Soil PH An Indices For Effective Management Of Soils For Crop Production.

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Abstract: - The PH properties of the soils of the Peter Natter School of Agriculture Ugwuomu, Enugu state were investigated. Soil samples were collected from surface and subsurface horizons 0-20cm and 20-40cm respectively in seven different locations. The two different horizon depths are tagged x and y and soil samples of the same depth in the seven different locations were bulked together as composite samples for soil PH. The PH levels of the soils were analyzed and the characteristics of the soils described. The soils of the study area were predominantly acidic and PH range was 4.9-6.0. The soils of the two horizons depth were also acidic in nature both in H2O and KCl and the charge particles range from 1-3 positive. Generally the results of the soils were below the level adaptable to most of the arable and field crop production as well as nutrient uptake and availability and Microbial activities.

Keywords: - PH, Soil, Crop, Agriculture, Ugwuomu

INTRODUCTION.

Soil is the mainstay of Agriculture and bedrock of food production. As cultivation of crops, animal grazing and some other connected activities of man are done on the soil. Soil fertility for crop production was successfully managed by shifting cultivation, whereby the soil fertility was naturally regenerated by bush fallow system. However, due to increase in population and urbanization, as well as erosive conditions, the arable lands (Agricultural land) become limited thereby reducing the fallow period or are impoverished by erosion. This resulted to inadequate plant nutrition with consequent progressive depression in yield and level of food Production. Cultivation can alter soil physical, chemical and biological properties whereby plant growth, development and yield could be influenced (Grant and Lafond, 1993). There is inappropriate Agricultural management that results in deterioration of soil quality (Mulline *et al,* 1990). While Elliot (1986) and Kay (1990), opined that cultivation can cause a disruption of soil aggregates and loss of soil organic carbon. The causes are attributed to over cultivation and over use of land for grazing that result in nutrient depletion and soil erosion. However the fertility status varies from soil to soil and region to region. Therefore the ability of a soil to produce high crop yield is referred to as soil fertility. Though a soil could be fertile but may not promote or increase crop yield due to some factors like soil PH and this calls for proper management and care to treat the soil in order to reduce to the beeriest minimum the soil PH problems in order to boost up crop yields and increase the level of food production. The relevance of soil PH in crop production cannot be over emphasized as it influences crop productivity and bacteria activities in the soil. Every crop has its own soil PH level that will foster good growth and yield. Any change in such soil PH level will adversely affect the life cycle of the crop. More so, the bacteria's that assist on organic matter degradation flourish best in slightly to moderate acidic soils and if the soil is strongly acidic, the bacteria may not act upon the organic matter in the soil and very little humus will be formed. Hence low plant nutrient mineralization. Furthermore soil PH is an important factor to be considered in using chemical fertilizers, as some of these fertilizers may increase the acidity level of the soil, which will in variable affect crop growth and yield. The PH scale ranges from 0-14 and PH range of soils may be divided into:

3.5-5.0 strongly acidic
5.0-6.5 moderately acidic
7.0 Neutral
8.5-10.0 strongly alkaline (Forth, 1978)

Acidity of soil means that the hydrogen ion (H^+) and Aluminum ion (Al^{3+}) concentration of the soil is high while Alkalinity implies that their concentrations are low. Again the Solubility of mineral nutrients is greatly affected by soil PH, phosphorous is never readily soluble in the soil but is most available in soil with a PH range that centered around 6.5 (Tisdale *et al;* 1993). Extremely and strongly acidic soils (PH4.0-5.0) can have high concentration of soluble aluminum (Al^{3+}) ion and manganese, which may be toxic to the growth of some plants, A PH range of approximately 6-7 promotes the most readily available plant nutrients, while a PH above 7 (alkaline) reduces the ability of plants to absorb elements such as iron, manganese, boron and other trace elements (Miller and Donahue, 1992; Tisdale et al; 1993, Greenland, 1981, White, 1979). This also causes loss of soil structure and dispersion of humus. Again there is relationship between soil PH and plant diseases because many diseases are caused or exacerbated by extreme PH this makes essential nutrient unavailable to the crops, because the soil itself is unhealthy. For example, Chlorosis of leafy vegetables and potato scab occur in alkaline condition and acidic soils can cause cub root (Miller and Donahue 1992, Tisdale et al; 1993). In Peter Natter School of agriculture at Ugwuomu, there is no detailed information on the PH level of the soils including its elemental concentration. Therefore, this work was conceptualized to study soil pH for effective management of soils of Peter Natter school of Agriculture to provide data on the soil pH properties of the surface and subsurface soil horizons that influence crop productivity. As correct soil pH can mean a bountiful harvest of fruits, roots/ tubers, vegetable and flowers, while wrong soil pH can lead to crop failures and soil barrenness. This will help to improve the quality of information from yield trials, crop production activities and researches on the soils. Soil pH characterization is essential for the determination of the potential and

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constraints of the natural resources. Thus the objective of this study was to characterize the soil pH level of Peter Natter School of Agriculture for documenting its potentials for optimum use.

Materials and methods

The experimental study was conducted at the Peter Natter School of Agriculture, Institute of Ecumenical Education Thinker's Corner Enugu. The area with an annual rainfall of 1200mm-1750mm is situated in South eastern Nigeria (06^0 48' N and 07^0 14'E). The rainfall pattern is bimodal between April and October, while dry season is between November and March. The soil is an Ultisol (FDAL, 1985) and is classified as Ustoxic Dystropept.

Soil Sampling

Soil samples where collected from surface and subsurface horizon, 0-20cm and 20cm-40cm respectively in seven (7) different locations. The two different horizon depth are tagged X and Y respectively. Soil samples of the same depth in the seven different locations were bulked together as composite samples and tagged A-G respectively. The collection of soil samples from each of the location unit was done using Auger. These soil samples collected from the seven different locations and two different depths was air-dried and sieved through 2mm mesh sieve and used for soil PH determination. The soil PH was measured with a glass electrode measured in extract of soil solution (1:2.5) in water and in KCl.

Result and discussion

The soils are predominantly acidic in reaction (table1). The acidic nature of these soils could be attributed to rather high rainfalls which apparently lead to leaching of basic cautions such as Ca^{++}, Mg^{++}, K^+ and Na^+ at the expense of H^+ and Al^{3+} leading to high soil acidity . Since this soil are acidic, it implies that the activities of many micro-organisms are inhibited, Nitrifying organisms and growth of some crops becomes inhibited when soil PH is less than 5.5, but fungi activities is optimal because fungi function from 4.0 to 5.0 (Miller and Donahue 1992, Tisdale, 1993). The result of these soils also indicated that earthworm cannot grow and proliferate, this invariable will hamper the production of macro-pores resulting from earthworm burrowing which will greatly enhance water infiltration and air circulation (Lee, 1985, Tomlin *et al*, 1995). And as it were, neither earthworm nor its cast was identified in the studied soils. Edward *et al,* (1990) observed that some species of earthworm facilitate the breakdown and mineralization of surface litter while others incorporate soil organic matter deeper into the soil profile and enhance aeration and water infiltration through burrow formation.

Soil PH levels of different portions of Peter Natter School of Agriculture Farm Ugwuomu.

Soil depth	Soil PH of different portion sites designates.													
	A		B		C		D		E		F		G	
	H_20	KCl	H_20	KCl	H_20	KCl	H_20	KCl	H_20	KCl	H_20	KCl	H_20	KCl
X 0-20cm	5.5	5.0	5.5	5.5	5.3	5.5	5.3	5.0	5.3	5.0	6.0	5.0	5.7	5.3
Y 20-40cm	5.4	4.9	5.4	5.0	5.5	5.0	5.5	5.0	5.5	5.0	5.6	5.0	5.6	5.3

Manganese is soluble at pH value lower than 5.5 and since pH of the soils tested ranged from 4.7 to 6.0 that means manganese will be readily soluble and this will greatly affect the productivity of crops in these soils, as it might become toxic to plant roots. Copper, Cobalt and Zinc will be available because the soil is not highly acidified and this high level of trace element can be toxic to the growth of plants in the tested soils. Nitrogen fixation activities will be low, even Azotobacter, which is a nitrogen fixing bacteria, that has been proved to survive in soils having PH value above 6 because from the study none of the locations has its pH exceeding 6.0 which means that the activities of Azotobacter will be reduced as well as Rhizobium activities. This affects the provision of nitrogen/nitrates nutrition for good crop growth and root development as well as plant/organism association in soil. Furthermore at PH value below 5.5, both primary and secondary nutrients become less available and this effect is most marked in the case of phosphorous. At PH below 6.0, there is less nitrate production. In acidic soils phosphorus and calcium deficiency occur, which implies that these nutrients will be below there critical levels in the tested soils. Also potassium availability is lessened since potassium is available more on alkaline soils. Majority of crops such as maize, pepper, pumpkin, okra etc cannot do well in these soils following their PH levels. By testing the PH of the soils with dilute KCL (potassium chloride), it was found that the charge particles range from 1-3 (positive) which indicated that the soil cannot release available nutrient very well to the plants growing on it.

Conclusion

A good knowledge of PH level of a soil in respect of Peter Natter School of Agriculture Ugwuomu under increasing cultivation intensity is important for its effective management for crop production. Soil PH analyzed in relation to this work is one of the indices for measuring soil productivity in relation to crop production. From the soil pH analyses results, the PH portions of the land ranges from 4.9 – 6.0 and most of our tropical crops cannot grow well under this range of PH. The implication of this result is that appropriate management should be adopted to realize the optimum production capacity of the soil.

Reference

[1]. Edward, W.M., Shipttalo, M.J, Owens, L.B and Norton, L.D (1990). Effect of Lumbricus terresteris L. burrows on hydrology of continuous no till corn fields. Georderma 46:73-84.

[2]. Elliot, E.I. (1985). Aggregate structure and carbon, nitrogen and phosphorus in native and cultivated soils. Soil Sci. Am. J. 50:627-633.

[3]. FDALR, (1985). Reconnaissance soil survey of Anambra state, Nigeria. Soil report FDALR Kaduna, 1985.

[4]. Forth, D. Henry, (1978) Fundamental of soil science 6th edition John Wiley and Sons, New York, 2005-208 pp.

[5]. Grant, C.A. and Lafond, G.P, (1993). The effect of tillage and crop sequence on bulk density and penetration resistance on a clay soil in Southern Saskatchewan. Can. J. soil Sci. 73:223-232.

[6]. Green Land, D.J., (1981). Characterization of soils, Oxford University Press, New York pp5.

[7]. Kay, D.D., (1990). Rates of change of soil structure under different copping systems. Adv. Soil Sci: 12:1-52.

[8]. Lee, K.E, (1985). Earthworms their ecology and relationships with soils and land use. Academic press, Sydney, 411 pp.13.

[9]. Miller, W.R. and Donachue, R.L., (1992). Soils: An introduction to soils and plant growth. Prentice Hall India, New Delhi-11001. 226-420pp.

[10]. Mullins, C.E. Mclead, D.A., North cote, K.H., Tisdale, J.M. and Young, I.M. (1990). Hard setting soils behavior, occurrence and management. Adv. Soil Sci. 11:37-108.

[11]. Tisdale, S.L., Nelson, W.L., Beaton, J.D., and Halin, J.L. (1993). Soil fertility and fertilizers. 5th edition Prentice Hall inc. Upper Saddle River, New Jersey 07458, USA. Pp45-561.

[12]. Tomlin, A.D, Slupitalo, M.D., Edwards, W.M and Protsz, R. (1995). Earthworms and their influence on soil structure and infiltration. In P.F. Hendrix (ed) Ecology and biogeography of Earthworms in North America. Lewski publishers Boca Raton FI.

[13]. White, R.E., (1979). Introduction to the principles and practices of soil science. Blackwell Scientific publications Oxford London. Pp417.