Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 10, Issue, 07, pp.70983-70985, July, 2018

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

DTPA-EXTRACTABLE ZINC AND ITS AVAILABILITY IN VALLEY SOILS OF MANIPUR

*Nivedita Oinam and Kumarjit, R.K.

Department of Soil Science and Agricultural Chemistry, Central Agricultural University, Imphal, Manipur, India

ARTICLE INFO

Article History:
Received 18th April, 2018
Received in revised form
17th May, 2018
Accepted 04th June, 2018
Published online 30th July, 2018

Key words:
DTPA-Zn,
Critical limit,
Rice, pH, Organic carbon, Soil.

**Corresponding author:*

ABSTRACT

Information regarding distribution of zinc in soils is important for understanding its chemical reactions and bioavailability in wetland as well as upland rice soils for application of fertilizers and increasing yield of reice plants. Thus, a study on relationship between physico-chemical properties and DTPA-extractable Zn content of rice soils were done, for that thirty six surface soil samples (0-20cm) were collected from different paddy fields of four valley districts of Manipur namely Imphal-east, Imphal-west, Thoubal and Bishnupur district using Stratified Random Sampling. . All the soil samples were acidic in reaction with pH ranging from 4.90 to 6.00 with mean value of 5.32. The Electrical Conductivity of the soils varied from 0.05 dSm¬¬¬-1 to 0.26 dSm -1 at 250C with a mean value of 0.11 dSm¬¬¬-1. The analyzed soils showed organic carbon content 0.79 to 3.51 % with a mean value of 2.68% and cation exchange capacity of the soils 8.3 to 24.4 [cmol (p+) kg-1] with mean value was 17.34 [cmol (p+) kg-1]. The studied soils were mostly clay in texture with 20.0 per cent to 73 .2 per cent content. Considering 0.6 mg kg-1 as the general critical limit of available zinc (DTPA-Zn) in soils, 91.67% of the soils are sufficient in zinc (DTPA-Zn) ranging from 0.55 to 1.26 mg kg-1 with mean value of 0.89 mg kg-1 in the soils. DTPA-Zn showed significant negative relationship with soil pH (r= -0.483**) indicating the availability of Zn decreases with increase pH.

Citation: Nivedita Oinam and Kumarjit, R.K. 2018. "Dtpa-extractable zinc and its availability in valley soils of manipur", *International Journal of Current Research*, 10, (07), 70983-70985

INTRODUCTION

Zinc is one of the important nutrients limiting rice productivity worldwide. It is required by rice in small quantity, but its deficiency has an adverse effect on healthy crop growth and yield may reduce up to 30 percent (Hafeez *et al*., 2015). The studies of zinc dynamics and management in rice soils are of great importance to feed ever-rising world population (Lal, 2009). In India, zinc deficiency has been reported in all agro-ecological regions, irrespective of the nature of soil and cropping system. Its deficiency, in particular, has been noticed almost in all the rice growing regions. Zinc is involved in a number of physiological processes of plant growth and metabolism including enzyme activation, protein synthesis, metabolism of carbohydrates, lipids, auxins and nucleic acids, gene expression and regulation and reproductive development (pollen formation) (Marschner 1995; Cakmak, 2000). Knowledge on distribution of available zinc content in wetland rice soils and various soil properties influencing its availability might prove to be the best approach for obtaining reliable information about the status of zinc for application of fertilizers and increasing rice yield. Therefore, an attempt was to study the DTPA- extractable Zn (available Zn) content and also its relationship with physic-chemical properties of soils in four rice growing valley districts of Manipur.

MATERIAL AND METHODS

A total of 36 soil samples (0-20 cm depth) were collected from different paddy fields of four valley districts of Manipur namely Imphal-east, Imphal-west, Thoubal and Bishnupur district covering all the blocks under using Stratified Random Sampling. The soil samples were air dried, grinded and passed through the 2 mm sieve for laboratory analysis. The soil properties studied were: Soil reaction (pH) (Jackson, 1973), Electrical conductivity (EC) (Jackson, 1973), Organic carbon (Walkley and Black method, 1934), Soil texture-Hydrometer method (Buoyoucous (1962), Cation Exchange Capacity (CEC) (Borah *et al*., 1987). Available zinc content of soils was measured in atomic absorption spectrophotometer (AAS) after extracting the soils with 0.005M DTPA following the standard procedure of Lindsay and Norvell, 1978.

RESULTS AND DISCUSSION

The results of soil analysis under study are presented in Table 1 The soil pH values ranged from 4.9 to 6.0. All the soil samples were acidic in nature with the mean value of 5.32. The Electrical Conductivity of the soils varies from 0.05 dSm^{-1} to 0.26 dSm^{-1} at 25^0C with a mean value of 0.11 dSm^{-1}.

Table 1. Physico-chemical properties and available Zn content of the soils

Districts	Sl. No.	Villages	pH	EC (dS m^{-1})	OC (g kg^{-1})	CEC [cmol(P+)kg^{-1}]	Sand (%)	Silt (%)	Clay (%)	DTPA-Zn (mg kg^{-1})
IMPHAL-WEST	1	Kangchup	5.0	0.26	2.64	23.1	35.9	10.0	54.1	1.1
	2	Awang Leirankabi	5.1	0.14	3.26	11.8	38.4	13.2	48.4	1.14
	3	Lamsang	5.5	0.12	3.44	10.3	45.9	10.0	44.1	1.13
	4	Phayeng	5.1	0.19	2.38	22.0	35.9	8.2	55.9	1.03
	5	Tharoijam	5.2	0.08	4.32	10.6	44.1	14.3	41.6	0.74
	6	Ghari	5.3	0.10	4.14	10.7	30.7	25.2	44.1	0.75
	7	Langjing	5.4	0.09	4.05	19.3	35.9	11.6	52.5	1.01
	8	Takyel Mapal	5.2	0.12	4.14	24.0	35.9	5.0	59.1	0.85
	9	Hiyangthang	5.2	0.22	4.23	17.0	36.6	15.0	48.4	0.99
	10	Lairengjam	5.0	0.11	4.50	22.0	32.5	10.9	56.6	0.82
THOUBAL		Charangpat Mamang	5.3	0.08	3.79	10.2	53.4	11.4	35.2	0.99
	12	Uyal	5.3	0.05	4.41	8.3	45.0	35.0	20.0	0.55
	13	Thokchom	5.0	0.13	5.28	19.9	12.5	34.8	52.7	0.91
	14	Haoreibi	5.5	0.16	5.64	22.2	11.6	30.0	58.4	0.87
	15	Kakching Khullel	5.4	0.08	5.38	19.7	20.0	21.6	58.4	0.97
	16	Keirak	5.1	0.11	5.02	21.0	1401	21.8	64.1	0.86
	17	Wabgai	5.4	0.08	5.73	24.0	14.1	20.0	65.9	0.84
IMPHAL-EAST	18	Hilgat	5.2	0.11	0.79	10.3	27.3	43.6	29.1	0.59
	19	Sonapur	5.3	0.11	2.82	22.0	21.8	17.5	60.7	1.17
	20	Dibong	5.2	0.08	0.80	12.2	22.7	35.7	41.6	0.77
	21	Lalpani	4.9	0.15	2.11	10.5	28.0	42.0	30.0	1.16
	22	Tellou	6.0	0.06	3.00	24.3	14.3	20.0	65.7	0.58
	23	Tangkham	5.2	0.17	2.55	23.0	11.8	24.1	64.1	1.01
	24	Waiton	5.9	0.11	3.70	24.0	16.8	14.1	69.1	0.67
	25	Nungoi	5.8	0.16	3.70	24.4	16.8	10.0	73.2	0.61
	26	Pangei	5.4	0.12	3.17	24.3	11.8	22.5	65.7	0.84
	27	Top Dasura	5.8	0.06	3.35	10.2	6.8	54.1	39.1	0.76
	28	Waklha	5.4	0.07	4.41	11.0	19.3	41.6	39.1	0.87
	29	Gangapat	5.7	0.08	3.00	11.2	11.0	42.0	47.0	0.89
	30	Khongman	5.6	0.09	2.90	15.6	9.0	44.0	47.0	0.86
	31	Kalika	5.3	0.05	4.50	12.6	21.8	31.6	46.6	0.96
	32	Andro	5.2	0.18	2.56	11.6	24.3	34.1	41.6	1.26
BISNUPUR	33	Keinou	5.5	0.13	3.00	19.3	17.5	40.0	42.5	0.63
	34	Potsangbam	5.1	0.09	4.29	23.2	14.1	30.9	55.0	0.89
	35	Ngangkha Lawai	4.9	0.08	4.84	15.4	20.0	25.0	55.0	0.93
	36	Kumbi	5.0	0.08	4.26	23.2	23.2	35.0	45.0	1.01
MEAN			5.32	0.11	3.67	17.34	62.99	25.16	50.46	0.89
RANGE			4.9-6.0	0.05-0.26	0.79-5.73	8.3-24.4	6.8-53.4	5.0-54.1	20.0-73.2	0.55-1.26

Table 2. Relationship between available Zn and soil properties

	pH	EC	OC	CEC	Clay	DTPA-Zn
pH	1					
EC	-0.289	1				
OC	-0.027	-0.236	1			
CEC	-0.196	-0.122	0.117	1		
Clay	0.253	0.218	0.291	-0.065	1	
DTPA-Zn	-0.483**	0.415*	-0.044	0.104	-0.007	1

** Correlation significant at the 0.01 level

* Correlation significant at the 0.05 level

The organic carbon content in the soils sample was high with a mean value of 2.68%. Soil organic carbon (SOC) is an important attribute influencing the soil physical, chemical and biological properties. The organic carbon content in the soils ranged from 0.79 to 3.51 %. The wide variation of organic carbon content may be due to various altitude of the state, previous soil management, in situ incorporation of rice stubbles, etc. The cation exchange capacity of the soils was ranged from 8.3 to 24.4 [cmol (p^{+}) kg^{-1}] and the mean value was 17.34 [cmol (p^{+}) kg^{-1}]. The low cation exchange capacity in the studied soils may be due to the presence of low calcium and magnesium content in the soils. On the other hand, the soils were low in soil reaction (acidic) which indicates that the soils were low in exchangeable bases leading to low cation exchange capacity. Such occurrence of CEC in these soils could be due to the presence of various functional groups in the decomposed organic matter and also due to the finer fractions of the soils. The clay content of soil varied from 20.0 per cent to 73.2 per cent (mean 50.46%). The silt and sand contents of the soils ranged from 5.0 to 54.1 per cent (mean 25.16%) and 6.8 to 53.4 per cent (mean 62.99%), respectively. The studied soils were mostly clay in texture.

DTPA-extractable Zn content in soils: Considering 0.6 mg kg-1 as the general critical limit of available zinc (DTPA-Zn) in soils, all the soils under the four valley districts (Imphal-east, Imphal-west, Thoubal and Bishnupur) were found to be sufficient, except for three villages Uyal of Thoubal district, Hilgat and Tellou of Imphal-east district. The DTPA-Zn content ranged from 0.55 to 1.26 mg kg^{-1} with mean value of 0.89 mg kg^{-1} in the soils. Among the soils, the highest amount of DTPA-Zn was found in Andro village of Imphal-east district while the lowest content was reported in Uyal village of Thoubal district. The data indicates that 91.67% of the soils are sufficient in zinc (DTPA-Zn).

Relationship between DTPA-Zn content and other physic-chemical properties of soils: To have understanding about the status of available Zn and its relationship with soil properties is helpful in understanding the inherent capacity of soils to supply Zn in optimum amount for plant nutrition. From the correlation (Table 2), it was clear that DTPA-Zn maintained significant negative relationship with soil pH (r= -0.483**) indicating the availability of Zn decreases with increase pH. Similar results reported by Sidhu *et al*., 2009; Talukdar *et al*., 2010). DTPA-Zn showed positive significant relationship with electrical conductivity (r= 0.415*).

Due to perturbation, soils under a particular cropping system may affect physico-chemical properties which may modify the DTPA-extractable Zn content and its availability to crops (Padhan *et al*., 2016).

REFERENCE

Borah, D.K., Bordolo, P.K., Karmakar, P.M., Barauah, N.G. and Das, M. 1987. Practical manual for fundamental soil scence (Part-II), Jorhat I.

Bouyoucos, G.J. 1962. Hydrometer method improved for making analysis of soils. *Agron. J.* 54: 464-465.

Cakmak I. 2000a. Role of zinc in protecting plant cells from reactive oxygen species. New Phytol 146:185–205

Hafeez, B., Khanif, Y.M., Saleem, M., Mastoi, M.I., & Gandahi, A.W. 2015. Zinc status of soils of Malaysia in relation to some physic-chemical properties. *Pakistan Journal of Agriculture, Engineering and Veternary science, 31*(1): 33-41

Jackson, M.L. 1973. Soil Chemical Analysis, Prentice Hall of India Private Limited, New Delhi.

Lal, R. 2009 Laws of sustainable soil management. Agron. Sustain Dev 29:7–10

Lindsay, W.L. and Norvell, W.A. 1978. Development of DTPA soil test for Zn, Fe, Mn and Cu. *Am. J. Soil Sci.*, 42: 421-428.

Marschner H. 1995. Mineral nutrition of higher plants. Academic, San Diego, p 889

Padhan, D., Rout, P. P., & Sahoo, T., Surface and Sub-surface distribution of available potassium in rice growing soils under western central table land Agro-climatic zones of Odisha. *Journal of Agroecology and Natural Resource Management 2*(5): 365-368 (2015)

Sidhu, G. S., & Sharma, B. D., Diethylene triamine penta-acetic Acid-Extractable Micronutrients Status in Soil under a Rice-Wheat System and Their Relationship with Soil Properties in Different Agro-climatic Zones of Indo-Gangetic Plains of India. *Communications in Soil Science and Plant Analysis, 41*(1): 29 – 51 (2010)

Talukdar, M.C., Basumatary, A., & Dutta, S.K., Status of DTPA–extractable Cationic Micronutrients in Soils under Rice and Sugarcane Ecosystems of Golaghat Dictrict in Assam. *Journal of the Indian Society of Soil Science, 57(*3): 313-316 (2009)

Walkley, A.J. and Black, I.A. 1934. Estimation of soil organic carbon by chromic acid titration method. *Soil Sci*. 37: 29-38.

****