Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.5, No.3, 2015

Micro Nutrient Status of the Fresh Water Swamp at the Nifor Outstation, Otegbo

OSAYANDE P.E. [1*] OVIASOGIE, P.O. [1] ORHUE E.R[2]
1.Chemistry Division, Nigerian Institute for Oil Palm Research (NIFOR), P.M.B. 1030, Benin City, Edo State, Nigeria
2.Department of Soil Science, Faculty of Agriculture, University of Benin, P.M.B.1154, Benin City, Edo State, Nigeria
*Corresponding author's email: pvefosa2001@yahoo.co.uk

Abstract
Micronutrient status of the Fresh Water Swamp at the NIFOR Raphia *hookeri* outstation, Otegbo was studied. Samples were obtained from mini pits sunk at two plantations in the study area. The collected samples were air-dried at room temperature for seven days and analyzed for micronutrients (Zn, Cu, Fe, Cl Mn) and physico-chemical properties in the laboratory using standard methods. The results showed that Zn decreased significantly in plantation1 but decreased not significantly in plantation2. Cu and Cl decreased not significantly in plantation 1 and increased not significantly in plantation 2 while Fe and Mn increased significantly with increased depth in both plantations. Changes in the soil environment as influenced by soil pH and organic carbon greatly influenced the availability of these micronutrients as observed in the positive correlation of soil pH with Zn and Cu in plantation 1 with r = 0.064 and 0.063 respectively; Fe and Mn in plantation 1 with (r = 0.638, p<0.05) and (r = 0.692, p<0.05) respectively. Organic carbon and Zn in plantation 1 with (r= 0.706, p<0.05) and Cl with r = 0.291. Detailed studies are however needed to determine the rates, types and frequency of application of these micronutrients.
Keywords: Micronutrients, Raphia *hookeri*, Otegbo

1.0 INTRODUCTION

The micronutrient elements Iron, Manganese, Zinc, Copper, Boron, Chlorine and Molybdenum are used by higher plants in very small amounts. While quantities of about 0.5kg/ha are helpful, amounts as small as 4.5 kg/ha can sometimes be damaging to plants. The micronutrients are no less essential than those elements that are needed in large amounts (Jones, 1976). Soil fertility therefore is determined by the presence of both macro and micronutrients. Most of the micronutrients are associated with the enzymatic system of plants (Wajahat *et al*, 2006).Whenever a micronutrient is deficient, the abnormal growth of plant results which sometimes cause complete failure of crop plants. Grains and flower formation does not take place in severe deficiency (Wajahat *et al*, 2006). Though the main sources of micronutrients are parent material, sewage sludge, town refuse, farmyard manure (FYM) and organic matter, the availability of micronutrients is particularly sensitive to changes in soil environment. The factors that affect the contents of such micronutrients are organic matter, soil pH, lime content, sand, silt and clay contents as revealed from different research experiments (Perveen *et al*., 1993). Having studied micronutrient status of some agriculturally important soil series of the Northwest Frontier Province, Pakistan, and their relationship with various physico-chemical properties for thirty soil series, they observed that Zinc was deficient in four soil series, marginal in sixteen and adequate in the remaining soils. They also observed that most sandy soils are deficient in micronutrients. Their study indicated that there were positive correlations of clay contents with Iron, Copper, Zinc and Boron. Studies on the micronutrients status of soils supporting Raphia palms are few. The study was therefore undertaken to provide information on the micronutrient status of soils supporting Raphia palms, with particular reference to soils supporting Raphia *hookeri* in hydromorphic soils.

2.0 MATERIALS AND METHODS

2.1 Study area

The study was conducted at the NIFOR outstation, Otegbo located just outside Warri in Delta State. It lies on Latitude $5^0$25' and Longitude 5^0 34'The locations covered the humid and sub-humid with mean annual rainfall of 3000 to 4000mm. Temperature ranges from a minimum of 21^0C to 32^0C with a mean of 25^0C. There are two distinct seasons, the dry season (November to March) and rainy season (March to October) and a short dry break in August.

2.2 Field study

Twelve mini pits sunk in two *Raphia hookeri* plantations were used for the study. The mini pits measured 60cm X60cm X120cm and two samples were collected from each pit, making a total of twenty four samples.

2.3 Laboratory study

The samples were taken to the laboratory for studies on micronutrient status and physico-chemical properties of the soils. In the laboratory, the soil samples were air-dried at room temperature for seven (7) days and sieved with a 2mm sieve and analysis on micronutrient status and physico-chemical properties of the soils were done as follows: Micronutrients (Copper, Zinc, Manganese and Iron) were determined by extracting the soil in 1% EDTA, the filtrate was aspirated into an air-acetylene flame of an atomic absorption spectrophotometer and Cu was read at 324.7 nm; Zn was read at 213.9 nm; Mn was read at 279.5 nm; Fe was read at 248.3 nm while soluble chloride in soil was obtained by silver nitrate titration, Okalebo *et al*, (1993). Soil pH was determined in a 1:1 soil to water suspension using a pH meter (Maclean, 1982). Particle size was determined by the hydrometer method (Gee and Bander, 1986). Organic Carbon was determined by the dichromate wet oxidation method (Walkley and Black, 1965).

3.0 RESULTS

Zinc decreased significantly with increased depth in plantation 1 but decreased not significantly with increased depth in plantation 2. Copper decreased not significantly with increased depth in plantation 1 but increased not significantly with increased depth in plantation 2. Iron increased significantly with increased depth in both plantations. Chloride decreased not significantly with increased depth in plantation 1 but increased not significantly with increased depth in plantation 2. Manganese like Iron also increased significantly with increased depth in both plantations.

4.0 DISCUSSION

In plantation 1, the soil pH had a significant correlation with Fe and Mn with ($r = 0.638$, $p < 0.05$ and $r = 0.692$, $p<0.05$) respectively but had a negative correlation with Zn, Cu and Cl. This positive and significant correlation indicated that increase in pH equally led to increase in the Fe and Mn components of the soils of plantation 1.
Organic carbon had a positive and significant correlation with Zn with ($r = 0.731$, $p<0.01$) and a positive correlation with chloride indicating that organic carbon supplied much of the Zn components of the soils of plantation 1 and probably the Cl component as well. Zn also had a positive and significant correlation with sand ($r = 0.588$, $p< 0.05$) and a positive correlation with silt, indicating that increased sand weathering also led to an increase in the Zn component of plantation 1. Zn had a negative but significant correlation with ECEC ($r = -0.679$, $p<0.05$) indicating that the increase in Zn content due to increase in sand weathering did not increase the ECEC of soils of plantation 1. Interactions among micronutrients with major elements are known to occur and to influence plant growth (Jones, 1976). This interaction was further buttressed with the positive and significant correlation of Zinc with Nitrogen with ($r= 0.731$, $p<0.01$). The availability of Zinc has been found to reduce with increasing soil pH. This perhaps explains the negative but significant correlation of soil pH with Zinc in plantation 1 with ($r = -0.580$, $p<0.05$). The soil pH of plantation 1 increased significantly with increased depth. The less availability of Zinc due to increased soil pH in plantation 1 could also be due to the complexation of Zinc by polyphosphates $[(NH_4)_4(PO_4)_2]$ which are more abundant in hydromorphic soils as a result of the reduced conditions of the soils as explained by the positive and significant correlation of Zinc with Nitrogen and also its positive correlation with Phosphorus. In plantation 2, the soil pH had a positive correlation with Zinc. This indicated a direct relationship. This direct relationship was due to the fact that the soil pH reduced rather than increase with depth. This led to the availability of Zinc in soils of plantation 2 as revealed by the negative correlation of Zinc with Phosphorus in soils of plantation 2. Chlorine is considered as an essential micronutrient as its concentration is found to be higher in plants than that of either Phosphorus or Sulphur. This present study revealed that Chlorine showed important interactions with major and secondary elements, for example Nitrogen, Phosphorus and Calcium in plantation 1; Potassium and Calcium in plantation 2 as well as ECEC.

5.0 CONCLUSION

This study revealed that micronutrients undergo a lot of interactions with major and secondary nutrient elements. Soil pH has also been found to influence the availability of most of these micronutrients especially Zinc. Though positive and significant correlations were obtained between organic carbon, clay and sand and micronutrients, detailed studies are however needed to determine the rates, types and frequency of application of these micronutrients.

REFERENCES

Gee, G.W. and Bander, J.W. (1986). Particle Size Analysis. In Klute, A (ed). Method of Soil Analysis. Part 1, 2nd Edition. American Society of Agronomy, Inc. Madison.
Maclean, E.O (1982). Aluminium in C.A. Black (ed). Methods of Soil Analysis. Part 2, Agro Monograph 9, Second edition, ASA and SSA, Madison, Wisconsin. PP 539-579
Okalebo, J.R.; K.W. Gathua and P.L. Woomer (1993). Laboratory methods of soil and plant analysis: Aworking manual. UNESCO.
Perveen, S., M.T. Farmanullah, J.K. Khattak and A. Hamid(1993). Study of micronutrient status of some

important sites of N.W.F.P., Pakistan. *Sarhad Journal of Agriculture.* 9(5): 467-473

Walkley, J.T. and Black L.A. (1965). A method of determining soil organic matter and proposed modification of the chromic acid titration method. *Soil Sci.J.* 37: 29-38

Wajahat N., S. Perveen and I. Saleem (2006). Status of micronutrients in soils of of district Bhimber (Azad Jammu and Kashmir). *Journal of Agricultural and Biological Science* Asian Research Publishing Network (ARPN). Vol 1, No.2 1990-6145

TABLE 1: Concentration of Micro Nutrients (mg/kg) of Plantation 1 and 2

Depth(cm)	Zn	Cu	Fe	Cl	Mn
Plantation 1					
0-60	1.30	1.88	0.93	592.00	2.94
60-120	0.71	1.41	2.15	497.00	4.62
LSD	0.49*	0.98**	0.77*	348.40**	0.89*
Plantation 2					
0-60	1.85	3.42	0.38	544.00	2.40
60-120	1.72	3.98	1.40	568.00	4.30
LSD	0.68**	2.35**	0.58*	112.20**	0.89*

*Sig
**NS

Table 2: Physico-chemical properties of the sampled plantations

Depth(cm)/ Location	pH	Organic C.	Clay	Silt	Sand
			g/kg		
Plantation 1					
0-60	5.55	6.45	13.50	22.33	964.20
60-120	5.85	2.02	56.00	17.33	926.70
LSD	0.15*	4.73*	19.90*	4.20*	18.90*
Plantation 2					
0-60	5.61	5.22	10.00	25.80	964.20
60-120	5.47	2.40	37.30	22.70	940.00
LSD	0.48**	1.29*	18.49*	10.16**	20.30*

*Sig
**NS

TABLE 3: Correlation Coefficient (r) between Selected Physicochemical Properties and Micro Nutrients of Plantation 1

	Zn	Cu	Fe	Cl	Mn
pH	-0.580*	-0.575	0.638*	-0.004	0.692*
O.C.	0.706*	-0.126	-0.373	0.291	-0.589*
N	0.731**	-0.054	-0.440	0.281	-0.667*
P	0.566	0.532	-0.751**	0.036	-0.637*
K	-0.086	-0.392	0.295	-0.529	-0.042
Ca	-0.394	-0.527	0.454	0.030	0.712**
Mg	-0.028	-0.288	0.057	-0.078	0.024
S	-0.715**	-0.750	0.333	-0.460	0.557
ECEC	-0.679*	-0.465	0.801**	-0.171	0.816**
Sand	0.588*	0.642*	-0.794	0.417	-0.779*
Silt	0.139	0.222	-0.395	-0.418	-0.237
Clay	-0.579*	-0.649*	0.834**	-0.279	0.780**

**Correlation sig at 0.01 level,
*Correlation sig at 0.05 level.
O.C. = Organic carbon

TABLE 4: Correlation Coefficient (r) between Selected Physicochemical Properties and Micro Nutrients of Plantation 2.

	Zn	Cu	Fe	Cl	Mn
pH	0.064	0.063	-0.259	-0.182	-0.334
O.C.	-0.036	-0.276	-0.429	-0.349	-0.790**
N	0.004	-0.308	-0.419	-0.374	-0.828**
P	-0.027	-0.104	-0.709**	-0.144	-0.782*
K	-0.046	-0.136	-0.221	0.058	-0.275
Ca	0.120	-0.059	-0.238	0.431	-0.301
Mg	-0.069	0.017	0.180	-0.367	0.089
S	0.125	-0.163	0.434	-0.052	0.455
ECEC	0.167	-0.042	0.254	0.063	-0.051
Sand	0.060	-0.011	-0.752**	-0.177	-0.697*
Silt	0.094	-0.198	-0.393	0.480	-0.249
Clay	-0.084	0.072	0.836**	0.020	0.739**

**Correlation significant at 0.01 level
*Correlation significant at 0.05 level
O.C. = Organic carbon