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STATUS OF Fe, Mn, Zn & Cu MICRONUTRIENTS IN AGRICULTURAL SOIL OF SOME SELECTED AREAS OF AMRAVATI DISTRICT, MAHARASHTRA, INDIA.

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Abstract:

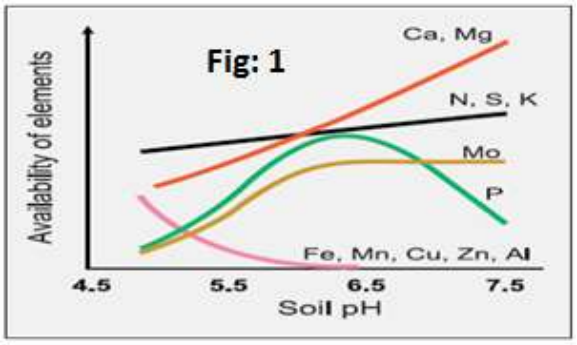
To assess the micronutrient status of agricultural soils of Amravati district a study was conducted. A total of 30 soil samples from farmer's field were collected and analyzed for DTPA-extractable micronutrient status. Content of micronutrient was in order of Mn> Cu> Fe> Zn. The DTPA- Mn, Fe, Cu and Zn in soils varied from 3.27 to 17.31, 0.25 to 0.83, 0.80 to 1.68 and 0.00 to 0.58 ppm. Among the micronutrients the deficiency of Fe and Zn are of major concern and soils require application of Zn and Fe fertilizers to maximize the crop yield. Deficiency is however likely to develop with continuous cropping and poor fertilizer management.

Key words: Agriculture Soil, Micronutrients, Atomic absorption spectrophotometer.

I) INTRODUCTION

Soil testing thus is an essential part of the Environment Impact Assessment (EIA) Studies. The interpretation of soil test values obtained on soil analysis is an important part of the fertilizer recommendations to agricultural crops. The soil test based fertilizer recommendations have been found more appropriate to achieve sustainable crop production as well as to improve soil health. There are 17 elements considered essential for plant growth. Three of them—C, H and O are supplied by the air and water. Of the remaining 14 elements, N, P, K, Ca, Mg and S are considered macronutrients. Fe, Mn, Zn, Cu, B, Mo, Cl and Ni are recognized as micronutrients. Investigation of micronutrients in soils mostly carried out to explain crop failures and to determine the effect on plant growth of elements, other than those already recognized as essential. Micronutrients are sometimes called minor or trace elements which required in fewer amounts.

Without the adequate supply of micronutrients, it is impossible to get maximum benefit from the applied NPK fertilizers. For this investigation Amravati area has selected. Amravati district is situated between 20°32' and 21°46' north latitudes and 76°37' and 78°27' east longitudes. The district occupies an area of 12,235 km². The district is bounded by Betul District of Madhya Pradesh state to the north, and by the Maharashtra districts of Nagpur to the northeast, Wardha to the east, Yavatmal to the south, Washim to the southwest, and Akola and Buldhana districts to the west. The district is divided into 14 Talukas and six sub-divisions. Iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn) are essential micronutrients for plant growth. Through their involvement in various enzymes and other physiologically active molecules, these micronutrients are important for gene expression, biosynthesis of proteins, nucleic acids, growth substances, chlorophyll and secondary metabolites, metabolism of carbohydrates and lipids, stress tolerance, etc.[1-2] The deficiency of essential micronutrient induces abnormal pigmentation, size and shape of plant tissues, reduces leaf photosynthetic rates and leads to various detrimental condition. Specific deficiency symptoms appear on plant parts but discoloration of leaves is most commonly observed. **Figure 1** is Relationship between soil pH and nutrient availability. In acidic soils, some nutrients may be insufficiently available for optimal plant growth and aluminium may become toxic. The above chart modified from several sources (National Plant Food Institute, Illinois Agronomy Handbook) shows the relationship of soil pH to nutrient availability. The optimum range for most vegetable plants is in the range of 6.3 to 6.8[4,7-10,13].The availability of micronutrient also reduces by other nutrient concentration in the soil (**Table 1).**



II) MATERIALS AND METHODS

This study was designed to determine the status of micronutrients in agriculturally fertile soils of Jamthi, Ramgaon and Devra Villages of Talukas and District Amravati, Maharashtra state. 30 sites were selected for the study during pre-monsoon seasons of 2013. Represented soil samples were collected with wooden tools to avoid any contamination of the soils. Four to six pits were dug for each sample. From each pit sample was collected at a depth 0-30cm. A composite sample of about 1kg was taken through mixing of represented soil sample. All composite samples were dried, ground with wooden mottle and passed through 2mm sieve. After sieving all the samples were packed in the polythene bags for laboratory investigations. Soil quality has been analyst to determine Cu, Fe, Mn & Zn micronutrient for the agricultural suitability following Indian Standard Procedures has been used in District soil water testing laboratory, Amravati, Maharashtra.

Determinations of Fe, Mn Cu & Zn:

The available fractions of iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) were extracted by DPTA-TEA buffer (0.005 M DTPA+ 0.01 M CaC12 + 0.1 M TEA) according to Lindsay and Norvell (1978) and the metals in the extract were determined using an PerkinElmer Analyst 800 atomic absorption Spectrophotometer[3,5,6,11,12,14] given in (Table 1).

II) RESULTS AND DISCUSSION

The minimum and maximum micronutrients values of analyzed soil are given in the Table 2. On the basis of micronutrients range rating (table-3) [5] the micronutrients status of soil of selected areas are given below.

a) In Jamthi Village Soil:

Minimum Cu, Fe, Mn, & Zn concentration in soil are found to 0.85, 0.25, 3.64 & 0.00 ppm and maximum are found to be 1.59, 0.64, 15.39 & 0.58. Critical limits **(Rating)** for these soil nutrients are Cu- medium to high, Fe-low, Mn-low to high & Zn-low (Table 2 chart 01 to 04).

b) In Ramgaon Village Soil:

Minimum to maximum range of Cu, Fe, Mn, & Zn concentration in soil are found 0.80 to 1.24, 0.50 to 0.76, 6.05 to 11.56 & 0.15 to 0.32 ppm. Critical limits **(Rating)** for these soil nutrients are Cu- medium to high, Fe-Medium to high, Mn-Medium to high & Zn-low (Table 2 chart 05 to 08).

c) In Devra Village Soil:

Minimum Cu, Fe, Mn, & Zn concentration in soil are found to 1.11, 0.39, 3.27 & 0.00 ppm and maximum are found to be 1.68, 0.83, 17.31 & 0.55. Critical limits **(Rating)** for these soil nutrients are Cu-high, Fe-low, Mn-low to high & Zn-low (Table 2 chart 09 to 12).

IV) CONCLUSION

Maximum and minimum values were observed in available micronutrient among different soils sample collected from 30 different locations of three villages of Amravati taluka & district. In Jamthi villages S1 to S10 site have deficiency of Fe & Zn and S2 to S6 site have deficiency of Mn. Those In Ramgaon villages S1 to S10 site have deficiency of Zn only. While In Devra villages S1 to S10 site have deficiency of Fe & Zn and S7 has deficiency of Mn. Deficient nutrients soil site are required micronutrient for soil health and maximum yield. Deficiency is however likely to develop with continuous cropping and poor fertilizer management.

V) ACKNOWLEDGEMENT

Authors are thankful to Head of Department,Mr. kharchan District soil, water testing laboratory Amravati for permission to carry this investigation, laboratory facilities and useful suggestions.

Table 1. Availability of micronutrients as affected by other micronutrients (antagonism) and macronutrients in soilless mixes.	
Elements	**Availability reduced by:**
B	Organic nitrogenous fertilizers and high levels of phosphorus.
Mn	High levels of potassium, phosphorus, iron, copper, and zinc.
Cu	High levels of zinc, nitrogen, and phosphorus.
Fe	High levels of copper, manganese, zinc, and phosphorus.
Mo	High levels of manganese and nitrate-nitrogen fertilizer.
Zn	High levels of copper and phosphorus.

Table 2: DTPA Extractable Micronutrient Status of Soil.

Village	JAMTHI				RAMGAON				DEVRA			
Soil Sample	Cu ppm	Fe ppm	Mn ppm	Zn ppm	Cu ppm	Fe ppm	Mn ppm	Zn ppm	Cu ppm	Fe ppm	Mn ppm	Zn ppm
S1	1.59	0.45	15.39	0.58	1.08	0.5	9.07	0.18	1.31	0.77	10.89	0.42
S2	1.17	0.52	4.55	0.47	0.8	0.69	6.44	0.16	1.21	0.72	13.61	0.42
S3	1.33	0.45	4.65	0.47	1.1	0.71	6.05	0.32	1.35	0.76	15.05	0.33
S4	0.97	0.64	4.62	0.23	1.1	0.65	6.22	0.27	1.35	0.83	6.3	0
S5	0.85	0.57	4.33	0.16	1.06	0.63	11.56	0.27	1.19	0.49	5.45	0.55
S6	0.96	0.52	3.64	0.2	0.98	0.68	8.12	0.32	1.23	0.39	12.07	0.51
S7	1.43	0.4	8.86	0	0.87	0.76	6.93	0.15	1.11	0.45	3.27	0.53
S8	1.42	0.32	13.81	0	1.07	0.73	10.36	0.21	1.58	0.67	11.26	0
S9	1.34	0.25	7.07	0	1.13	0.7	9.37	0.23	1.68	0.49	17.31	0
S10	0.98	0.32	5.28	0.4	1.24	0.65	6.7	0.27	1.56	0.42	6.09	0
Min	0.85	0.25	3.64	0	0.8	0.5	6.05	0.15	1.11	0.39	3.27	0
Max	1.59	0.64	15.39	0.58	1.24	0.76	11.56	0.32	1.68	0.83	17.31	0.55

Table 3. Critical limits **(Rating)** for Interpreting levels of soil nutrients.			
Parameter	**Low**	**Medium**	**High**
Cu	<0.2	0.2 - 1.0	>1.0
Fe	<4.5	4.5 - 10.0	>10.0
Mn	<5	5 – 10	>10
Zn	<0.8	0.8 - 2.0	>2.0

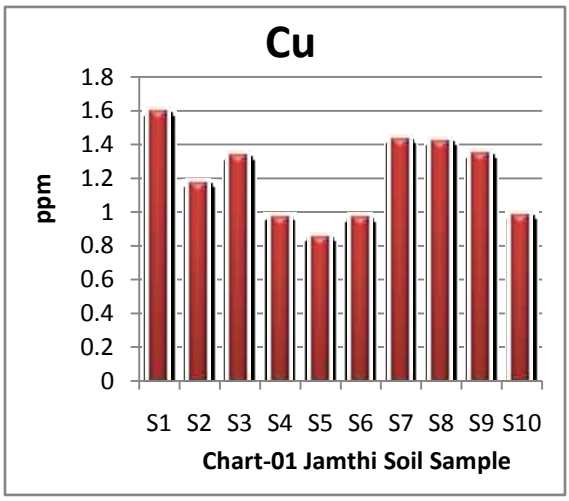


Chart-01 Jamthi Soil Sample

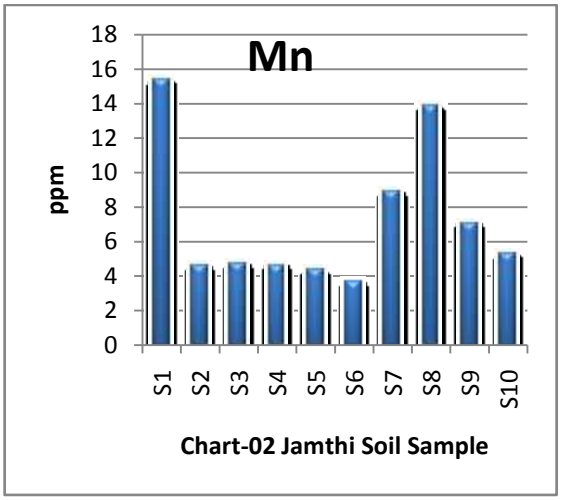


Chart-02 Jamthi Soil Sample

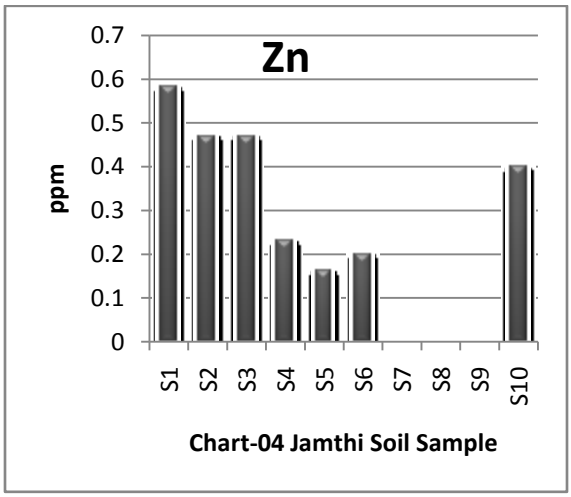


Chart-04 Jamthi Soil Sample

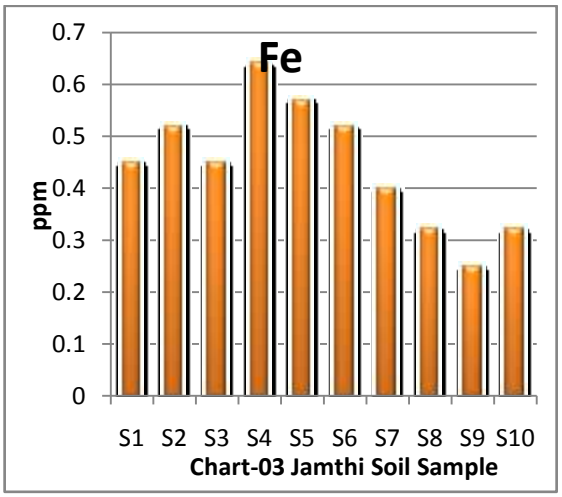


Chart-03 Jamthi Soil Sample

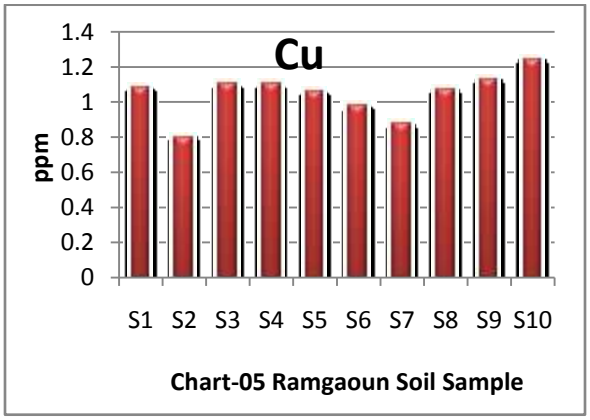


Chart-05 Ramgaoun Soil Sample

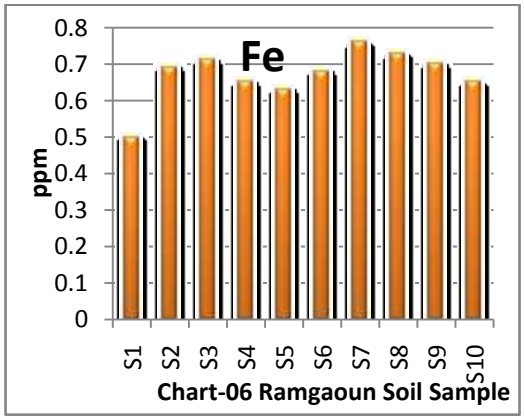


Chart-06 Ramgaoun Soil Sample

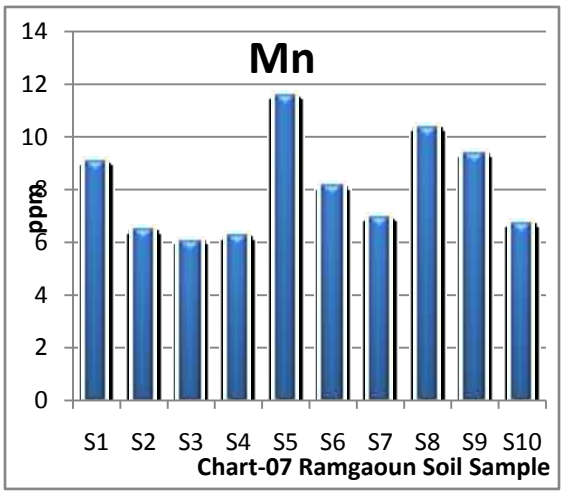


Chart-07 Ramgaoun Soil Sample

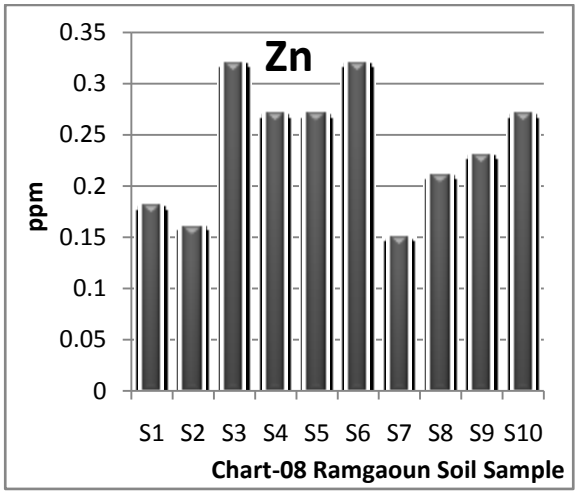


Chart-08 Ramgaoun Soil Sample

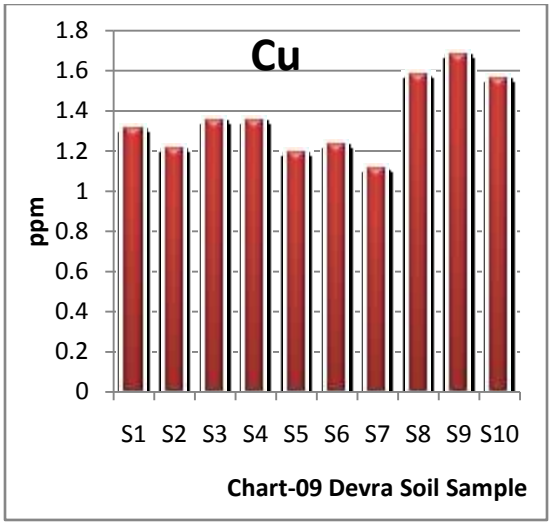


Chart-09 Devra Soil Sample

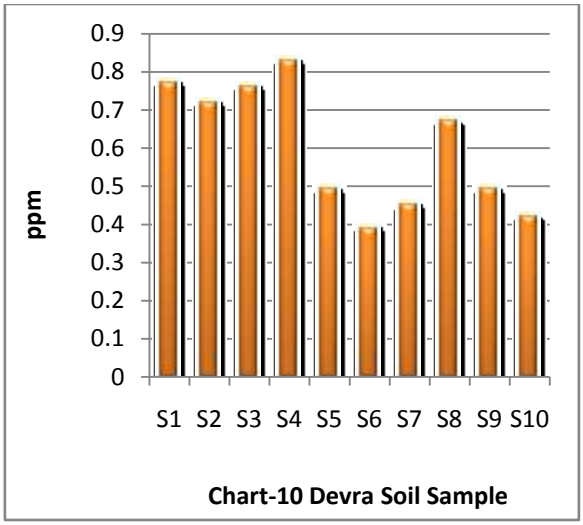


Chart-10 Devra Soil Sample

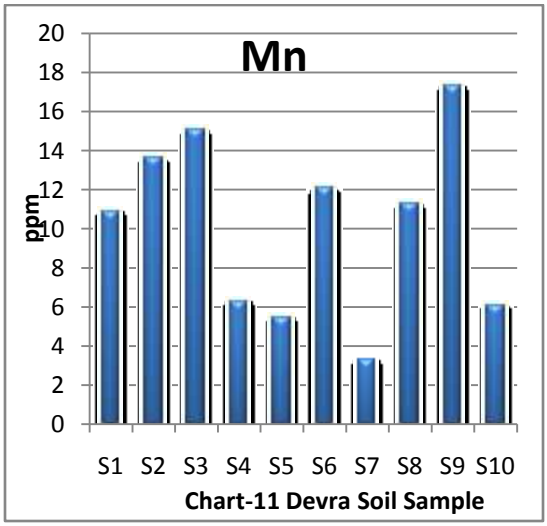


Chart-11 Devra Soil Sample

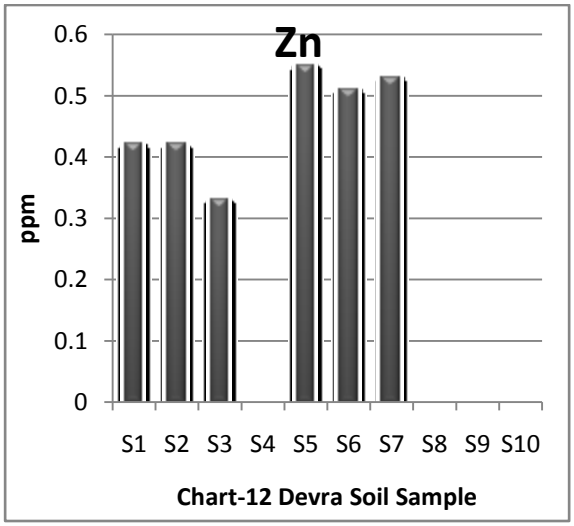


Chart-12 Devra Soil Sample

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