MICRONUTRIENT STATUS IN SOME SOILS OF SELECTED SITES OF IDEATO AREA OF IMO STATE, NIGERIA.

CHIKERE-NJOKU .C.
DEPARTMENT OF SOIL SCIENCE AND ENVIRONMENT, IMO STATE UNIVERSITY, OWERRI, P.M.B 2000, NIGERIA
E-mail: Chikerenjoku@gmail.com

ABSTRACT
The status of soil micronutrients of selected sites of Ideato Area of Nigeria was investigated in 2015. A total of 8 composite soil samples were collected from 8 selected sites and analyzed using standard procedures. Particle size distribution revealed that soils were of a sandy loam textural class, Soil pH was very strongly acidic (mean 4.89), with low level of organic carbon (mean 1.12 g/kg). Generally, Cu was found to be in the medium category (mean 0.76 mg/kg). While Zn and Fe were above the critical limits (mean 5.48-13.08 mg/kg) for crop production and ranked as "high" using existing standards. This implies that cationic micronutrient were well supplied in the soils of the area and deficiencies of the elements are unlikely at the time of soil investigation. It is recommended that organic manure sources be incorporated to improve the overall fertility of the soil.
Keywords: Micronutrients, soil fertility, Tropical Soils**.**

INTRODUCTION
Micronutrients are minerals which are required in minute quantity for the proper growth and functioning of plants. Although these nutrients are required in small quantities, shortage of these elements in soils may result in poor crop yields (Deb and Sakal, 2002). A number of factors such as soil microenvironment, soil physico-chemical properties and cropping systems affect the availability of these nutrients in agricultural fields (Wei *et al*., 2006). Studies have shown that soil pH, phosphorus and organic matter contents influence the availability of micronutrients under various soil conditions (Shuman, 1988, Wei *et al*., 2006, Li *et al*., 2007).

In plants, there is specific functions micronutrient elements play. Copper is involved in chlorophyll formation and degradation of sugar and in the synthesis of protein in the chloroplast. Iron is capable of acting as electron carrier in enzyme systems that bring about oxidation-reduction reactions. Zinc functions as metal-activator of enzymes such as enolase, carbonic anhydrase and tryptophan synthase (Brady and Weil, 2002) zinc is also involved in auxin production responsible for longitudinal growth of plants and help in the reproductive phase of plants (Alloway, 2008). It also increases the utilization of the major nutrient elements N, P and K by plants and has profound effects on genetic expression (Alloway, 2008).

Micronutrient deficiencies of soils constitute a threat to the increasing rate of marginal lands on the global scale and to about 50% of the 93 million ha of land space of marginal lands in Nigeria (Fagbami, 1997). Micronutrient status of soils of Ideato Local Government Area has largely not been investigated. This is imperative given the geometric expansion in population with more mouths to feed which makes continuous cultivation of the land inevitable in this part of the country. The continuous use of inorganic fertilizers, especially the compound fertilizer (N.P.K) might have brought, about micronutrient deficiencies in the soils as reported in some soils of the region (Singh, 1997).

Consequently, the present study seeks to investigate the micronutrient status of soils of Ideato Local Government Area of Imo State Southeastern Nigeria. It is hoped that the resulting data will contribute to proper soil management and improved crop yield in the area.

MATERIALS AND METHODS
Study Area
The study was conducted in Ideato area of Imo State, Southeastern Nigeria. It comprises of eight sites; Umuagongbogo, Umuagondidia, Ozuone, Ozuoakoli, Isiokpe, Obodo Ukwu, Uzii and Osina. The area lies between latitudes $5^0 52^{'}$N and longitudes $7^0 22^{'}$E. The climate is essentially humid tropical, characterized by distinct wet and dry seasons with an average annual precipitation of 2164mm. The wet season begins in March/April and ends in October. The maximum rainfall occurs during the months of July and September. The dry season lasts from November to March the subsequent year. Temperatures are high with a maximum range of 33^0c – 33^0c and minimum 26^0c – 28^0c. The soils are mainly derived coastal plain sand (Orajaka, 1975).

Soil Sampling
A total of 8 composite soil samples were collected at (0-20cm) depth from 8 locations. The collected soil samples were properly labeled and stored on polythene bag for onward laboratory analysis.

Laboratory Analysis

Soil samples collected were air-dried and sieved with a 2mm sieve. Particle size analysis was determined using the Bouyoucous hydrometer method (Gee and Or, 2002).The soil pH was determined in both distilled water and 0.1N kCl Solution (Mclean, 1982). The soil organic carbon was measured by digestion method (Nelson and Sommers 1982). Total nitrogen was determined in accordance with Bremner and Mulvaney, (1982). Soil micro nutrients (copper, iron and zinc) concentrations were determined by spectrophotometric method. 5g of soil was leached with 100ml ammonium acetate (pH 4.8). Micronutrient contents of the leachate was determined using a spectrophotometer.

Data Analysis

Soil data were subjected to descriptive statistics such as mean, standard deviation and coefficient of variance.

RESULTS AND DISCUSSION

Table 1 shows the results of the physical properties of the soil samples. The particle size distribution of the soils indicate that soils have relatively high proportion of sand with a mean value of 80.39 g/kg, mean silt of 8.59 g/kg and mean clay of 11.38 g/kg giving the soils a generally sandy loam texture in all the locations. This is expected and further ascertained by Christ-Emenyonu and Onweremadu (2011) who reported that most tropical soils are sandy in nature which is associated with the nature of the parent materials (coastal plain sand) and is typical of the soils of the southeastern Nigeria.

The chemical properties of the soils at the study sites (table 2) showed that the soil pH was very strongly acidic with mean value of 4.89 at both sites may be attributed to severe weathering and leaching resulting with loss of exchangeable basis. The results (table 2) also shows that organic carbon (O.C) contents ranged from 0.71 g/kg in Umuezukwe to 2.52 g/kg in Umuome with a mean value 1.12 g/kg. These values fell within the "low" category (Esu, 1991) of fertility classes. This suggests that the soils are prone to leaching of nutrient. This opinion is in agreement with the observations of Yadav and Malason, (2007) for tropical soils generally. The low organic carbon content of the soils is characteristics of the humid tropical soils due to rapid decomposition and mineralization of organic matter and to poor management such as burning of crop residues by farmers. Yadav and Malason, (2007).

The content of available Zn in the locations ranged from 2.98 mg/kg in Ubahaeze to 8.21 mg/kg in Umuezukwe respectively with a mean value of 5.48 mg/kg (Table 2). Based on the scale of critical limits by Esu (1991), all the soils fell in the category of "high". This shows that plant will have a good zinc "store". This result agrees with the reports of Fagbami (1997), of extractable zinc values of 0.23-6.25 mg/kg. Anonymous (2000) observed a range of 4.13 – 11.88 mg/kg, with a mean of 5.1 mg/kg. The above values are above critical range.

Copper (Cu) contents of the studied soils were rated "medium" in all the locations and ranged from 0.41 mg/kg, Umuagongbogo, to 1.06 mg/kg at Umuezike with a mean value of 0.76 mg/kg in the studied locations. Based on Esu (1991), nutrients fertility ratings, the values fell within the "medium" categories. Copper content was highest in Umuezike with a value of 1.00 mg/kg while the least was in Umuagongbogo of 0.41 mg/kg. The higher copper content in Umuezike may be attributed to anthropogenic sources and higher organic matter content which has been reported to increase copper content in soils by Brady and Weil, (2002). The copper content values confirm the findings of Sillanapaa (1982) that most soils in the tropical region of Nigeria have normal copper range. Thus, it could be predicted that deficiency of Cu would not occur in these soils in the nearest future. Lombin (1983) had earlier reported that the contents of available Cu in soils of Nigeria are adequate and poses no fertility problem.

The results (Table 2) revealed that the soils are rich in available Fe, varying from 8.80 mg/kg in Umuagongbogo to 18.75 mg/kg in Ozuakoli with a mean of 13.08. The values fall within the 'High' category of Esu (1991) scale of micronutrients fertility rating. The high Fe contents in soil (above the critical limits of 2.5 mg/kg crop production) means that Fe deficiency is not likely for crops grown on these soils. This is so when viewed against the backdrop of report of Mengel and Geurtzen (1986) that Fe deficiency is very unlikely in acid soils as it is known to be soluble under relatively acid and reducing conditions (Chestworth, 1991). Hundal *et al*., (2006) however emphasized that higher iron content were obtained in the soils of the coastal plains with high variation ranging from 1.52 to 1.78 mg/kg. Similarly, Havlin *et al*., (2003) revealed that concentration of iron in the lithosphere vary widely from 0.7 – 55% mostly in primary minerals, clays, oxides and hydroxides. Therefore, the soils were sufficiently supplied with iron with very little chances of deficiency.

Table 1: Physical Properties of the Soils of the Selected Sites

Location	Sand (g/kg)	Silt (g/kg)	Clay (g/kg)	Textural class
Umuagongbogo	81.19	8.00	10.80	SL
Umuagondidia	78.00	11.13	10.57	LS
Ozuome	83.20	9.80	7.00	SL
Ozuoakoli	80.53	9.53	9.93	SL
Isiokpo	83.53	6.13	10.33	LS
Obodo Ukwu	78.51	7.90	13.47	SL
Uzii	79.07	8.03	16.23	SL
Osina	79.06	8.20	12.73	SL
Mean	80.39	8.59	11.38	

Table 2: Chemical Properties of the Selected Sites

Location	pH	O.C (g/kg)	Zn (mg/kg)	Cu (mg/kg)	Fe (mg/kg)
Umuagongbogo	4.97	1.15	5.18	0.41	8.80
Umuagondida	4.97	0.73	6.69	0.55	15.33
Umuome	5.10	2.52	4.06	0.74	14.12
Ozuakoli	4.73	0.83	6.33	0.71	18.75
Isiokpo	4.77	0.71	8.21	0.99	10.72
Obodo Ukwu	4.83	0.74	2.98	0.96	15.33
Uzii	4.83	1.06	5.41	0.69	9.95
Osina	4.97	1.18	5.01	1.06	11.81
Mean	4.89	1.12	5.48	0.76	13.08

OC = Organic carbon, Zn = Zinc, Cu = Copper, Fe= iron

CONCLUSION AND RECOMMENDATIONS

The results revealed that the soils were sandy to loamy in texture, highly acidic and low in organic carbon. Copper was found to be in the medium category. The soils contained Zn and Fe above the critical limits for crop production and categorized as "high". It further shows that cationic micronutrients were well supplied in the soils of the area and that deficiencies of the elements were unlikely in the foreseeable future. Based on the observations, it is suggested that the incorporation of organic matter be encouraged to further improve the overall fertility of the soil.

REFERENCES

Alloway, B.J (2008). Zinc in Soils and Crop Nutrition International Fertilizer Industry Association and International Zinc Association, Brussels, Belgium and Paris, 135 pp.

Anonymous (2000). Availability of Macro and Micronutrients in Agriculturally Important Soils of Northeastern Nigeria, University of Maiduguri Committee on Research.

Brady, N.C, Weil, R.R (2002). The Nature and Properties of Soil 13th edition. Macmillan Publisher Co. N.Y USA. 565 pp.

Bremner, J.M and Mulvaney, F.S (1982). Nitrogen Total in D.L, Sperks (Ed.) pp. 1085- 1122. Methods of Soil Analysis, part 3 SSSA Book Series 5, Madison USA.

Chestworth, N. (1991). Geochemistry of nutrients in J.J. Mortredt. L.M. Shuman and R.M Welch (eds) Micronutrients in Agriculture 2nd Edition. Soil Sci. Soc. Am,. Inc. Madison; Wisconsin. USA 27-478.

Christ-Emenyonu,C.M. and Onweremadu E.U (2011). Indicators of Erodibilty of Soils under different Land Use Types in Imo State,

Nigeria. Journal of Agriculture, Food and Environment, 7 (4): 38-45.

Deb, D.L. and Sakal, R. (2002). Micronutrients in Fundamentals of Soil Science. Indian Society of Soil Science, Indian Res Institute New Delhi, pp. 391-403.

Esu, I.E (1991). Detailed Soil Survey of NIHORT Farm at Bunkure, Kano State, Nigeria. Institute of Agricultural Research Zaria, 72 pp.

Fagbami, A.A (1997). Extent of Marginal Lands in Nigeria Proceedings of the 23rd annual Conference of Soil Science of Nigeria held at Congregation hall, city Campus Usman Danfodio University, Sokoto, Nigeria.

Gee, G.W and Or. (2002). Particle Size Analysis in Method of Soil Analysis part 2, Ed; Page A.I; Miller R.H. and Keeney D.R. America Society of Agronomy, Madison, WL, Pp. 383-308.

Havlin, J.L; Beaton, J.D. Tisdale, S.M and Nelson, W.L (2003). Soil Fertility and Fertilizers: An Introduction to Nutrient Management (6th Ed). Pearson Prentice Hall. Upper Saddle River, New Jersey, 502 pp.

Handal, H.S, Kumar, R; Singh, D and Manchanda, J.S. (2006). Available Nutrient and Heavy Status of Soils of Punjab, North-West India. Journal of the Indian Society of Soil Science 54 (1): 50-56.

Li, B.Y, Zhou, D.M, Cang, L, Zhang, H.L Fan X. H. and Qin, S.W. (2007). Soil Micronutrient availability to Crop as affected by long-term inorganic and organic fertilizer applications. Soil & Tillage Research 96; 166-173.

Lombin, G (1983). Evaluating the Micronutrient Fertility of Nigeria Sem-arid Savanna Soils Zinc Soils,No. 736, 42-47.

Mclean, E.O. (1965). Soil pH and Liming Requirement in; A.L Pagel(Ed) Methods of Soil Analysis part 2, 2nd (Ed.). Agron mono.ASA and SSSA, Madison, Wisconsin, USA, 679-820.

Mengel, K and Geustren, G. (1986). Iron Chlorosis and the cause of chlorosis. Journal of plant Nutrition 9:161-173.

Nelson, D.W. and Sommers, L.E (1982). Total Carbon, Organic carbon and organic matter, INC D.L Sparks (Edition). Methods of soil analysis, part 3, Chemical Method, SSSA Series 5, Madison, Wisconsin, USA, pp. 961-1010.

Orajaka, S.O (1975). Geology on: maps: Eastern States (G.E.K of Ofomata, Ed), Ethiope Publishers; Benin City Nigeria, 5-7 pp

Shuman, L.M (1988). Effects of Organic Matter on the Distribution of Manganese, Copper, Iron and Zinc in Soil Fractions. Soil Science 146: 192-198.

Sillanpaa, M. (1982). Micronutrients and the nutrient status of soils. A Global study FAO Soils Bulletin No. 48 FAO Rome Italy.

Singh, L. (1997). Soil Fertility Management: The key to high productivity. Abubakar Tafawa Balewa University, Inaugural Lecture series No. 6.

Weix, Hao M; Shao, M and Gale, W.J (2006). Changes in soil Properties and the Availability of Soil Micronutrients after 18 years of Cropping and Fertilization. Soil & Tillage Research 91; 120-130.

Yadav, V and Malanson, G. (2007). Spatilly Explicit Historical Land Use Land Cover and Soil Organic Carbon Transformations in southern Illinois. Agriculture, Ecosystems and Environment, 123 (4); 280-292.