}. According to the Nutrient Index Value (NIV) soils of Mehsana district were marginal in DTPA extractable Fe (1.88) status.

Keywords: Micronutrient, DTPA, Fe, Coefficient correlation

Introduction
The importance of micronutrients has been realized during the past four decades when widespread micronutrient deficiencies were observed in most of the soils in our country. The improper nutrient has led to emergence of multi-nutrient deficiencies in the Indian soils (Sharma, 2008). Iron is one of the most deficient nutrients in plant metabolism and their growth, mainly due to limited solubility of the oxidized Fe^{3+} form in aerated condition (Zuo and Zhang, 2011; Samaranayke *et al*., 2012) [12, 8]. Iron deficiency causes various nutritional disorder in crops, resulting in low yields and poor nutritional quality of produce. Iron plays important role in chlorophyll synthesis, maintenance of chloroplast structure and function. Being the fourth most abundant element in the earth crust, iron is generally present at high quantities in soils; however, its bioavailability in aerobic and neutral pH environments is limited. In aerated conditions, iron is mainly found in the Fe^{+3} form, predominantly as a constituent of oxyhydroxide polymers with extremely low solubility. Normally, Fe^{+3} form does not sufficiently meet plant needs (Rout and Sahoo, 2015) [7]. The visual symptoms of inadequate iron nutrition in higher plants are interveinal chlorosis of young leaves and stunted root growth. In reduced conditions, the concentration of soluble iron may increase by several orders of magnitude because of low redox potential (Schmidt, 1993) [9]. Thus, there is an urgent need for correction of Fe deficiency and for arresting its spread.

Materials and Methods
The total geographical area of Mehsana district is 4393 sq. km having 10 talukas (Fig. 1). The study area is in between 23° 15’ to 23° 53’ N latitudes and 72° 07’ to 72° 46’ E longitudes with an elevationof 92-96 metre above the mean sea level. The district has semi arid and sub-tropical climate with hot and dry summer with an average rainfall of 625 mm. In general, the soils of the study are sandy loam in texture having poor moisture retention capacity. To assess DTPA- extractable Fe from soils of Mehsana district, three hundred and seventy one representative surface soil samples (0-15 cm) were collected from farmers’ fields during summer season using multistage stratified random sampling method covering 10 talukas of Mehsana district of Gujarat. The DTPA-extractable Fe was determined by Atomic Absorption Spectrophotometer using 0.005 *M* DTPA as an extractant (Lindsay and Norvell, 1978).The soil samples were categorized into low, medium and high categories based on the critical limit of available Fe (Lindsay and Norvell, 1978). The nutrient index values (NIV) for DTPA-extractable Fe was calculated utilizing the formula suggested by Ramamurthy and Bajaj (1969) [6].

$$NIV = \frac{[(N_l * 1) + (N_m * 2) + (N_h * 3)]}{100}$$

Where,
N_l, N_m and N_h are the percentage of soil samples falling in low, medium, and high categories for nutrient status and are given weightage of 1, 2 and 3, respectively.
The nutrient index are rated in various categories viz., very low (<1.33), low (1.33 - 1.66), marginal (1.66 - 2.00), adequate (2.00 - 2.33), high (2.33 - 2.66) and very high (> 2.66) as rating given by Stalin *et al.* (2010). Coefficient correlation (r) between soil properties (EC, pH and OC) and DTPA-extractable Fe was analyzed by statistical procedure as outlined by Panse and Sukhatme (1961) [3].

Results and Discussion
The DTPA-extractable Fe content in soils of Mehsana district is given in Table 1. The DTPA-extractable Fe content in soils of Mehsana district ranged from 3.12 to 14.68 mg kg^{-1} with a mean value of 6.74 mg kg^{-1}. The results also revealed that the minimum value (3.12 mg kg^{-1}) of DTPA-extractable Fe was found in Kheralu taluka, whereas the maximum value (14.68 mg kg^{-1}) was found in Unjha taluka. Among different talukas, Kadi taluka contained the highest mean value of DTPA-extractable Fe (7.92 mg kg^{-1}), while Kheralu taluka had the lowest mean value of 5.85 mg kg^{-1} DTPA-extractable Fe. The mean value of DTPA-extractable Fe is in conformity with the findings of Meena *et al.* (2006) [2] and Polara and Kabariya (2006) [5]. On whole, 28.84.% samples were found in low category, 54.72.% in medium category while remaining 16.44.% in high category in soils of Mehsana district. The result further revealed that the maximum deficiency in soil was observed in Vadnagar (36.11 %) and Kheralu (32.50 %) talukas, while maximum sufficiency was observed in Jotana (32.00 %) taluka. The low status of DTPA-extractable Fe of district probably due to the low organic carbon content, coarse textured soil and higher pH leading to decreasing availability of Fe in soil. The results of low status of DTPA-extractable Fe of the present investigation are in close agreement with the findings Patel *et al.* (1994) [4] in soils of Gujarat and Meena *et al.* (2006) [2] in soils of Rajasthan. Nutrient index value of Mehsana district ranged from 1.75-2.08 indicating marginal to adequate fertility status of soil (Table 2). The highest nutrient index value of 2.08 was found in Jotana taluka followed by Mehsana (2.02) which indicate the adequate fertility status of DTPA-extractable Fe in both talukas. The lowest nutrient index value of 1.75 was obtained in soils of Kheralu taluka which indicate the marginal fertility status of DTPA-extractable Fe. Overall, the soils of Mehsana district had nutrient index value of 1.88, indicating marginal status for DTPA-extractable Fe (Fig. 3). DTPA-extractable Fe showed highly significant and negative correlation with soil pH (-0.218**) whereas OC (0.193**) had significant and positive relationship with DTPA-extractable Fe (Table 3). The positive correlation of Fe with soil organic carbon might be due to the formation of relatively more soluble Fe- organic chelates (Talukdar *et al.* 2009) [11].

Table 1: Talukawise range and mean values (mg kg^{-1}) with percent distribution in different categories of DTPA-extractable Fe in soils of Mehsana district

Name of Taluka	*Range (Mean)*	*Per cent distribution of soil samples*		
		Low (<5 mg kg^{-1})	*Medium (5-10 mg kg^{-1})*	*High (>10 mg kg^{-1})*
Becharaji	3.36-12.84 (6.58)	30.00	55.00	15.00
Kadi	4.10-12.62 (7.920)	22.50	55.00	22.50
Kheralu	3.12-12.10 (5.85)	32.50	60.00	7.50
Mehsana	3.76-13.80 (7.23)	25.53	46.81	27.66
Jotana	3.30-12.58 (7.42)	24.00	44.00	32.00
Vadnagar	3.84-12.46 (6.45)	36.11	50.00	13.89
Satlasana	3.28-12.88 (6.15)	32.26	54.84	12.90
Unjha	4.32-14.68 (6.79)	28.13	62.50	9.38
Vijapur	3.50-14.42 (6.44)	30.00	57.50	12.50
Visnagar	3.40-13.04 (6.43)	27.50	60.00	12.50
Overall	*3.12-14.68 (6.74)*	*28.84*	*54.72*	*16.44*

*Values in parenthesis indicate mean value of respective nutrient

Table 2: Nutrient Index values and fertility status of DTPA extractable Fe of Mehsana district

Name of Taluka	*Nutrient Index Value*	*Fertility Status*
Becharaji	1.85	Marginal
Kadi	2.01	Adequate
Kheralu	1.75	Marginal
Mehsana	2.02	Adequate
Jotana	2.08	Adequate
Vadnagar	1.78	Marginal
Satlasana	1.81	Marginal
Unjha	1.81	Marginal
Vijapur	1.83	Marginal
Visnagar	1.85	Marginal
District	*1.88*	*Marginal*

Table 3: Correlation coefficient (r) of soil properties (EC, pH and OC) with DTPA-extractable Fe

DTPA-extractable Fe	**Soil Properties**		
	EC	**pH**	**OC**
	-0.038	-0.218**	0.193**

* Significant at 5 % level of significance
** Significant at 1 % level of significance

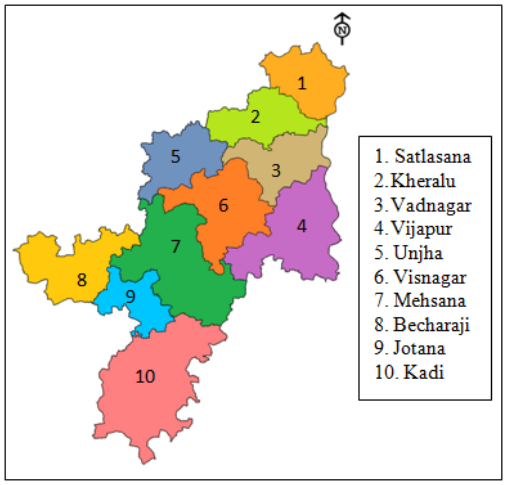

Fig 1: Different Talukas of Mehsana District

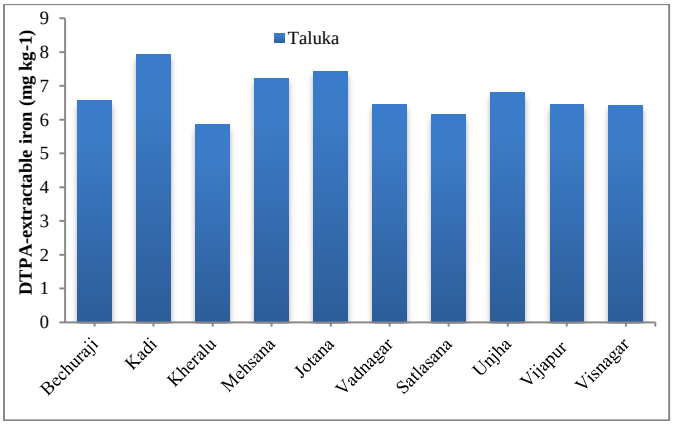

Fig 2: Talukawise mean values of DTPA-extractable iron content (mg kg^{-1}) in soils of Mehsana district

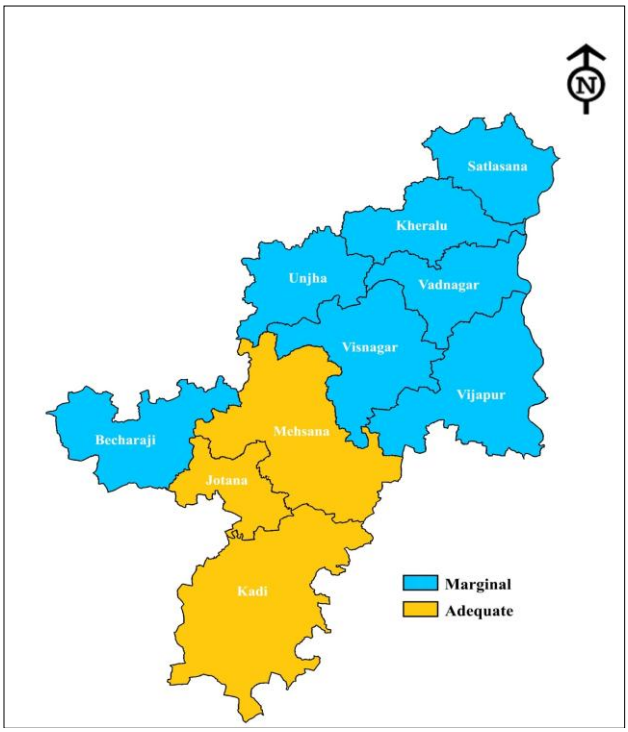

Fig 3: DTPA-extractable Fe status in Mehsana district

Conclusions

Lack of knowledge and importance about micronutrients among farmers, exhaustive and high yielding cultivars and neglected usage of farm yard manures seems to have terminated to a wide occurrence of Fe deficiency. It is obvious that the soil DTPA extractable Fe varied with variation in soil properties of different talukas of Mehsana district. It was observed that the soils of Mehsana district have marginal status of DTPA-extractable Fe. The iron fertilization should be given importance in fertilizer package for growing crops otherwise high yield losses eventually be the end product.

References

1. Lindsay WL, Norvell WA. Development of a DTPA Soil test for zinc, iron, manganese and copper. Soil Science Society America Journal. 1978; 42:421-428.
2. Meena HB, Sharma RP, Rawat US. Status of macro and micronutrients in some soils of Tonk district of Rajastan. Journal of the Indian Society of Soil Science. 2006; 54(4):508-512.
3. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR, New Delhi, 1967.
4. Patel KP, Dangarwala RT, George V, Patel KC, Ramani VP, PateI MS. Micronutricnt and sulphur research in Gujarat. Research Bulletin. Gujarat Agricultural University Anand, 1994; 2:1-92.
5. Polara JV, Kabaria BD. Fertility status of irrigation soils of coastal Amreli District of Gujarat. Journal of the Indian Society of Coastal Agricultural Research. 2006; 24:50-51.
6. Ramamoorthy B, Bajaj JC. Available N, P and K status of Indian soils. Fertilizer News. 1969; 14:24-26.
7. Rout GR, Sahoo S. Role of iron in plant growth and metabolism. Reviews in Agricultural Science. 2015; 3:1-24.
8. Samaranayake P, Peiris BD, Dssanayake S. Effect of excessive ferrous (Fe^{2+}) on growth and iron content in rice (Oryza sativa). Int. J. Agri. Biol. 2012; 14:296-298.
9. Schmidt W. Iron stress-induced redox reactions in bean roots. Physiol. Plantarum. 1993; 89:448-452.
10. Stalin P, Singh MV, Muthumanickam D, Chitedeshwari T, Velu V, Appavu K. Four Decade of Research on Management of Micro- and Secondary-Nutrient and Pollutant Elements in Crops and Soils of Tamil Nadu. Publication No. 8. AICRP micro- and secondary-nutrients and pollutant elements in soils and plants, IISS, Bhopal. 2010; 8:22.
11. Talukdar MC, Basumatary A, Dutta SK. Status of DTPA extractable cationic micronutrients in soils under rice and sugarcane ecosystems of Golaghat district in Assam. Journal of the Indian Society of Soil Science. 2009; 57(3):313-316.
12. Zuo Y, Zhang F. Soil and crop management strategies to prevent iron deficiency in crops. Plant and Soil. 2011; 339:83-95.