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Status of available micro nutrients in soils of Mahisagar district of Gujarat

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Abstract
A study was undertaken to assess the status of available micro nutrients in soils of Mahisagar district of Gujarat. Total 180 surface (0-15 cm) soil samples were collected from cultivated farmer's fields of 6 talukas of Mahisagar district during April- May 2018. The soil samples were analyzed for DTPA-extractable Fe, Mn, Zn and Cu. The DTPA-extractable Fe, Mn, Zn and Cu content in these soils ranged from 1.89 to 39.22, 3.96 to 32.46, 0.22 to 5.91 and 0.05 to 6.79 with their corresponding mean values of 15.14, 11.59, 1.64 and 1.53 mg kg^{-1}, respectively. Overall, nutrient index values for available Fe, Mn, Zn and Cu were 2.53, 2.55, 2.61 and 2.81 in soils of Mahisagar district which very high fertility status.

Keywords: DTPA-extractable Fe, Mn, Zn, Cu and nutrient index

Introduction
The concept of soil quality has evolved since the last decade of the 20th century to answer the growing concern about sustainable soil management. Over exploitation and mismanagement of soil resources in quest for immediate gains without any regards to long term sustainability of its health have led to adverse alteration in soil properties, environment quality, agricultural productivity and sustainability.

The basic objective of the soil-testing programme is to give farmers a service leading to better and more economic use of fertilizers and better soil management practices for increasing agricultural production. High crop yields cannot be obtained without applying sufficient fertilizers to overcome existing deficiencies. Soil survey is the process of classifying soil types and other soil properties in given area and geo-encoding such information. The information in a soil survey can be used by farmers and ranchers to help determine whether a particular soil type is suited for crops or livestock and what type of soil management might be required.

Soil fertility is one of the important factors which determines the productivity and profitability of crops and cropping systems in agriculture. In simple terms soil fertility is the ability of the soil to provide all essential nutrients required for plant growth in a proper proportion. In order to achieve higher productivity and profitability, every farmer should realize that fertility levels must be measured as these measurements can be used to manage soil fertility. Soil surveying and mapping provide information regarding nutrient availability in soils which forms the basis for the fertilizer recommendations for maximizing crop yields. Soil fertility maps are meant for highlighting the nutrient needs, based on fertility status of soils (and adverse soil conditions which need improvement) to realize good crop yields. Obviously, a soil fertility map for a particular area can prove high benefit in guiding the farmers, manufacturers and planners in ascertaining the requirement of various fertilizers in a season/year and making projections for increased requirement based on cropping pattern and intensity.

Soil is a medium for plant growth and development and its productivity depends on several factors among which soil fertility is a major one showing direct relation with the crop yields, provided other factors are at optimum level. Soil testing is the key to fertility management while reclamation and rehabilitation of degraded lands is strategic to maintain over all soil health. Soil fertility evaluation involves the estimation of the nutrient supplying power of a soil. A proper evaluation of the fertility of a soil before planting a crop helps in adopting appropriate measures to make up for the shortcomings and ensuring a good crop production. The soil must supply micronutrients as a consequence of adoption of high yielding varieties (HYVs) and intensive cropping together with shifting towards high analysis NPK fertilizers has caused decline in the level of micronutrients in the soil to below normal at which productivity of crops cannot be sustained.

The improper nutrient status has led to emergence of multinutrient deficiencies in the Indian soils (Sharma, 2008)

Material and Methods

To assess the available Fe, Mn, Zn and Cu content in soils of Mahisagar district, total 180 representative surface soil samples were collected from farmer's fields. One representative surface soil sample was collected from field up to a depth of 0 to 15 cm by zig- zag method. 30 soil samples were collected from each 6 talukas of Mahisagar district during April- May 2018. The soil samples were air dried in shade. The soil samples, after air drying were ground with wooden mortar and pestle and passed through 2.0 mm sieve. The prepared soil samples were stored in polyethylene lined cloth bags with proper labels. The soil samples were brought to laboratory for further analysis. DTPA-extractable Fe, Mn, Zn and Cu were determined from soil samples by using Atomic Absorption Spectrophotometer method as suggested by Lindsay and Norvell, 1978 [6].

$$\text{Nutrient Index} = \frac{(Nl \times 1) + (Nm \times 2) + (Nh \times 3)}{Nt}$$

Where, Nl, Nm and Nh are the number of samples falling in low, medium and high categories for nutrient status and are given weightage of 1, 2 and 3, respectively. Nt is the total no. of sample. The nutrient index values are rated into various categories *viz*., very low, low, marginal, adequate, high, and very high as rating given by Stalin *et al*, 2010 [18].

Table 1: Taluka wise range and mean values for available micronutrient cations in soils of Mahisagar district

Name of taluka	Fe(mg/kg)	Mn(mg/kg)	Zn(mg/kg)	Cu(mg/kg)
Balasinor	1.89-30.8(10.10)	4.20-32.4(13.20)	0.65-4.09(1.92)	0.24-6.79(2.01)
Lunawada	2.80-39.2(19.78)	6.17-31.3(12.23)	0.25-5.91(2.05)	0.05-3.86(1.61)
Kadana	7.72-34.6(19.56)	5.15-18.4(10.84)	0.37-4.16(1.60)	0.10-4.59(1.17)
Khanpur	3.94-34.06(17.31)	4.18-19.18(10.96)	0.24-3.16(1.60)	0.34-3.74(1.37)
Virpur	3.71-32.0(12.08)	4.99-30.40(11.15)	0.22-5.73(1.52)	0.05-3.62(1.07)
Santrampur	3.56-30.82(11.9)	3.96-32.18(11.10)	0.23-5.38(1.15)	0.15-5.98(1.98)
District	1.89-39.22(15.14)	3.96-32.46(11.59)	0.22-5.91(1.64)	0.05-6.79(1.53)

DTPA-extractable Fe

The overall Fe status of the soils of Mahisagar district was high. It was ranged from 1.89 to 39.22 mg kg^{-1} with mean value of 15.44 mg kg^{-1}. Soils of Lunawada taluka recorded the highest mean value of DTPA extractable Fe (19.78 mg kg^{-1}) followed by that of Kadana (19.56 mg kg^{-1}) and Khanpur (17.31 mg kg^{-1}) talukas, whereas, the lowest mean value (10.1 mg kg^{-1}) of DTPA extractable Fe was found in the soils of Balasinor talukas. About 9.44, 27.7 and 62.77 per cent samples rated as low, medium and high in available Fe status, respectively. The medium Fe content in these soils may be due to presence of minerals like magnetite. Patel *et al*., (2017) [6] reported similar results for soils of Aravalli district.

DTPA Extractable Mn

The soils of Mahisagar district were ranged from 3.96 to 32.46 mg kg^{-1} with mean value of 11.59 mg kg^{-1} in case of DTPA extractable Mn. The soils of Balasinor taluka have highest mean value (13.20 mg kg^{-1}) followed by Lunawada (12.23 mg kg^{-1}) and Virpur (11.15 mg kg^{-1}) talukas. The lowest mean value (10.84 mg kg^{-1}) was observed in Kadana taluka. About 4.44, 36.1 and 59.5 per cent samples rated as low, medium and high in available Mn status, respectively. Similar results were reported for soils of Aravalli district (Patel *et al*., 2017) [6].

DTPA Extractable Zn

The available Zn status of the soils of Mahisagar district was high. It was ranged from 0.22 to 5.91 mg kg^{-1} with a mean value of 1.64 mg kg^{-1}. Lunawada taluka soils have highest mean value (2.05 mg kg^{-1}) of available Zn followed by Balasinor (1.92 mg kg^{-1}) Kadana and Khanpur (1.60 mg kg^{-1}) talukas. Soils of Santrampur taluka have the lowest mean value (1.15 mg kg^{-1}) for available Zn status. About 7.23, 23.8 and 68.8 per cent soil samples were categorized as low, medium and high in available Zn status, respectively. Similar results were obtained for soils of Gir Somnath district of Gujarat (Hadiyal *et al*., 2016) [14].

DTPA Extractable Cu

In general, the available Cu status of the soils of Mahisagar district was high. The available Cu ranged from 0.05 to 6.79 mg kg^{-1} with mean value of 1.72 mg kg^{-1}. The highest mean value of available Cu was observed in Balasinor (2.01 mg kg^{-1}) followed by soils of Santrampur (1.98 mg kg^{-1}) and Lunawada (1.61 mg kg^{-1}) talukas. The lowest mean value was registered in Virpur taluka (1.07 mg kg^{-1}). Almost all taluka have mean value greater than 1.0 mg kg^{-1} (Table 2), hence, it sufficient in majority soils samples. About 3.34, 10.55 86.11 per cent samples were found in low, medium and high categories of available Cu. Results reported in present investigation find supports from the work reported elsewhere for for villages of northern Madhya Pradesh by Rajput *et al.* (2015) [11], Hadiyal *et al.* (2016) [14] for Girgadhda and Una talukas of Gir Somanth district, Karajanagi *et al.* (2016) for Malaprabha command area of Karnataka, for Patan district by Patel *et al.* (2016) [15], Wagh *et al.* (2016) [16] for Nagpur district of Maharashtra.

Table 2: Taluka wise nutrient index values and fertility status of available micronutrientcations in soils of Mahisagar district

Name of taluka	Nutrient index values				Fertility status			
	Fe	Mn	Zn	Cu	Fe	Mn	Zn	Cu
Balasinor	2.16	2.53	2.86	2.96	Medium	High	High	High
Lunawada	2.66	2.66	2.53	2.8	High	High	High	High
Kadana	2.96	2.63	2.6	2.7	High	High	High	High
Khanpur	2.7	2.6	2.76	2.9	High	High	High	High
Virpur	2.3	2.5	2.53	2.66	High	High	High	High
Santrampur	2.4	2.36	2.4	2.86	High	High	High	High
District	2.53	2.55	2.61	2.81	High	High	High	High

Conclusion

The soil survey data of Mahisagar district clearly indicates that the status of DTPA-extractable Fe, Mn, Zn and Cu was high. Based on overall nutrient index value in soils of Mahisagar district, available Fe, Mn, Zn and Cu were classified in high fertility status.

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