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PRELIMINARY INVESTIGATION OF TRACE ELEMENTS IN SOME FARMING COMMUNITIES OFJIGAWA STATE

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ABSTRACT
The savannah soils especially the ferrallitic and ferruginous types have peculiarities associated with soil color, texture, parent-rock formations that make them unique. Instrumental Neutron Activation Analysis (INAA) was used to determine five essential elements (Cl, Fe, K, Mg, Mn) useful in plant nutrition and several others commonly found in association in the soil mineralogy of savannah region of Nigeria. Trace elements concentration determined from the three farming communities' shows that the soils are acidic. But they are rich in essential elements such as Chlorine, iron, potassium, manganese and magnesium. The three farming communities lack calcium.

Key words: *Savannah, Elements, Analysis, Farming, Activation*

INTRODUCTION
The Savannah soils in Nigeria cover an extensive landmass that support agrarian activities for the socio-economic development of Nigeria and therefore need continuous investigations, as new techniques unfold and are available for the study region. Agricultural land is primary required for the production of food for human and animal consumption, agricultural activities also include the growing of plants for fibre and fuels (including wood) and for other organically derived products (pharmaceuticals etc.) for use by humans and his animals (Kenk and Cotic.1983, Hovenkonnou. et al. 2006). A major factor limiting agricultural development in Nigeria is the lack of information on soil and land characteristic. Soil topography plays a major role as one of the factors influences pathogenesis and in the process dictates the distribution and use of the soils on the landscape (Hoosebeeket al.2009, Esu, et al.2008). Land use aerial photographs for the Nigerian Savannah have been

identified without reference to soil element content by (Field and Collins, 1986).

The study of the soil has been fostered peoples' interest in plants growth and food production (Hinrich et al 1983). The ability to produce food is the fundamental factors in societal developmental, therefore need to know the kind of element or nutrient for a better production (Siidou et al, 2004). One of the most important natural resources that cover much of the Earth's surface is Soil. Most life on earth depends upon the soil as a direct or indirect source of food. Plants are rooted in the soil and obtain nutrient from it. Animals also got nutrients from eating the plants on the soil. Soil is home of many organism, such as seeds, spores, insects, and worms. The contents of soil changes constantly and there are many different kinds of soil. Our soil resources can be compared to a bank where continued withdrawal without repayment cannot continue indefinitely. As nutrient are removed by one crop and not replaced for subsequent crop production yields will decrease accordingly. Accurate accounting of nutrient removal and replacement, crop production statistics and soil analysis result will help the producer manages fertilizer applications to grow good crops, most farmers need to fertilize the soil.

Soil analysis is used to determine the level nutrients found in a spoil. As such, it can only be as accurate as the sample taken in a particular field. The results of a soil analysis provide the agricultural producer with an estimate of the amount of fertilizer nutrients needed to supplement those in the soil (Baker et al, 1956, Adjei-Nsiah et al. 2004).

High yields of top quality crops require an abundant supply of 19 essential nutrient elements which are as follows: Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur, Boron, Chlorine, Cobalt, Copper, Iron, Manganese, Zinc, and Molybdenum (Stenley 1995). But the most beneficial element in the soil is Sodium and Selenium (Samuel et al 1985).

MATERIALS AND METHODS

Sample Location and Collection

Jigawa state lies within the savannah plains of Northern Nigeria. The samples were collected from three farming communities of the state, namely Hadejia, Gumel and Kafin-Hausa. Mostly the root penetration of cereals grown within the savannah ranges from 20 to 50cm depth. The top 20cm of the soil were scrapped off in order to remove traces of

surface contamination due to human activities. Around one kilogram of soil sampled was taken to the laboratory for homogenization and quartering.

Sample Preparation

The samples collected from the three different farming communities were exposed to ambient air in a dust free environment before drying to constant weight in a monitored oven at a temperature of 50°C. Soil samples were then pulverized with an agate mortar into fine powder, reducing them to about 80 mesh size (IAEA, 1990). The major aim of this was to allow a representative sample to be chosen as an aliquot for the analysis. Polyethylene vials and bags were washed in Nitric acid and rinsed in purely distilled water and dried. The samples were weighed into the bags wrapped, heat-sealed and placed into 2/5 dram vials. The rapped samples were plugged with cotton wool in the 2/5 dram vials so as to maintain a fixed geometry. Standard were prepared and packaged in the same manner as the samples. The international Atomic Energy Agency (IAEA)- soil-7 was used as the comparator standard Reference material (SRM).

Table 1 A typical profile of one site of the savannah soil sampled.

Depth (cm)	Description
0-11	Very pale brown (10YR 7/3, dry). Loam: Weak medium sub-angular blocky structure, slightly hard, moist firm, few grass roots, few quartz gravel, clear wavy boundary
11-27	Very pale brown (10YR 8/3, dry). Light loam: weak medium sub-angular blocky structure, dry slightly hard, few grass roots, few quartz gravel, clear wavy boundary
27-75	Light gray (10YR 7/3, dry). Mottled reddish yellow loam: moderate, medium sub-angular blocky structure, dry hard few quartz gravel, few ant holes, gradual wavy boundary
75-129	Light gray (10YR 7/3, dry). Mottled reddish yellow loam, moderate medium sub-angular blocky structure, dry hard, few quartz gravel and iron concretions, few medium ant holes, gradual wavy boundary

Neutron activation analysis of the samples was performed using Miniature Neutron Source
(MNSR) in Center For Energy Research and Training (CERT) A B U Zaria

Trace Element Detection

In activation analysis, an element is always bombarded with neutrons, charged particles or Photons. The excited intermediate is formed by the induced nuclear reaction of which it may be de-excited via the emission of prompt γ-rays. Trace element detection in neutron activation analysis consists of first irradiating a sample with neutrons from a source (e.g a nuclear reactor) to produce specific radio nuclides of the elements of interest. The sample to be analyzed is exposed to a flux of thermal neutrons. Some of the neutrons are captured by isotopes of elements in the sample, the result in the formation of a nuclide with the same proton number, but with one more mass unit of weight. Then a prompt gamma ray is immediately emitted by the new nuclide, hence the term (n,γ) reaction, expressed as:

$${}^{m}_{z}A + {}^{1}_{0}n \rightarrow {}^{m+1}_{z}A + \gamma$$

where Z=refers to the proton number, and
M= the mass number.

But usually the product nuclides (${}^{m+1}_{z}A$) are radioactive, and by measuring its products one can identify and quantify the amounts of target element in the sample.

Findings

From the preliminary investigation of the three farming communities of Jigawa state, it was found that the soils of the areas are so acidic. Therefore the soils need to be neutralizing by adding lime to it. The farmers need to add fertilizers in order to get a good yield from their farms. It was found also that the soil conductivity falls in between (0-20) cm.

RESULT/DISCUSSION

The preliminary investigation shows that the farming communities where the samples was sampled have the following elements, (Al, Ba, Br, Ca, Ce, Co ,Cl, Cr, Cs, Dy, Eu, Fe, Hf, K, La, Lu, Mg, Mn, Na, Rb, Sb, Sc, Sm, Ta, Th, Ti, V, and Yb).

Soil pH

The significance of soil pH is that it affects various soil properties including conductivity (Ghidyal and Tripathi, 1987), soil mineral formation and soil structure.

Table2 Soil pH values for the samples investigated at a temperature of 27°C

S/N	Site	pH	Remarks
1	Gumel	5.27	Strongly acidic
2	Hadejia	4.88	Very Strongly acidic
3	Kafin-Hausa	5.10	Strongly acidic

According to the pH values of the farming communities under investigation it shows that the soils are either very strongly acidic or strongly acidic. This may be as a result of either leaching or high soil temperature during the arid months leading to evaporation of soil water leaving residues strong undiluted salts. Soil amendment process such as addition of lime (CaO) will be preferable in order to reduce the acidity (Miller and Donahue, 1997)

Soil conductivity

Conductivity range gives the range of tolerance of the plant root system to salt solutions. Miller and Donahue, 1977 gives the range of electrical conductivity as it affects growth of plants.

Table 3 Conductivity range and plant tolerance

Conductivity (Scm-1)	Growth reduction by salt in soil
0-20	Few plants are affected
20-40	some sensitive plants affected (Strawberries)
40-80	many plants are affected
80-160	most crop plants are affected
160 and above	Few plants grow well

According the table of the soil communities under the investigation, only few plants may be affected, because the conductivity falls in between (0-20) $\mu Scm-1$

Table 4 Conductivity values for the samples investigated

S/N	Soil Location	Savannah region	ConductivityμS cm-1)
1	Gumel	Sudan	14 ± 1.1
2	Hadejia	Sudan	18 ± 1.5
3	Kafin Hausa	Sudan	20 ± 1.2

Table 5 Elemental Abundances in the farming Communities units in ppm otherwise stated.

Element	Gumel	Hadejia	Kafin-Haus
Al	0.60	1.75	1.00
Ba	97.92	380.20	198.3
Br	BDL	BDL	1.08
Ca	BDL	BDL	BDL
Ce	NA	NA	55.29
Cl	319.80	BDL	BDL
Co	9.35	10.22	13.9
Cr	22.76	34.98	31.65
Cs	0.67	1.92	BDL
Dy	1.47	2.54	1.84
Eu	0.58	1.18	BDL
Fe	0.51	1.29	1.07
Hf	18.34	24.82	32.81
K	BDL	1.91	BDL
La	BDL	34.30	22.18
Lu	0.23	0.36	0.43
Mg	0.11	0.34	0.10
Mn	241.30	138.50	132.40
Na	BDL	0.29	BDL
Rb	BDL	62.05	49.00
Sb	BDL	BDL	BDL
Sc	2.59	4.59	3.90
Sm	2.10	5.95	3.90
Ta	0.62	1.39	1.97
Th	4.99	19.61	15.10
Ti	0.12	0.22	0.18

V	7.47	16.05	19.08
Yb	1.63	4.34	3.57

BDL=below detection limit

Trace elements concentration determined from the three farming communities' shows that the soils are acidic. But they are rich in essential elements such as Chlorine, iron, potassium, manganese and magnesium. The three farming communities lack calcium.

CONCLUSION

In conclusion therefore, soil element data and their physical parameters were obtained for the three farming communities (Hadejia, Kafin-Hausa, and Gumel), tested for elemental content. Data reported in this preliminary investigation will serve as base-line information on trace elements in Jigawa state. As an extension of the work, the data will be useful as preliminary investigation results for the purpose of monitoring trace element levels.

RECOMMENDATIONS

The government should the research through financing it from time to time in order to monitor trace elements level in the state and around.
The study of the entire state should be carried out using a grid point system in order to obtain a comprehensive data for elemental abundances.

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