



Distribution of DTPA extractable Micro Nutrients in Rice growing soils of Karimnagar district of Andhra Pradesh

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Received: July 20th 2013, Accepted: August 8th 2013, Published: January 1st 2014

Abstract:

A crop nutrient survey was conducted in 54 mandals covering 150 rice fields in Karimnagar district of Andhra Pradesh were studied for distribution of DTPA extractable Zn, Cu, Fe and Mn and their relationship with some soil properties. Soils of the selected rice fields are non-saline and the pH of the soil was ranged from 7.29 to 8.33 among selected villages of 54 mandals, and was neutral to slightly alkaline in reaction. Organic carbon content of the soils ranged between 1.1 to 7.6 with a mean of 3.6%, and was in categorized as low to medium. The content of micronutrient increased with the increase in organic carbon and decreased with increase in pH and CaCO₃. As per critical limit prescribed for Zn, Fe and Mn; 50, 26 and 2% of the soil could be rated as deficient in available zinc. Iron and manganese respectively, copper was found to be adequate.

Key words: Critical limits, DTPA extractable micronutrients, rice soils.

Introduction:

The knowledge of distribution of micronutrient cations in soils provides an idea of the inherent capacity of soils to supply the nutrients. Past studies reveal the content and distribution of the nutrient cations in different soils and their relationship with soil properties [1-5]. However, information in this regard for the soils of Karimnagar of Andhra Pradesh is scanty and therefore, an attempt has been made to assess the micronutrient status in selected rice soils and their relationship with some important soil properties. Therefore, the present investigation was carried out with the main objective of distribution of micronutrient status in rice growing areas of Karimnagar district of Andhra Pradesh.

Materials and Methods:

The Karimnagar district is inherited by igneous and metamorphic rocks under Northern Telangana zone and fall under semi-arid (moist) tropics with an annual rainfall of around 960 mm. with ustic soils

moisture regime and isohyperthermic soil temperature regime. Representative surface soil samples were collected from 0-15 cm depth in all 150 selected rice fields, further the samples were analyzed for pH, EC, OC and particle size distribution i.e sand, silt and clay content following standard procedures. The available micronutrients cations viz, Zn, Cu, Fe and Mn in soils were extracted with AB-DTPA solution (Diethlyne Triamine Penta Acetic acid) [6]. The concentrations of each element in extractant were measured by using Atomic Absorption Spectrophotometer (AAS) (Varian 240 FS) and expressed as mg kg⁻¹. Correlations were calculated between DTPA-extractable micronutrients and soil properties [7].

Results and Discussion:

In general, the soils were neutral to slightly alkaline pH ranged from 6.56 to 8.33 and lowest pH was recorded in Mallapur mandal (7.2) and highest pH was recorded in Mahadevpur mandal (8.09) of surface soils. The EC (dSm⁻¹) of soil ranged between 0.02 to 1.38 with an overall mean value of 0.39 and the soils were non-saline. Highest EC was recorded in Husnabad mandal (0.16) and least was in Darmaram mandal (0.92). Soils are calcareous and calcium carbonate content varied from 0.14 to 19.9%. The soils are sandy clay loam to clay in texture with clay content ranged from 22.6 to 46.2%. The organic carbon content ranged between 0.11 to 0.76% with an overall mean value of 0.36% in rice growing soils of Karimnagar district. Highest mean organic carbon was recorded in Gollapally mandal (0.61%) and lowest was recorded in Ramadugu mandal (0.15%). Mean values of Available micronutrients in soils of different mandals of Karimnagar district were presented in table 1. Available micronutrients in soils had negative correlation with pH and soluble salts content and positive correlation with organic carbon content (Table 2). Similar results were also reported

by [8, 9]. Nearly 77% of soils were with low organic carbon status (Table 1).

Table 1: Soil -chemical properties and micro-nutrient concentration in the selected rice fields of mandal mean values of Karimnagar district in Andhra Pradesh

Name of the Mandals	Soil -chemical properties			Micro-nutrient concentration			
	pH	EC (dsm ⁻¹)	OC (%)	Zn	Cu	Fe	Mn
	mg kg ⁻¹						
(1) Yellareddy pet mandal	7.47	0.61	0.47	0.55	1.69	4.81	8.49
(2) Musthabad mandal	7.41	0.31	0.45	1.14	1.86	6.34	10.29
(3) Gambhirao pet mandal	7.32	0.56	0.51	0.79	1.58	7.40	6.39
(4) Sirsilla mandal	7.53	0.46	0.50	0.40	1.54	8.37	24.43
(5) Vermulawada mandal	7.72	0.43	0.28	1.12	1.53	3.91	7.68
(6) Koratla mandal	7.43	0.82	0.28	0.43	0.58	3.74	5.61
(7) Metpally mandal	7.76	0.78	0.18	0.38	0.31	2.56	11.01
(8) Kathalapur mandal	7.64	0.40	0.57	0.69	3.03	6.04	7.64
(9) Manakondur mandal	7.25	0.31	0.48	0.59	1.85	7.84	8.26
(10) Chandurthi mandal	7.76	0.32	0.28	0.77	2.07	4.37	4.92
(11) Mallapur mandal	7.27	0.29	0.36	0.72	1.67	8.59	20.89
(12) Veenavanka mandal	7.63	0.35	0.33	0.61	1.89	10.65	9.69
(13) Jamikunta mandal	7.54	0.44	0.22	0.45	1.52	5.58	9.15
(14) Hujrabad mandal	7.58	0.74	0.29	0.70	1.72	3.41	6.21
(15) Bejanki mandal	7.48	0.39	0.30	1.10	1.90	5.15	15.45
(16) Ellanthakunta mandal	7.82	0.27	0.27	0.80	3.86	1.92	21.75
(17) Koheda mandal	7.47	0.43	0.38	1.03	2.04	3.46	18.03
(18) Chigunumamidi mandal	7.51	0.34	0.43	0.70	2.80	3.65	0.94
(19) Husnabad mandal	7.57	0.16	0.41	0.90	2.30	6.41	23.27
(20) Beemdevarapally mandal	7.91	0.22	0.32	0.92	2.60	3.97	11.31
(21) Yelakathurthi mandal	7.88	0.80	0.22	1.22	2.86	8.16	18.42
(22) Khesavapatnam mandal	7.59	0.16	0.48	0.43	3.37	6.24	12.79
(23) Saidhapur mandal	7.61	0.33	0.20	0.39	2.13	8.35	9.36
(24) Kamalapur mandal	7.50	0.40	0.38	0.43	1.37	3.68	19.35
(25) Sulthanabad mandal	7.88	0.21	0.46	0.33	3.69	7.15	23.88
(26) Peddapally mandal	7.77	0.68	0.26	1.33	3.79	9.35	22.54
(27) Ramagundam mandal	7.87	0.24	0.31	0.99	2.16	2.62	18.06
(28) Kamanpur mandal	7.61	0.32	0.46	1.01	3.53	12.11	13.22
(29) Mutharam (oded) mandal	7.42	0.18	0.44	1.20	1.32	10.29	10.47
(30) Manthani mandal	7.75	0.23	0.20	0.06	2.54	8.68	20.30
(31) Thadicherla mandal	7.38	0.27	0.56	0.38	1.73	9.27	9.28
(32) Kataram mandal	7.93	0.78	0.39	1.49	2.65	7.56	31.38
(33) Mahadevpur mandal	8.09	0.41	0.20	0.58	1.53	4.43	18.91
(34) Bonipally mandal	7.86	0.23	0.23	0.72	2.40	7.92	21.04
(35) Gangadhara mandal	7.62	0.21	0.29	0.65	1.86	8.89	9.74
(36) Rama dugu mandal	7.74	0.22	0.15	0.84	1.56	12.22	9.00
(37) Pegadapally mandal	7.67	0.35	0.36	0.88	1.96	7.14	9.67
(38) Malyal mandal	8.01	0.24	0.43	1.21	2.20	13.41	15.60
(39) Jagtial mandal	7.87	0.30	0.43	0.66	2.53	12.31	7.90
(40) Medipally mandal	7.44	0.16	0.31	1.00	3.64	8.75	12.60
(41) Raikal mandal	7.58	0.24	0.45	0.67	3.82	4.81	13.81
(42) Sarangapur mandal	7.55	0.48	0.26	1.17	1.82	10.90	15.31
(43) Dharmapuri mandal	7.64	0.38	0.41	1.19	5.30	11.46	29.82
(44) Velgatur mandal	7.73	0.28	0.19	0.67	1.95	10.76	8.34
(45) Gollapally mandal	7.81	0.17	0.61	1.26	2.67	9.37	5.91
(46) Dharmaram mandal	7.55	0.92	0.38	0.96	1.79	4.67	8.55

(47) Julapally mandal	7.51	0.55	0.30	1.21	3.67	1.69	18.06
(48) Choppadandi mandal	7.28	0.32	0.45	0.56	1.59	2.98	19.39
(49) Thimmapur mandal	7.66	0.20	0.22	0.69	1.58	6.65	8.32
(50) Ibrahimpatnam mandal	7.70	0.54	0.30	0.99	2.00	21.91	7.65
(51) Konaracopet mandal	7.40	0.44	0.35	0.45	1.86	29.31	16.54
(52) Mutharam mandal	7.55	0.39	0.28	0.97	1.87	32.89	6.61
(53) Odhela mandal	7.47	0.19	0.55	0.37	3.76	11.78	11.10
(54) Srirampur mandal	7.51	0.35	0.39	0.35	1.83	29.73	7.66
Overall mean	7.59	0.39	0.36	0.76	2.23	9.18	13.25

Table 2: Correlation coefficients (r) between soil -chemical characteristics and soil available Micronutrients.

Soil character	Soil available micronutrients				Yield
	Zn	Cu	Fe	Mn	
pH	-0.018*	-0.006*	-0.045*	-0.103*	-0.079*
EC	-0.087*	-0.025*	-0.071*	-0.104*	-0.015*
OC	0.115*	0.115*	0.021*	0.130*	0.060*

* Significant @ CD >0.5 or 5% level

The DTPA- Zn content in soils under study in Karimnagar district, ranged from 0.16 to 1.83 mg kg⁻¹ with an overall mean value of 0.76 mg kg⁻¹. As critical limit of 0.6 mg kg⁻¹ [10] out of 150 soil samples 75 samples (50%) were deficient in Zn. Zinc deficiency was reported to an extent of 58% in the soils of Karimnagar district of Andhra Pradesh. Zn content was recorded lowest (0.33 mg kg⁻¹) in the soils of Sulthanabad mandal and highest (1.49 mg kg⁻¹) in Kataram mandal out of 54 mandals, soils of 24 mandals were deficient in available zinc (Table 1). Available Zn content significantly and negatively correlated (0.833*) with CaCO₃, Soil sand and silt also had negative correlation but OC and clay had positive influence on DTPA-Zn [11] (Table 2). The DTPA -Cu content in soils ranged from 0.28 to 6.27 mg kg⁻¹ with an overall mean value of 2.23 mg kg⁻¹. Considering 2.0 mg kg⁻¹ as critical limit for copper is normal for plant growth [12, 13].

The lowest available copper was recorded (0.31 mg kg⁻¹) in Metpally mandal and highest was (5.30 mg kg⁻¹) in Dharmapuri mandal. The rice growing soils of all the mandals were found to have available copper above the critical level of 0.3 mg kg⁻¹ soil (Table 1). Soil pH and CaCO₃ content had significant negative correlation (r = -0.41* and -0.48)

respectively with Copper, but OC (r = 0.115*) and clay (r = 0.36*) had significant and positive correlation with copper (Table 2). These finding are in agreement with (2 and 13). DTPA-Fe content in these soils ranged from 1.05 to 60 mg kg⁻¹ with a mean of 9.18 mg kg⁻¹. Considering the critical limit of 4.5 mg kg⁻¹ for iron . 26% samples out of total 150 soil samples collected in the district were found to be deficient. The available iron recoded was higher (32.89 mg kg⁻¹) in Mutharam mandal and lowest (1.69 mg kg⁻¹) in Julapally mandal (Table1). DTPA-Mn of rice growing soils of the district ranged from 0.5 to 44.04 mg kg⁻¹ with a mean of 13.25 mg kg⁻¹. Out of the total 150 soil samples 2% samples were deficient in available Mn by considering critical limit 3.0 mg kg⁻¹ suggested by (14). The lowest available manganese was recorded (0.87 mg kg⁻¹) in Mutharam mandal and highest was (31.38 mg kg⁻¹) in Kataram mandal (Table 1). Available Mn content was significantly and positively correlated with organic carbon (0.41*) (Table 2) and clay (0.33*). In general, calcium carbonate decreased the availabilities of micronutrients owing to their insoluble hydroxides at higher pH [15]. Contrary to it, organic carbon had positive influence on DTPA-micronutrients due to complexation.

Conclusion:

The content of organic carbon increases the increased the available micronutrients and available micronutrients decreased with increase in pH and CaCO_3 . As per critical limit prescribed for Zn, 50% of the soil could be rated as deficient in available zinc. Iron, copper and manganese were found to be adequate. The copper content of the soils was above the critical level.

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