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# HUMAN HEALTH CONSIDERATIONS IN IDENTIFICATION/ ANALYSIS OF CHEMICAL ELEMENTS IN URBAN FARM LANDS IN CALABAR, NIGERIA

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ABSTRACT :

The express direction of this study on field identification and analysis of farm garden soils in Calabar Urban and its environ is aimed at the determination of Human health impact of the elements identified. The study background has generally substantiated that urban farm lands are quite contaminated caused by the variety of human activities that contribute to the pollution of the soils. The position derives inspiration from earlier studies carried out by Purves (1997) and Meetham (1998). The background also ramified on vie nature of the system of land farming system by mostly women who are engaged in market garden farming to supply the urban market's daily demands. The problem statement directs attention to the need for identification of the chemicals/elements in a bid to ascertaining the soil quality status as fit for cultivation of craps for human consumption. The justification focused on the overall utility of this knowledge for urban environmental health planning. The objectives direct attention to need for ascertaining the nature of the soil, isolation of their relevant categories and identification of cation exchange and Identification of acidity levels. The methodology encapsulates description of study design, area of study, study population, sampling procedure, instrument for data collection, method of data analysis. Data was analyzed by a variety of measures such as laboratory and specification of different elements observed on the basis of and quantity in the soils sampled for analysis. Soils were careful sampled and collected following the presented scientific approaches. The results were carefully reported and the health implications stated. From the report it was evident that farmlands were not quite containing like previous studies reported about other urban farmland in different part of the world. This means absence of the substances have little threat of health wise acts on urban residents. But in line with principle of Geo-medicine, it reported that absence of certain essential trace elements like iodine, Boron, Molebedum etc. could spell doom for population in the future. The result of this study has therefore opened a new vista for nutritionist and dietist to explore ways of advising residents on other possible ways to supplement their diet intakes for the supply of these elements that are in these demand for health enhancement.

## Introduction :

A variety of farming cultures are operational in urban areas through practices on small land due to high land value in the cities. They go by different nomenclatures, in different places but the most popular ascription is the "Market Garden System". They are practiced in available lots in urban centres as well as urban suburbla in every city of the world. The farm cultivars are mostly ecologically determined in line with the particular ecological elements such as soil, weather condition and so on. Like water and air, soil quality is an important consideration due to the recognition of the biological processes of aeration, capillarity and cation exchange or acidity are all determinant in the farm land analysis. There is the grave necessity of devoting attention to the evaluation of urban farmlands due to the nature of human (anthropogenic) activities undertaken in the urban area.

Several studies have been undertaken to substantiate the nature of urban land characteristics on the basis of its pollutants concentration In different cities of the world. Purves (1997) in his study of urban gardens in Finland reported that urban gardens contains more contaminants than rural soils. Similarly Mecthan (1998) pointed out soils can easily loose their stock of plants under the influence of acid rain.

In Calabar as well as other urban locales, the plethora of activities embarked upon have grave consequences on soil quality status for agricultural productivity or consumable farm crop production. This is evident by established knowledge that crops absorb water through their root systems and transport same through their xylem and phloem tissues for evaporation through their leaf stomata. This process of evapotranspiration is also contributing to elements absorption capacity of the crops (Plants) thereby resulting in absorption of deleterious chemicals or elements which when consumed result in grievous health damages.

There is also sufficient evidence in the literature that some chemicals or element have long half-life in the soil and results in the process of bio accumulation instead of degradation. Bio accumulation explains a trend in which a particular element in the form of heavy metals such as Lead, Mercury, Cadnium can remain in the soil for a lengthy period of time which is transferred to plants which may be consumed by animals or other organisms which equally consumed by man are progressively moved along the food chain, resulting in eventually in human health effects of various categories

There is also bio magnification where recalcitrant chemicals are present in low levels of natural waters but appear in high concentration in the biota (Ubong and Hobo 2000).

There is also likelihood of chemicals which are toxic or hazardous that can be found in urban garden soils. These categories are to be either carcinogenic (cancer causing), mutagenic (causing birth defects) borne by these considerations thus, the expediency of undertaking research study in Calabar becomes evident.

## STATEMENT OF THE RESEARCH PROBLEM/JUSTIFICATION

Calabar urban farm land/market garden activities are carried mostly by women who engage in the cultivation of a variety perennial crops which are in immediate demand by the urban market. Existing statistics by Purves (1997) Metham (1996) and others who are working assiduously on soil quality characteristics in different parts of the world have proven that market garden soils are more contaminated than rural soils. The reason is simply that the variety of activities engaged upon by the urban population have the significant likelihood of contaminating the soils. Ironically, a good number of the women engaged in this occupation have little or no knowledge of the overall implication or presence of some of these soil contaminants. Activities engaged in production or consumption of materials that release heavy metals like lead, mercury, calcium and others to the biota have significant health Implications that should be well known unregulated. Activities such as application of fertilizer to enrich crop productivity levels have significant health implications. There is also the imperative of understanding the soil properties and characteristics such as porosity, friability, aeration, caution exchange rate and moisture retention capacity.

Available literature explored along this line in recent studies of this nature is non-existent or are at best scant. The grave implication of inadequate information by the urban land farmers concerning the possible health implications of contaminated farm lands need not to be emphasized.

This research undertaking is focused on assessing the overall soil quality status in line with the FAO (1986) health parameters and report same for the benefit of the urban residents as well as other transient population.

## JUSTIFICATION OF THE STUDY

**The study is justified on such grounds as:**

- Provision of a clear knowledge concerning soil quality status for sound agricultural practices
- Creation of awareness for those engaged in the urban farming culture so as to regulate their activities in line with existing information.
- Provision of a sound environmental health information for all stakeholders and residents as well as to regulate their attitude of waste management.
- Extension of the frontier of knowledge beyond the existing reserve of information.
- Provision of early warning signals regarding the long term health implications of consumption of crops cultivated on some contaminated garden soils.

## OBJECTIVES OF THE STUDY

**The study is guided by the following objectives:**

- To clearly ascertain the nature and composition of the soils in terms of its general constituents
- To isolate existing contaminants in their relevant categories
- To analyse the cation exchange capacity and as well as determine the acidity level so as to properly advise farmers in the soil management Practices.
- To inform residents and others engaged in activities that generate recalcitrant waste to the environment on appropriate ways of managing or handling them.
- To assess the possible health implications identified and analysed.

## LITERATURE REVIEW

### *A Brief Overview*

The problem identification of this study derives from the recognition of the close relationship between environmental quality and human welfare in terms of health. Studies in Geo-merlicine which is an emerging field of knowledge reveal that the human body requires certain essential chemicals and elements for proper growth and vigour. Beeson et al (1996) worked assiduously on the factor of soil and nutrition, along similar lines was another effort by Calabrese (1981) on nutrition and environmental health and equally Cannon et al focused on "Geochemical environment in relations to human health and disease". These and many other efforts have been in study flushed in this study, based on the recognition of the intricate relationship between human environment, food/nutrition and human health. Mongomerry (2000) has equally devoted a great deal of attention to the understanding of the relationship between trace elements, their dose requirements and human health. In line with the problem identification of this study, this review will explore relevant themes concerning chemical analysis and identification of trace elements in urban gardens/farmlands in Calabar, Cross River State, Nigeria.

## SOIL ELEMENTS AND HUMAN HEALTH IMPLICATIONS

Montgamery (2000) has elaborately dwelt on the essence of geological elements, their nature and occurrences and their value in human health. By so doing, he has listed a number of such elements called trace elements, their functions and some effects of their deficiency in humans. Here, the e elements are here by essentially listed alongside their functions in parenthesis; Iron (oxygen transplant) Iodine (thyroid hormone) Copper (interacts with iron in some enzymes) Manganese (metabolism) Cobalt (interaction of enzymes with heavy metals) Chromium (insulin action) Fluorine (proper tooth and bone growth) etc.

Several others are listed along with some whose functions are not known. Furthermore (Montgomery) discussed the various media or sources through which the elements may get to the environment or human body systems. Some of these include leaching, mining operations, biological activities, water treatment (pollution) etc. For all the efforts his focus culminated in the dose response curve which he explained to refer to the level of optimal intake of each element by the human body. Beyond end below this level there is a crises in one way or the other. Urban farm lands like other spheres of the environment have a fair share of these elements as well as other harmful substances in the environment. This substantiates Purves (1997) report that urban farmlands are most contaminated. Meetham (1998) equally presented a similar account regarding the property of urban lands. It follows natural therefore that urban land use have more than just natural trace elements. The variety or urban land use and anthropogenic activities might have deteriorated the natural properties of the lands.

## TOXIC SUBSTANCE AND OTHER CONTAMINANTS IN THE URBAN FARM LANDSCAPES

Studies have been embarked upon to investigate the status of urban soils with the results that urban lands are highly contaminated caused by the plethora of anthropogenic activities embarked upon on the land (Purves and Seskin 2005). In their findings heavy metals like Lead,

Mercury, Zinc and Cadmium were identified alongside other recalcitrant impurities like DDT and other Categories of toxic Substances. DDT rather called Dichloro-diphenyl-TriChloroethene is an example of a group of chemicals called Pesticides which are commonly used by urban farmers (Ubong and Gobo 2000). The first official definition of pesticides was provided by the United States Environmental Protection Agency (USEPA 1974, as "any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. A variety of pests do attack urban farm crops and therefore call for their mitigation. Herbicides are also used by urban farmers to mitigate weeds or herbs. Most of these have their short term or long term ecological or human health impacts or implications.

Following Ubong and Gobo (2000) pesticides can be persistent or recalcitrant. When, They fail to be mineralized or metabolized at significant rates in terrestrial or aquatic ecosystems (Ubong and Gobo 2000). Following this they reported that pesticides are of considerable public health significance for a number of reasons such as I. Assimilation by plants and animals in edible portions (ii). Adherence to edible portions of root crops (ill), Accumulation in earthworms and then showing up in high concentrations in fishes and birds feeding on them (iv). Washing and leaching into water ways with the likelihood of impacting man, fish and other sea foods.

Pesticides persistence or recalcitrance is said to be explained based on the time required for half life of the pesticides to be lost from the environment (Alexander 1977). Based on this, it was reported that DDT, seems to be most stubborn pesticides in that it persists in the soil for over 20 years.

In line with their recalcitrance or persistency certain expression have been used to describe their nature or actions environmentally or in human health consideration such as (i) BioMagnification or Bio accumulation and (li), Carcinogenicity and Terratogeneity/Mutageneity (Mitchel, 1974, Offune 2001).

Following the definitions provided by the authors above: (i) Recalcitrant chemicals are said to Biomagnify or Bio accumulate when at they are present at low levels in natural waters but appear in high concentration in the Biota; (ii) Carcinogenity refers to effects of chemical causing cancer, while terratogeneity refers to substances which cause birth the defects in women.

By and large, besides those elements/chemicals highlighted and discussed above there are numerous other lethal and deleterious substances in the biota that are of significant health implications to humans.

## METHODOLOGY OF STUDY

The basic outlines of the methodology of this study is as follows

### *RESEARCH DESIGN*

This research design is a scientific field analytic design aimed at assessing environmental status on the basis of its soil component.

### *AREA OF STUDY*

The area of Study is Calabar, Urban Metropolis and its suburbia or environs. Calabar is located on the shores of the Gulf of Guinea facing the Atlantic Ocean, The marine coastal location confers on it marine equable weather enhanced by land and sea breeze. It falls within the subequatorial climatic biome with per humid weather condition in terms of its rainfall regimes.

The soil characteristics is that of peat waterlogged in the Southern area occupied by coastal estuarine mangrove vegetation while to the central and the north, the soil is of the sandy loamy in the region of secondary forests. The urban farm lands/lots are located in unbuilt up property owned by individuals or Institutions. Majority of those engaged in the urban farming occupation are women who are in irregular employment. Important crops

cultivated are water leaf, fruited pumpkin, Indian, Spinach, Okoro, Cassava and cereals like maize and rice. Characteristically these land located within the built-up high activity zone A have a sure likelihood of being degraded one way or the other. The high intensity annual rainfall in the area is also a factor that may produce acidification or leaching to the farm soil thereby requiring liming or Sweetening.

***POPULATION OF THE STUDY***

The population of the study relates to urban farm lots located mostly in the urban could area and those and the periphery or suburbs.

***SAMPLING TECHNIQUE***

This involved purposive area sampling whore representative farm lots were selected based on ecological or edaphic conditions. Strategic points such as urban core regions, southern coastal regions and Northern fringes and Southern locations were taken into considerations.

## INSTRUMENTS FOR DATA COLLECTION

Data was collected using soil augers, soil calorimeter soil thermometer and other relevant instruments.

## METHODS OF DATA COLLECTION

Soil was collected in farm locations using soil auger for scooping and storage in well sterilized containers for laboratory analysis. Considering the weather regime, there were two slots of data collected involving wet season data and dry season data.

## DATA ANALYSIS

**Field data was analysed in the laboratory for determination of:**

i. Soils physical properties
ii. Soils chemical properties
iii. Presence of trice elements
iv. Alkalinity or acidification level
v. Identification of contaminants in the form of heavy metals and radioactive substances.

Field data/laboratory results are provided on the table below for discussion.

**PHYSICO – CHEMICAL ANALYSIS OF URBAN FARM LANDS IN CALABAR**

| S/N | CORDINATES OF SAMPLING POINTS | ALT | DESCRIPTION | pH | % Org.C | % T.N | Mg/kg Avail.P | Cmol/ Ca | kg mg | Cmol/ K | Kg Na | Cmol/ AL+++ | kg H+ | Cmol/kg ECEC | % BS | % Clay | % Silt | % Sand |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | N05º2'32'.2776'' E08º21'4.72284'' | 84 | Sample 1 surface | 6.0 | 0.98 | 0.08 | 25.37 | 3.8 | 0.4 | 0.10 | 0.08 | 0.60 | 0.20 | 5.18 | 84.0 | 16.0 | 21.0 | 63.0 |
| 2 | '' | '' | Sample 1 subsurface | 5.9 | 0.94 | 0.09 | 6.0 | 4.0 | 1.6 | 0.12 | 0.10 | 0.44 | 0.48 | 6.74 | 86.0 | 18.0 | 21.0 | 61.0 |
| 3 | N05º2'12.8245'' E08º21'15.8184'' | 84 | Sample 2 surface | 6.0 | 1.04 | 0.09 | 9.12 | 3.4 | 0.4 | 0.09 | 0.07 | 0.60 | 0.24 | 4.80 | 82.0 | 10.0 | 13.0 | 77.0 |
| 4 | '' | '' | Sample 2 subsurface | 6.8 | 1.50 | 0.13 | 7.50 | 7.4 | 0.6 | 0.11 | 0.09 | 0.36 | 0.24 | 8.80 | 93.0 | 15.0 | 14.0 | 71.0 |
| 5 | N4º56'33.02376'' E8º20'27.02436'' | 66 | Sample 3 surface | 6.0 | 1.34 | 0.12 | 9.37 | 8.0 | 0.4 | 0.12 | 0.09 | 0.72 | 0.20 | 9.53 | 90.0 | 14.0 | 19.0 | 67.0 |
| 6 | '' | '' | Sample 3 subsurface | 6.5 | 1.00 | 0.09 | 27.37 | 7.4 | 0.4 | 0.11 | 0.08 | 0.36 | 0.64 | 8.99 | 89.0 | 19.0 | 19.0 | 62.0 |
| 7 | N4º55'27.27768'' E8º19'16.49388'' | 42 | Sample 4 surface | 6.3 | 1.62 | 0.14 | 29.37 | 3.8 | 1.2 | 0.10 | 0.08 | 0.40 | 0.96 | 6.54 | 79.0 | 11.0 | 20.0 | 69.0 |
| 8 | '' | '' | Sample 4 subsurface | 6.3 | 1.42 | 0.12 | 33.37 | 3.0 | 0.6 | 0.10 | 0.07 | 0.60 | 0.64 | 5.01 | 75.0 | 12.0 | 23.0 | 65.0 |
| 9 | N4º57'14.59296'' E8º20'15.95004" | 61 | Sample 5 surface | 6.2 | 1.98 | 0.17 | 20.87 | 6.0 | 0.6 | 0.12 | 0.10 | 0.68 | 0.16 | 7.66 | 89.0 | 10.0 | 19.0 | 71.0 |
| 10 | '' | '' | Sample 5 subsurface | 6.2 | 1.18 | 0.10 | 9.50 | 6.0 | 0.8 | 0.13 | 0.11 | 0.48 | 0.56 | 8.08 | 87.0 | 13.0 | 23.0 | 64.0 |
| RANGE | | | | 4-8 | 0.5% -3.0% | 0.2 % - 2.5 % | 11.0mg/ kg- 22mg/k g | 0- 2500m g/1Ca 0.01M ol - 15cmo l5cmol kg-1 | 0- 500 MG /1 Mg 0.5 g/k g- 5g/ kg | 0- 725m g/1K | 0.3- 0.7m g/kg | 0- 50mg/1 Al | 4-8 | 2.39- 33.8cmol/kg | 45% - 55% | 33.9 % - 40.5 | 0.00 2- 0.07 5 | 45%- 60% |

**Legend**
**Org C =** Organic Carbon, TN = Total Nitrogen, **Avail** P = available Phosphorus, **ECEC =** Effective Carbon exchange capacity, **BS =** saturation
Sample 1 – Alkimasa Farms, near the proposed Health Centre
Sample 2 – Federal Agricultural Quarentine (Fed. Agric)
Sample 3 – Yuttee Farm, 62 Orok Orok Street, Calabar
Sample 4 – New Airport Farm/Gardens, Nigeria Airspace, Anantigha, Calabar
Sample 5 – CREPA Gardens, 3 Mary Slessor Avenue

Source: Field Survey 31st June, 2024.

## PROCEDURE/RESULTS

### *PROCEDURE*

This entails field data planning and embarkation.

For representative spatial spread five areas location were purposively sampled. These have been clearly represented by a legend which covers from samples 1-5 with their corresponding place names. Thus sample I (Akimasa Farms), Sample 2 (Federal Agric), Sample 3 (Yuttee Farm), Sample 4 (New Airport Farm) and Sample 5 (CREPA Gardens). Correspondingly, a 3-dimensional(3D) coordinate of the sample points were mapped out by taking readings of the Northings', "Easting" and elevation (ALTITUDES) for each location, soil samples were collected for both surface and subsurface elements as shown on the table.

Laboratory analyses involved isolation or speciation of soil elements for identification of soil pH level (Acidity/Alkalinity) soil organic content, Total Nitrogen, available phosphorous, cation exchange rate, magnesium (Mg) Sodium (Na), Aluminum, Hydrogen etc. This information is represented on the table for physio-chemical analysis of urban farmlands in Calabar, Nigeria.

## RESULTS

The altitudes ranged from 42-84 meters above see level for all locations sampled. For the pH (acidity/Alkanity analysis the highest value of 6.8 were detected from sample 3 at sub surface level indicating excess acidity for crop cultivation. Sample I at the subsurface level had the lowest alkanity value of 5.9. grossly, the alkanity ranged of 4-8 was determined for from the laboratory testing.

The soil organic matter analysis reflects a range 0.5% - 3.0%, showing a fluctuation in the nutrient content of the edaphic properties. The highest value of 1.98 was identified for sols at altitude of 61 meters reflecting some conformity between catena properties of the topography. Right through the sampled locations, a slight variation in range is observed between the surface and subsurface values. For instance a difference of 0.04% (Akimasa), 0.01% (Federal Agric), 0.34% (Yuttee Farm), 0.8% (New Airport) and 0.72% (CREPA).

Burning the value for the last location there seems a homogenous staus in the organic matter content across the sampled terrains.

There is also a homogenous spread in the total nitrogen content across the sampled sites with a modal content of 0.17% for CREPA and a least score of 0.08 for Akimasa. Overall, the nitrogen status of the areas suggest a fairly good fertility status for agricultural engagements. The range lies between 0.2% - 2.5%.

Available phosphorous content following the laboratory speciation appears quite variegated with a wide range of 11.0mg/kg to 22mg/k. the modal value of 23.37 was recorded for New Airport subsurface sample while the lease value of 9.12mg/kg was recorded for Federal Agriculture surface swamp. Right through a significant wide range is recorded for difference between the surface samples and the subsurface sample for each point/locations. The phosphorous status indicates significant variation in nutrient status of the soils, the different locations.

The cations distribution as recorded for Calcium(ca), Magnesium (mg), Potassium (k) and sodium(Na) appears significantly variable which also conforms with the explanation of the variegated nutrient status of soil as explained based on the distribution of available phosphorus. The aluminum (Cmol/Al+++) appear low I distribution thereby suggesting a marked absence of lateralization in the area, Hydrogen(H+) content is optimal in certain locations indicating a marked incidence of teaching, learning to soil acidification and loss of fertility.

For other elements in the category BS, clay salt and sand they appear in significant concentration predicated in the geological antecedents of the littoral formations. In all, there appears insignificant present of heavy metals and toxic substances.

## HEALTH CONSIDERATIONS

From the findings presented in report above, there seems a marked departure from the results gleaned from extant literature that urban farm lands are the most contaminated and deleterious (Purve, 1997) Meetham, 1998). He basis of this difference with reference to Calabar will provide at the later part of our submission.

Evidently is absence or little presence of toxic elements like mercury, zinc, cadmum and other recalcitrant element DDT (Dichloro-Dephyl-Trichlorothen), (Ubong and Hobo, 2000).

These scholars reported that recalcitrant elements have the proprieties of Bio magnification or Bioaccumulation and long half-life in the soils. They attribute the effects of some of these to incidents of carcinogenetic (Cancer causing) mutagenicity (gene mutation), teratogenicity (causing birth defeats) and so on. This provides the bright side of the explaination of health implications. On the dark side in line with the principle of geomedicine

reported by Montgomery (2000) marked incidence of lack of trace elements like iodine, Buron, Cobalt, etc have significant adverse health implications for the health of residents. Therefore the dire necessity of further investigating the soils elements status of the farmlands for identification relevant trace elements.

## CONCLUSION :

Following the findings/results, the marked absence of deleterious contaminants in the farm studies may attributable to a number of explanations.

i. Lack of little application of soil additives by farmers, paucity of industrial activities in the area and so on.

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