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Assessment of Macro and Micronutrients in Soils from Panvel Area, Maharashtra, India

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Abstract:

Soil is a medium through which crops grow to perform the need of human for food and cloths. Agriculture refers to an art of hoist plants from the soils and is one of the most economical factors for human beings. In achieving better crop yield the farmers should be made aware about the status of soil constituents, chemistry of water available, nutrient supply to the crop, climatic conditions etc. Panvel is rice bowl of *Kokan region of Maharashtra* which is a staple food of majority of the people. Most of the rice producers are small farmers who lack resources and because of this the productivity of rice in this area is declining. This study has focused on the investigation of macro- and micronutrients in soils from Panvel area of Maharashtra. The soil samples collected from Poyange village near Panvel (Raigad district) in November 2006 - 2007. Ten representative locations were selected for the study and the analytical results were expected to be representative of the entire field. The different physical parameters and macro elements were analyzed in laboratory are pH, EC, C_{org}, P and K. The micro elements such as Cu, Zn, Fe, Mn were estimated by Atomic Absorption Spectroscopy while calcium and magnesium, carbonate, bicarbonate, chloride were estimated volumetrically. The observed values of microelements found to be the order of the Zn < Cu <Mn< Fe. Soil samples of the study area are found in rich in copper, manganese and iron while zinc is within range of normal soil. In this study soils show low pH values (< 7) indicating their acidic nature which can be counteracted by adding basic fertilizers. The low value of EC could be due to leaching of soluble salts due to high rain fall in this area. The study indicates that in all the soil samples natural manure and organic fertilizers are the best alternatives to augment C_{org} and micro-organism which will help increasing the rice productivity.

Keywords: Macronutrients, Micronutrients, Panvel, Physico-chemical analysis, Rice field soils.

1.0 Introduction:

Agriculture refers to an art of raising plants from the soils and is one of the most economical factors for human beings. Agriculture is largely influenced by controlling factors like climate, soil topography while soil erosion is a serious problem for agricultural productivity. In achieving better crop yield the farmers should be made aware about-

1) Status of soil the constituents
2) Chemistry of water available
3) Nutrient supply to the crop
4) Climatic conditions.

With this kind of awareness one will maintain proper yield and economy of the production and for this reason the present study has been undertaken which could be helpful in assessing the present status of the soils in the study area. It will also help in suggesting the farmers about the proper supply of nutrients for healthy growth of crops and to increase productivity to maintain their economy. Soil is a natural body which develops as a result of pedogenic processes which takes place during and after weathering of parent rocks in which plants and other forms of life are able to grow. Currently, there is widespread interest in developing sustainable agricultural systems that are less dependent on external inputs, especially chemical fertilizers and herbicides, to reduce impacts on the environment and to conserve and improve soils (Moonen and

Barberi, 2008). Reuse of Industrial and domestic and bioenergy by-products is one of the new ways of recovering and re-using nutrient resources in agriculture (Atefeh, 2013), however, these by-products can potentially harm the soil and related environments. Chemical fertilizersmay gradually increase the acidity of the soils. Healthy soils indicate the integrity ofterrestrial ecosystems which remain intact and having ability to recover from disturbances such as drought, climatechange, pest infestation, pollution and human exploitation, including agriculture (Ellert et *al*, 1997). In general soil chemical fertility and in particular lack of nutrient inputs is a major factor in soil degradation (Hartemink, 2010) and hence tropical soils often have negative soil nutrient balances (Smaling, 1995) because of inherent low fertility status, inappropriate land use, poor management, erosion and salinization (Bationo et al, 2006). To boost and sustain rice yield Tabi et al (2012) suggested soil management practices defined for identified units instead of a common management for all units.

Panvel is rice bowl of *Kokan region of Maharashtra* which is a staple food of majority of people. This is a sole crop predominantly cultivated by the farmers in the Tahsil-Panvel during the Kharip season which is again followed by another cdrop of rice and hence it is the most peculiar cropping pattern of this region. Most of the cultivators are minor and small farmers which are lacking the resources and because of this the productivity of rice in this area is more or less stagnant or going to declining. Estimation of the nutrient contents and their forms is important in assessing the nutrient supply of the soils to the crops which largely helps in the scientific nutrient management. Analysis of Macronutrients, Micronutrients from the rice field soils has been done by Atomic absorption Spectroscopy and other conventional chemical methods.

2.0 Material and Methods:

In the present work chemical analysis of rice field soil samples collected from Poyange village near Panvel (Raigad district of Maharashtra, India) has been carried out. A list of small and marginal rice grower farmers from Poyange village was prepared with the help of Maharashtra State Agriculture Department in November 2006. The soil sample collected is good representative soil samples is first criteria applied. The analytical results are expected to be representative for the entire field. With the help spade or khurpi contaminated surface soil material was removed (Gupta, 2007) and by digging V shaped holes, up to a depth of 22cm, a uniform 2cm thick slice of soil samples were collected in a plastic bucket. These collected samples were air dried and thoroughly mixed on a piece of clean cloth and the bigger lumps were broken using wooden pestle and mortar (Tandon, 1993). The soil particles were disaggregated, crushed and sieved with 10 mesh diameters, stored in glass bottles and labelled.

pH values were determined by using digital pH meter for whjich 20g soil sample was mixed with 40ml distilled water in 1:2 ratio. The resulting suspension was stirred intermittently for 30 minutes with glass rod and allowed to stand for one hour. The pH values were recorded by inserting combine electrode into the supernatant. pH value is a measure of the hydrogen ion activity of the soil water system and expresses whether soil is acidic or basic. It also determines the availability of nutrients, microbial activity and physical condition of soil.

Total ion contents in the soil solution is expressed by electrical conductivity (EC) which also determine the current carrying capacity of the soil giving a clear idea of the soluble salts present in the soil. Non saline soil has a EC of 0 - 1.4 mS/cm while for strongly saline it is 4.5 - 11.4 mS/cm. The electrical conductivity values of a soil samples were determined by using digital Equiptronics conductivity meter for which 20g soil was added in 40ml distilled water. This 1:2 soil water suspensions extract was filtered through Whatmann No. 1 filter paper. The suspension was then stirred intermittently and for complete dissolution of soluble salts the suspension was allowed to stand for 30 minutes without any disturbances. The soil was allowed to settle down and then conductivity cell was inserted in solution to take the reading to record the EC values.Organic carbon (C_{org}) carbon in the soil was determined by using Walkey- black method (Walkey and black, 1934) modified and described by Jackson (1967).

Estimation of available phosphorus was done by using method given for acidic soil by Bray and Kurfz (1945). Potassium in the soils was estimated by flame photometer with K-filter. Standard solutions of potassium were prepared (2 to 20ppm) to obtain the standard curves to know the concentrations of K. Calcium and magnesium forms stable complexes and were determined by Versenate (EDTA) titrimetric

method. In this process the interference of Cu, Zn, Fe, Mn was prevented by adding carbonate solution. Using Erichrome black-T indicator (at pH -10) the end point was determined by observing colour change from wine to red to blue or green (Jackson 1958). The method given by (Lindsay and Novell, 1978) is commonly used for available micronutrients in soil samples. This method consists of DTPA (diethylenetetraminepenta acetic acid) as an extractant and the micronutrients in the extract are determined by using Atomic Absorption Spectrophotometer). The carbonate, bicarbonate and chloride concentrations were determined by employing usual volumetric methods given by (Tandon, 1993).

3.0 Result and Discussion:

The values of soil pH (Table 1) in this area range from 5.63 to 6.82 indicating an acidic nature of soil while EC values range from 0.13 to 0.27 mS/cm (Fig. a) (normal EC ranges from 0.02 to 2.0 mS/cm) and such soil is said to be non-saline. The low ES values could be due to high rainfall in this area which washes out soluble cations from the soils. One of the most widely used test for assessment of available nitrogen in soil is based upon estimation of readily oxidizable organic carbon which roughly represents 58 % of the total soil organic matter. The values for C_{org}range from 0.59 to 1.57% (Fig. b) which are below 2% and hence the soils are deficient in organic matter and alternatively in nitrogen also. Phosphorous is necessary for seed germination and essential for flowering and fruits formation deficiency symptoms are purple stems and leaves, yields of fruit and are poor. Observed values of phosporous range between 14 kg/hectare to 143 kg/hectare with only three samples showing higher values. Potassium values range between 220 kg/hectare to 336 kg/hectare (Fig. b).

Table 1: Concentrations of various physico-chemical parameters in soil samples.

Sample No .	pH	EC	C_{org}	P	K	Cu	Fe	Mn	Zn	CO_3	HCO_3	Cl	Ca	Mg
1	5.95	0.25	1.49	143.4	336	9.54	23.28	18.62	0.72	150	366	177	28	56
2	6.37	0.21	0.93	61.15	224	9.62	24.64	18.64	0.80	120	360	170	32	58
3	6.82	0.17	0.59	18.82	280	8.18	21.96	17.68	1.44	30	122	192	24	66
4	6.43	0.19	0.93	50.62	229	8.44	24.88	18.70	1.06	0	183	124	24	48
5	6.53	0.17	0.87	12.99	227	8.04	21.86	15.82	0.87	0	127	230	28	87
6	5.63	0.27	1.57	108.4	220	10.48	25.26	15.96	1.60	0	091	266	32	47
7	6.78	0.14	0.59	14.11	221	8.24	17.54	15.76	0.56	0	244	248	28	43
8	6.68	0.13	0.59	16.13	280	8.18	20.14	15.78	0.56	0	122	266	24	66
9	6.57	0.14	0.81	37.18	231	8.4	25.4	18.68	0.80	30	122	301	32	52
10	5.76	0.25	1.37	110.7	226	9.59	26.04	18.74	1.14	0	61	248	28	49

EC: mS/cm C_{org}: %, P & K: Kg/hectre, Cu, Fe, Mn, Zn,CO_3, HCO_3, Cl, Ca, Mg: ppm.

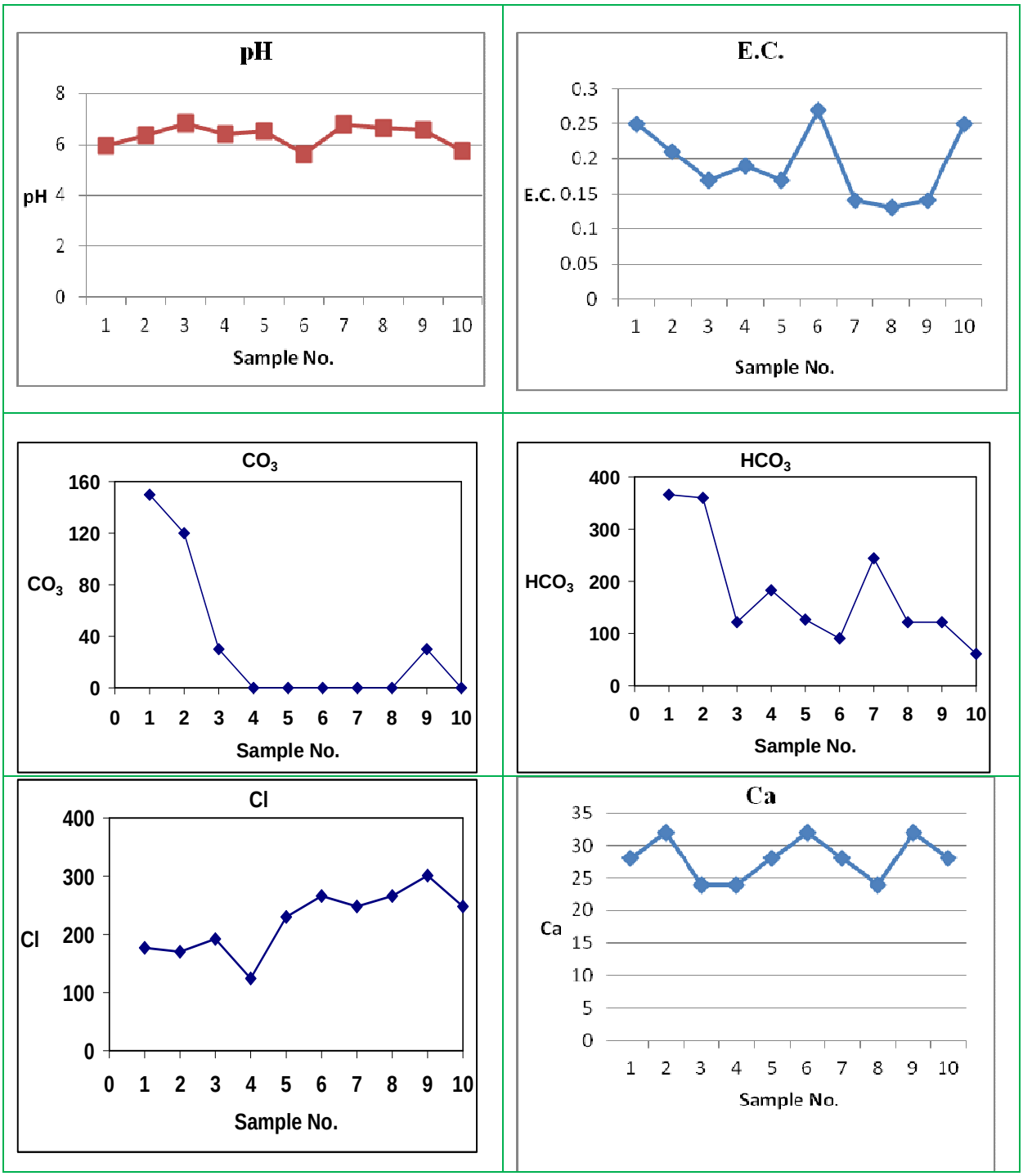

Figure a: Showing the variation in pH, EC, CO_3, HCO_3, Cl and Ca in various soil samples.

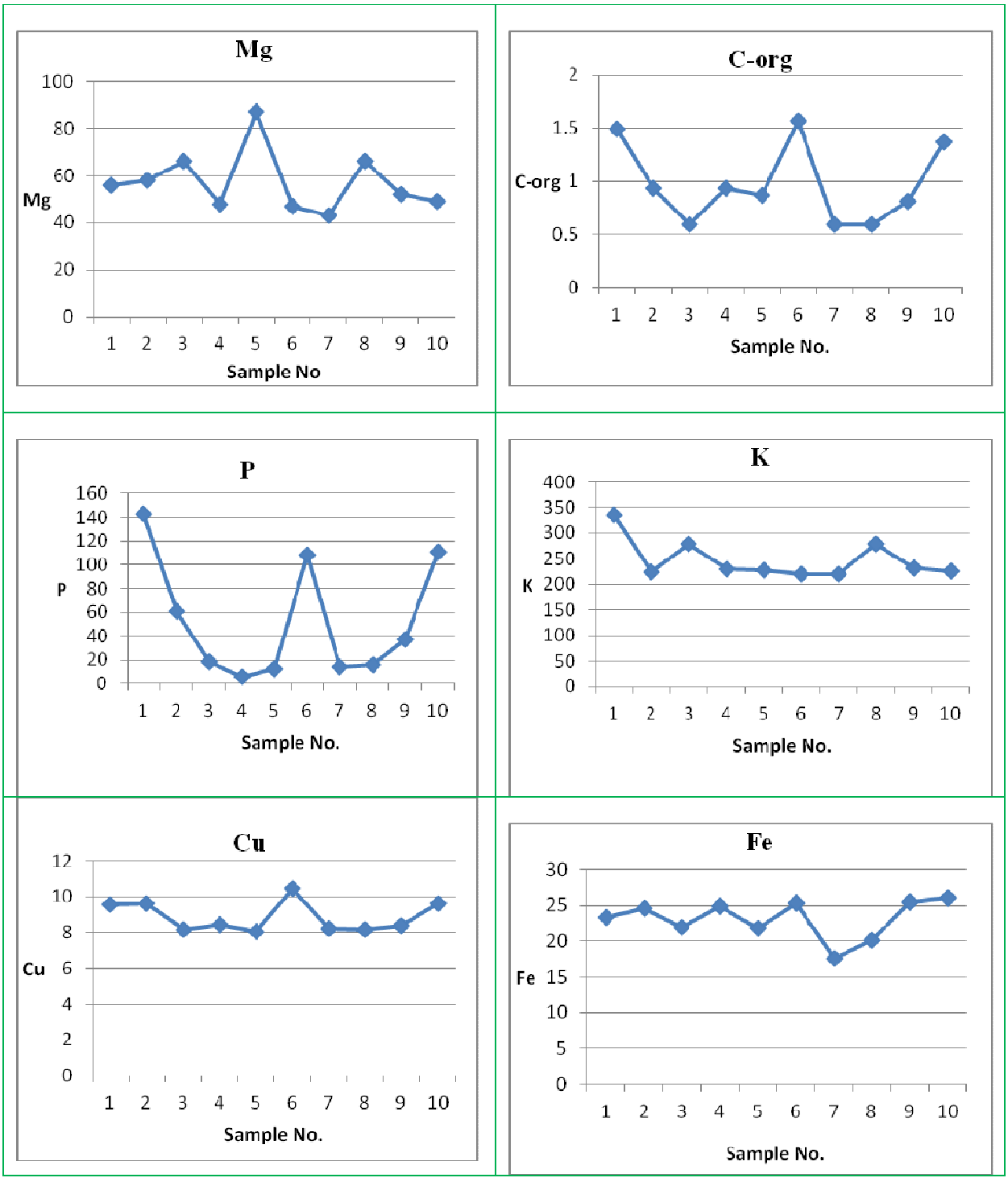

Figure b: Showing the variation in Mg, C-org, P, K, Cu, and Fe in various soil samples.

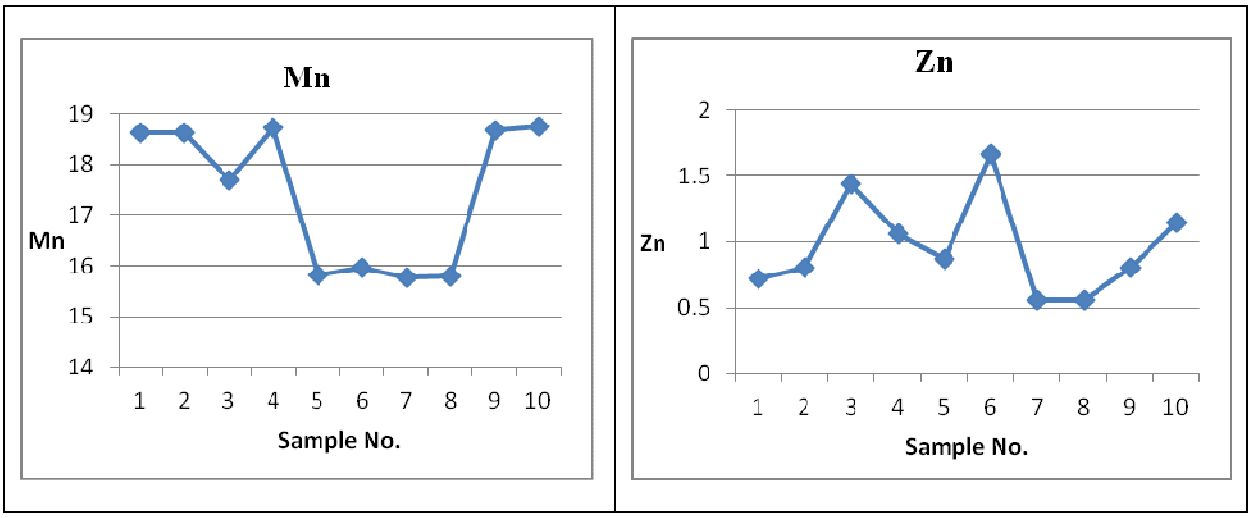

Figure c: Showing the variation in Mn and Zn in various soil samples.

The concentrations of Cu range between 8.04 to 10.48 ppm indicating enrichment of Cu in the soils (optimum range for Cu is 0.2 to 2.5 ppm). Iron content in analyzed samples has been found to be between 17.54 ppm and 26.04 ppm which are also very high as the normal range for Fe is 2.5 to 4.5 ppm (Fig. b) . Manganese content in the normal soils range from 1.02 to 2.5ppm and since the soils samples from the study area show manganese content from 15.76 to 18.74ppm the soils are highly enriched in Mn. Similarly soils are also enriched in Zinc (ranging between 0.56 and 1.60 ppm, Fig. c) as in normal soil it ranges from 0.51 to 1.21ppm.

4.0 Conclusions:

1) It is concluded that the soils from the study area are enriched in micronutrients like Zn, Mn, Cu, Fe although they show varying range. Soil samples 1, 6 and 10 are enriched in C_{org} and while soil samples s 3, 5, 7 and 8 are defendant in phosphorous.

2) The phosphorous deficiency symptom is purple stems and leaves which results in a poor yield of rice production. So it is suggested for the rice field soils of the sampling area 3, 5, 7 and 8 to add phosphate fertilizers (20 kilo phosphorous per acre) according to the standards given by the Agricultural University and for other sampling areas 10 kilo phosphorous per acre.

3) To overcome the nitrogen deficiency it is suggested to add nitrogen containing fertilizer (20 to 30 kilo nitrogen per acre in all the sampling area. Potassium content is quite better in all sampling area and hence the use of potash containing fertilizers 15 to 20 kilo potassium per acre is sufficient for all sampling areas.

4) Further 5 tons per acre natural manure should be added in order to to increase the rice productions. Soils from sampling areas 1, 6 and 10 are acidic and hence it is suggested that 6 tones lime [$(Ca(OH)_2$] per hectare (in 2 to 3 dosed in a year) should be added to improve the soil pH.

5) For all the soils in the area the natural manures and organic fertilizers would be best alternative to chemicals fertilizers because it would increase the $C_{org}$and microorganisms in the soils which help crop growth and yield.

5.0 Acknowledgment:

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References:

1) Atefeh, R. B. (2013) Influence of soil amendments and soil properties on macro– and micronutrient availability to microorganisms and plants. Doctoral thesis Swedish University of Agricultural Sciences, 63p.

2) Bationo A, Hartemink A, Lungu O, Naimi M, Okoth P, Smaling E, Thiombiano L (2006). African Soils: Their Productivity and Profitability of Fertilizer Use. *Background paper prepared for*

the African Fertilizer Summit, June 9 – 13, 2006, Abuja, Nigeria.

3) Bray, R. H. and Kurtzs, L. T. (1945): Determination of total organic and available form of phosphorus in soils. *Soil. Sci*, 59:39-45
4) Ellert, B. H., Clapperton, M. J. and Anderson D. W. (1997): An ecosystem perspective of soil quality. *In G. Gregorich and M. R. Carter (eds.) Soil quality for crop production and ecosystem health. Elsevier, Amsterdam. p. 115–141*
5) Gupta, P. K. (2007): *Soil, Plant, Water and Fertilizer analysis. 2nd Ed. Agrobios, (India), Jodhpur.1-5.*
6) Hartemink, E (2010). Land use change in the tropics and its effect on soil fertility. *19th World Congress of Soil Science, Soil Solutions for a Changing World 1 – 6 August 2010, Brisbane, Australia.Published on DVD.*
7) Jackson, M. L. (1967): *Soil Chemical Analysis Prentice Hall of India Pvt. Ltd., New Delhi pp. 205.*
8) Lindsay, W. L. and Norvell, W. A. (1978): Development of DTPA soil test for zinc, iron, manganese and copper. *Soil Sci. Soc. Am. J*. 42: 421-428
9) Moonen, A. C. and Barberi, P. (2008): Functional biodiversity: an agroecosystem approach. *AgriculEcosys. Environ.,*127:7–21.
10) Smaling EMA (1995). The balance may look fine when there is nothing you can mine: Nutrient stocks and flows in West African Soils. IN Proceedings of a Seminar on The Use of Local Mineral Resources for Sustainable Agriculture in West Africa, *In H Gerner and AU Mokwunye (Eds.), IFDC-Africa, November 21-23, 1994.*
11) Tabi, F. O., Omoko, M., Boukong, A., Mvondo, Ze A. D., Bitondo, D. and FuhChe, C. (2012): Evaluation of lowland rice (Oryza sativa) production system and management recommendations for Logone and Chari flood plain – Republic of Cameroon. *Agricultural Science Research Journals*. 2(5): 261-273.
12) Tandon, H. L. S. (1993): *Methods of analysis of soils. Plants, Water and Fertilizers.*
13) Walkley, A. and Black, I. A. (1934): An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. *Soil Science* 37:29-38.