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Physico-Chemical Analysis of Different Types of Soils that Support the Growth of Legumes (Beans) in Yobe State, Nigeria

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Abstract: *This paper is aimed at assessing the level of the heavy metals: Lead (Pb), Arsenic (As), Cadmium (Cd), Chromium (Cr), and Nickel (Ni) and Physico-Chemical parameters in different types of that support the growth of legumes in bade, Nguru, and Potiskum local government area of Yobe state. Bunches of soil, and legumes (beans) samples were collected from the site. Prepared samples were digested using freshly prepared aqua Regia (HNO3 + HCl) in the ratio 1:3. Analysis of the samples was done using Atomic Absorption Spectroscopy (AAS). The result obtained shows that, the level of arsenic ranged from 6.70ppm in soil from Azam and 1.00ppm from Kukar Gadu with the lowers value and in seed was found to be 3.40ppm from Bambori, not detected in kukar gadu, and has the lower value in Azbak with the value of 1.08ppm. Cadmium had the highest value in Garin Lamido with the value of 4.78ppm and lowers value in Azbak 1.58ppm in soil, and the metals in seed were found to be 2.56ppm and lower in 0.25ppm. The element Chromium (Cr) was higher in Garbi with the value of 6.67ppm and lower in Azbak with the value of 0.65ppm, in soil the value was found to be 3.40ppm and lower in 0.40ppm from Azbak, and not detected in Kukar Gadu. High level of Nickel (Ni) was found in 4.16ppm in Bambori and lower in kukar Gadu with the value of 1.87ppm, and in soil the level of nickel was found to be 1.70ppm in and lower in 0.40ppm in Azam. Lead (Pb) was found to be 3.69ppm from Azbak and lower in Garbi 0.09ppm in soil 1.56ppm deguli and not detected in Garbi, Azam, and Garin Lamido. The variation in the level of the elements in soil and beans could be attributed mostly to atmospheric deposition and the variety of the soil or legumes.*

Keywords: Analysis, Legumes, Metals, Physico-Chemical & Soil

INTRODUCTION

There has been increasing concern with regard to the accumulation of toxic heavy metals in the environment and their impact on both public health and the natural environment (Gardea Torresdey *et al* 2004). The accumulation of heavy metals in soil is becoming a serious problem as a result of industrial and agricultural practices to name but a few of the cause of pollution today. Fertilizers from sewage sludge, mining waste and paper mills all contribute to the continuous deposition of heavy metals into soils. Another point of concern is the effect of leaching on these contaminated sites which in turn contaminate 3 water tables (Gratao *et al* 2005). Large quantities of untreated municipal sewage and industrials effluent are centred directly to surface water causing rigorous pollution mainly due to heavy metals. The potential cost and environmental friendly nature have attracted increasing attention (Peraz-Sirvent *et al*., 2008). This kind of technology, known as "phytoremediation" represents a harmless and low cost technique, lacking of distinctive side effects (Cunningham and Owen, 1996). Most of the studies on phytoremediation have mainly focus on metal hyperaccumulating plant (Blaylock and Huang, 2000). Hyperaccumulator can accumulate several hundred-folds certain metals comparing normal plant species, with no adverse effect on their growth (Lasat, 2002).

Soil is a complex mixture of mineral particle that can interact with organic matter, water, air, gas and pollutants. Each of these entities will interact with one another that could alter the intrinsic values, industrial process, agricultural production, mining and human activities have results in considerable contamination of soil with heavy metals. Soil polluted with metals may threaten ecosystem and human health (Pulford and Watson, 2003). The presence of heavy metals in soil could be leached out by mobilization due to precipitation, adsorption or complexation (Impens *et al*., 1991). Traditional remediation technologies of soils contaminated with toxic metals are generally too costly, and often result in deterioration of soil properties (Meers *et al*, 2004). The potential uses of plant as a suitable vegetable cover for heavy metal-contamination land, with their lower cost and environmental friendly nature, have attracted increasing attention. (Peraz-Sirvent *et al.,* 2008). This kind of technology, known as " phytoremediation", represent a harmless and low cost technique, lacking of distinctive side effect (Cunningham and Owen, 1996). Most of the studies on phytoremediation have mainly focus on metal hyperaccumulating plants (Blaylock and Huang, 2000). Hyperaccumulators can accumulate several hundred fold certain metals comparing normal plant species, with no adverse effect on their growth (Lasat, 2002).

Statement of the Problem

Heavy metals mean serious risk in environmental pollution. Some of them are essential for many organisms in a low concentration, but the others should be toxic at low concentrations, too. The heavy metals are contacted through the food chain with living organisms. Industrial, transport and municipal waste origin effects of contaminants appear more and more in environmental pollution, and many of which earlier and nowadays got a large amount of heavy metals into the environment. Therefore, over the last few decades the trace element analytical examination of the various biological and human samples has become increasingly important, due to the high rate of the kidney and other human organs problem in the region (Gashua, Nguru and Postiskum), there is need to investigate the level of heavy metals and to enlighten public on the effect of this metals and find a proper solution to the problems.

Objectives of the study

The objectives of the study is to:

- **(i)** determine some physiochemical properties such as electrical conductivity (EC), cation exchange capacity (CEC), $_{P}$H, the soil texture, organic matter, etc of the soil that support the growth of the legume plant.
- **(ii)** determine the level of the heavy metals such as (Cr, Ni, Pb, Cd and Ar); in the Soil, Root and Shoot of the experimental legume (beans).
- **(iii)** determine the level of cations (Ca^{++}, Mg^{++}, K^{+}, and Na^{+}), and anions (Cl^{-}, NO_3^{-}, SO_4^{2-} and PO_4^{3-}) in the samples**.**
- **(iv)** compare the levels of the contaminants with WHO/FAO permissible limits.

Significance of the study

Recent concerns regarding the environment contamination have initiated the development of appropriate technologies to assess the presence and mobility in the soil. Presently, the use of plant to extract or remove organic and inorganic pollutant such as heavy metals from contaminated soil is increasing. This technology, termed as phytoremediation is environmental friendly, inexpensive and the uptake capabilities of plant root system, together with the translocation, bioaccumulation, and contaminant degradation abilities of plant have prompted the search of native and hyper accumulation plant species. This will provide information concerning the exposure index of some heavy metals and ions in the areas and provide reference data for researchers and support monitoring report of accumulation studies of these areas by the State and Federal Environmental Protection Agencies.

Scope of the study

The scope of this research work is limited to analyzing the level of some heavy metals, cations, anions and physical parameters in soil, roots and the shoots of the plant.

The Study Areas

The study areas where soil samples will collected, covered some part of Gashua (Azam, Azbak, and Garin Lamido), Nguru (Bambori, Garbi and Tukuikui), and Postikum (Deguli, Kukar Gadu and Badejo) Local Government Areas of Yobe State of Nigeria and the legume (beans) sample will be collected at Lake Chad Research Institute Maiduguri, Borno State of Nigeria.

METHODOLOGY

SAMPLE AND SAMPLING SITES

MATERIALS

The materials required for the research work include;

a) Samples; Soils (clay, sandy, loamy) and legumes

b) Reagents and Instruments;

(i) Sulphuric Acid

(ii) Hydrochloric Acid

(iii) Whatmann filter paper

(iv) Scientific caltulator

(v) Barium Chloride
(vi) Magnesium sulphate
(vii) Potassium dichromate
(viii) Ferrous ammonium sulphate
(ix) Distilled water
(x) Weighing balance
(xii) AAS Spectrophotometer machine
(xiii) GC-MS machine
(xiv) pH meter
(xv) U/V- visible
(xvi) Phosphoric acid
(xvii) Methanol RG
(xviii) 2-Aminopyridine-3-Carboxylic acid
(ix) Ethanol Absolute Reagent
(iix) 2-Aminophenol
(iiix) Dimethylformamide (DMF)

Study Areas

This study will be conducted at five (5) different villages in Gashua (Azam, Azbak, and Garin Lamido), Nguru (Bambori, Garbi and Tukuikui) and Postiskum (Deguli, Kukar Gadu and Badejo) Local Government Area of Yobe State of Nigeria.

Gashua (Azam, Azbak, and Garin Lamido) is situated along the water ways of the Yobe River, is few miles between the convergence of the Hadeja and Jama'are River. It has an average elevation of about 299m, with land mass area of 772km^2 and with a population of 139,782 (Census 2006). It has an area density greater than 181 persons per km^2. Bade and Duwai are the main local language being spoke by the local inhabitants while Fulfude, Kanuri and Hausa are use for communications purpose. Farming, Fishing and commercial activities are the main occupation practice (by populance in Gashua) as a means of living.

Nguru (or N'Gourou) (Bambori, Garbi and Tukuikui) is a Local Government Area in Yobe State, Nigeria. Its headquarters are in the town of Nguru near the Hadejia River at 12°52′45″N 10°27′09″E. It has an area of 916 km^2 and a population of 150,632 at the 2006 census. The town probably dates from around the 15th century. There is a variety of landscape types in the area, including the protected Hadejia-Nguru wetlands of Nguru Lake, and the "Sand Dunes", a semi-desert area.

Potiskum (Deguli, Kukar Gadu and Badejo) is a Local Government Area in Yobe State, Nigeria, on the A3 highway at11°43′N11°04′ECoordinates: 11°43′N 11°04′E. It had an area of 559 square kilometres (216 sq mi) and a population of 205,876 at the 2006 census. The postal code of the area is 631. Potiskum is the main settlement for the Ngizimawa, Kare-kare and Bolawa people. Potiskum has been a thriving trade hegemony in Yobe State because of its strategic position as a centre of commerce, learning, spiritual and cultural revival. People from neighbouring Borno, Jigawa, Kano, Bauchi and Gombe States, and numerous others from Niger, Chad, Cameroon, Benin and Central African Republic have stakes in the 'biggest cattle market in sub-Saharan Africa,' which is situated in Potiskum.

Samples Collection

Soil samples was collected from the study areas and labeled with a unique identification number. At the sampling sites, soil Samples was stored in cleaned polyethylene bag. The legumes (Beans) was collected at Lake Chad Research Institute, Maiduguri, Borno State of Nigeria.

Methods

Sample Preparations

Throughout the study, analytical grade reagents were used. A standard solution of the heavy metal ions was prepared from their respective nitrate salts at concentration of 1000 mg L^{-1}. Distilled water was use for stock solution preparation and dilution purposes. A solution of single and multi-component metal ions was prepared at the same concentration (20 mg L^{-1} each). pH adjustments to the desired values (2, 4, 6, 8, 10 and 12) was achieved using 0.1 N HCl or 0.01 M NaOH solution. All glassware was clean with dilute HNO_3 (10% v/v) and oven dried at 120°C before use (Lukman *et al.,* 2013).

Determination of heavy metals, cations and anions

Analysis for heavy metals was carried out directly on each final solution using Perkin Elmer Analyst 2000 Atomic Absorption Spectroscopy (AAS) in accordance with the method described by Boyd and Turker (1992).

Data Analysis

Data collected was subjected to person's correlation analysis, one-way analysis of variance (ANOVA) was used to assess whether the level of heavy metals varied significantly between the samples. Probabilities less than 0.05 ($p<0.05$) will be considered statistically significant. All statistical calculations were performed with SPSS 26.0 for windows.

Results and Discussions

Results

Physiochemical Properties of the Soil The taxonomic classification of the soil from the sampling site indicates that, the soil is clay. The soil was found slightly acidic with the pH value of 6.468. The observed pH level of the soils is generally within the range for soil in the region. Soil pH plays an important role in the sorption of heavy metals. It controls the solubility and hydrolysis of metal hydroxides, carbonates and phosphates. It also influences ion-pair formation, solubility of organic matter, as well as surface charge of Fe, Mn and Aloxides, organic matter and clay edges (S. Tokalioglu, and S. Kartal, 2006). The electrical conductivity (EC) was observed to be 0.224 mS/cm whereas the CEC value was found to be 12.984. Cation Exchange Capacity measures the ability of soils to allow for easy exchange of cations between its surface and solutions. The relatively low level of clay and CEC indicate high permeability and leachability of metals in the soil from site one.

Table 4.1 shows the different concentration of heavy metals in the sample in Azbak ward of Bade local government area of Yobe state.

Table 4.1: Comparison in total concentrations of some heavy metals

Elements	Soil	Root	Shoot	Seed
	Concentration in ppm			
Ar	3.20	2.15	2.01	1.98
Cd	1.58	1.06	0.98	0.36
Cr	0.65	0.60	0.51	0.40
Ni	2.01	1.89	1.02	1.00
Pd	3.69	2.59	1.45	0.40

Table 4.1 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Azbak ward of Bade local government area of Yobe state. The concentration of arsenic ranges from 3.20ppm in soil, 2.15ppm in root, 2.01ppm in shoot, and 1.98ppm in seed which shows the highest concentration in soil and lowest concentration in seed. The concentration of cadmium found to be 1.58ppm in soil, 1.06ppm in root, 0.98ppm in shoot, and 0.36ppm in seed, the concentration of chromium in soil 0.65ppm, 0.60ppm in root, 0.51ppm in shoot, and 0.40ppm in seed. Nickel was found to be ranges from 2.01ppm in soil, 1.89ppm in root, 1.02ppm in shoot, and 1.00ppm in seed and lead ranges from 3.69ppm soil, 2.59ppm in root, 0.45ppm in shoot, and 0.40ppm in seed respectively.

Table 4.2 shows the different concentration of heavy metals in the sample in Azam ward of Bade local government area of Yobe state.

Table 4.2: Comparison in total concentrations of some heavy metals

Elements	Soil	Root	Shoot	Seed
	Concentration in ppm			
Ar	6.70	3.15	2.98	1.08
Cd	3.58	2.06	1.98	0.56
Cr	4.65	3.60	2.51	1.40
Ni	1.98	1.04	0.98	0.40
Pd	0.69	0.09	0.05	ND

Table 4.2 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Azam ward of Bade local government area of Yobe state. The concentration of arsenic ranges from 7.00ppm in soil, 3.15ppm in root, 2.98ppm in shoot, and 1.08ppm in seed which shows the highest concentration in soil and lowest concentration in seed. The concentration of cadmium found to be 3.58ppm in soil, 2.06ppm in root, 1.98ppm in shoot, and 0.56ppm in seed, the concentration of chromium in soil 4.65ppm, 3.60ppm in root, 2.51ppm in shoot, and 1.40ppm in seed. Nickel was found to be ranges from 1.98ppm in soil, 1.04ppm in root, 0.98ppm in shoot, and 0.40ppm in seed and lead ranges from 0.69ppm soil, 0.09ppm in root, 0.05ppm in shoot, and not detected in the seed respectively.

Table 4.3 shows the different concentration of heavy metals in the sample in Garin Lamido ward of Bade local government area of Yobe state

Elements	Concentration in ppm			
	Soil	Root	Shoot	Seed
Ar	4.23	3.98	2.05	1.78
Cd	4.78	3.16	2.98	2.00
Cr	4.66	3.89	3.00	2.40
Ni	2.98	2.04	1.98	1.40
Pd	0.50	0.03	ND	ND

Table 4.3 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Garin Lamido ward of Bade local government area of Yobe state. The concentration of arsenic ranges from 4.23ppm in soil, 3.98ppm in root, 2.05ppm in shoot, and 1.78ppm in seed which shows the highest concentration in soil and lowest concentration in seed. The concentration of cadmium found to be 4.78ppm in soil, 3.16ppm in root, 2.98ppm in shoot, and 2.00ppm in seed, the concentration of chromium in soil 4.66ppm, 3.89ppm in root, 3.00ppm in shoot, and 2.40ppm in seed. Nickel was found to be ranges from 2.98ppm in soil, 2.04ppm in root, 1.98ppm in shoot, and 1.40ppm in seed and lead ranges from 0.50ppm soil, 0.03ppm in root, not detected in shoot, and not detected in the seed respectively.

Table 4.4 shows the different concentration of heavy metals in the sample in Deguli ward of Potiskum local government area of Yobe state

Table 4.4: Comparison in total concentrations of some heavy metals

Elements	Concentration in ppm			
	Soil	Root	Shoot	Seed
Ar	5.20	4.18	3.51	2.78
Cd	3.81	3.00	2.99	2.56
Cr	4.75	3.91	3.70	3.40
Ni	2.98	2.04	1.98	1.70
Pd	2.53	2.13	1.98	1.56

Table 4.4 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Deguli ward of Potiskum local government area of Yobe state. The concentration of arsenic ranges from 5.20ppm in soil, 4.18ppm in root, 3.51ppm in shoot, and 2.78ppm in seed. The concentration of cadmium found to be 3.81ppm in soil, 3.00ppm in root, 2.99ppm in shoot, and 2.56ppm in seed, the concentration of chromium in soil 4.75ppm, 3.91ppm in root, 3.70ppm in shoot, and 3.40ppm in seed. Nickel was found to be ranges from 2.98ppm in soil, 2.04ppm in root, 1.98ppm in shoot, and 1.70ppm in seed and lead ranges from 2.53ppm soil, 2.13ppm in root, 1.98ppm in shoot, and1.56ppm in the seed respectively.

Table 4.5 shows the different concentration of heavy metals in the sample in Kukar Gadu ward of Potiskum local government area of Yobe state

Table 4.5 Comparison in total concentrations of some heavy metals

	Concentration in ppm			
Elements	Soil	Root	Shoot	Seed
Ar	1.00	0.18	ND	ND
Cd	2.81	2.00	1.01	0.25
Cr	1.35	0.91	0.20	ND
Ni	1.87	1.45	1.00	0.90
Pd	1.47	1.03	0.28	0.06

Table 4.5 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Kukar Gadu ward of Potiskum local government area of Yobe state. The concentration of arsenic ranges from 1.00ppm in soil, 0.18ppm in root, not detected in shoot, and seed. The concentration of cadmium found to be 2.81ppm in soil, 2.00ppm in root, 1.01ppm in shoot, and 0.25ppm in seed, the concentration of chromium in soil 1.35ppm, 0.91ppm in root, 0.20ppm in shoot, and not detected in seed. Nickel was found to be ranges from 1.87ppm in soil, 1.45ppm in root, 1.00ppm in shoot, and 0.90ppm in seed and lead ranges from 1.47ppm soil, 1.03ppm in root, 0.28ppm in shoot, and0.06ppm in the seed respectively.

Table 4.6 shows the different concentration of heavy metals in the sample in Badejo ward of Potiskum local government area of Yobe state

	Concentration in ppm			
Elements	Soil	Root	Shoot	Seed
Ar	3.87	3.16	2.98	2.00
Cd	4.86	3.45	3.00	2.53
Cr	3.35	2.91	1.30	1.00
Ni	3.87	2.45	2.00	1.44
Pd	3.57	2.83	2.72	1.26

Table 4.6 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Badejo ward of Potiskum local government area of Yobe state. The concentration of arsenic ranges from 3.87ppm in soil, 3.16ppm in root, 2.98ppm in shoot, and2.00ppm in seed. The concentration of cadmium found to be 4.86ppm in soil, 3.45ppm in root, 3.00ppm in shoot, and 2.53ppm in seed, the concentration of chromium in soil 3.35ppm, 2.91ppm in root, 1.30ppm in shoot, and 1.00ppm in seed. Nickel was found to be ranges from 3.87ppm in soil, 2.45ppm in root, 2.00ppm in shoot, and 1.44ppm in seed and lead ranges from 3.57ppm soil, 2.83ppm in root, 2.72ppm in shoot, and 1.26ppm in the seed respectively.

Table 4.7 shows the different concentration of heavy metals in the sample in Bambori ward of Nguru local government area of Yobe state.

Elements	Concentration in ppm			
	Soil	Root	Shoot	Seed
Ar	6.27	5.15	4.23	3.40
Cd	3.00	2.26	2.00	1.56
Cr	5.65	4.10	3.21	2.40
Ni	4.16	3.89	2.62	1.60
Pd	1.69	0.59	0.45	0.20

Table 4.7 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Bambori ward of Nguru local government area of Yobe state. The concentration of arsenic ranges from 6.27ppm in soil, 5.15ppm in root, 4.23ppm in shoot, and 3.40ppm in seed which shows the highest concentration in soil and lowest concentration in seed. The concentration of cadmium found to be 3.00ppm in soil, 2.26ppm in root, 2.00ppm in shoot, and 1.56ppm in seed, the concentration of chromium in soil 5.65ppm, 4.10ppm in root, 3.21ppm in shoot, and 2.40ppm in seed. Nickel was found to be ranges from 4.16ppm in soil, 3.89ppm in root, 2.26ppm in shoot, and 1.60ppm in seed and lead ranges from 1.69ppm soil, 0.59ppm in root, 0.45ppm in shoot, and 0.20ppm in seed respectively.

Table 4.8 shows the different concentration of heavy metals in the sample in Garbi ward of Nguru local government area of Yobe state.

Elements	Concentration in ppm			
	Soil	Root	Shoot	Seed
Ar	5.40	3.15	3.00	1.08
Cd	3.68	2.96	1.08	1.00
Cr	6.67	4.90	3.51	2.40
Ni	1.98	1.54	0.99	0.70
Pd	0.09	ND	ND	ND

Table 4.8 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Garbi ward of Nguru local government area of Yobe state. The concentration of arsenic ranges from 5.40ppm in soil, 3.15ppm in root, 3.00ppm in shoot, and 1.08ppm in seed which shows the highest concentration in soil and lowest concentration in seed. The concentration of cadmium found to be 3.68ppm in soil, 2.96ppm in root, 1.08ppm in shoot, and 1.00ppm in seed, the concentration of chromium in soil 6.67ppm, 4.90ppm in root, 2.51ppm in shoot, and 2.40ppm in seed. Nickel was found to be ranges from 1.98ppm in soil, 1.54ppm in root, 0.99ppm in shoot, and 0.70ppm in seed and lead ranges from 0.09ppm soil, not detected in root, shoot, and not detected in the seed respectively.

Table 4.9 shows the different concentration of heavy metals in the sample in Tukuikui ward of Nguru local government area of Yobe state

	Concentration in ppm			
Elements	Soil	Root	Shoot	Seed
Ar	5.60	4.18	3.51	2.78
Cd	3.81	3.00	2.99	2.56
Cr	4.00	3.91	3.70	3.00
Ni	2.98	2.54	2.00	1.40
Pd	2.53	2.13	1.48	1.16

Table 4.9 shows the comparison in total concentrations of some heavy metals in soil, root, shoot, and seed sample from Tukuikui ward of Nguru local government area of Yobe state. The concentration of arsenic ranges from 5.60ppm in soil, 4.18ppm in root, 3.51ppm in shoot, and 2.78ppm in seed. The concentration of cadmium found to be 3.81ppm in soil, 3.00ppm in root, 2.99ppm in shoot, and 2.56ppm in seed, the concentration of chromium in soil 4.00ppm, 3.91ppm in root, 3.70ppm in shoot, and 3.00ppm in seed. Nickel was found to be ranges from 2.98ppm in soil, 2.54ppm in root, 2.00ppm in shoot, and 1.40ppm in seed and lead ranges from 2.53ppm soil, 2.13ppm in root, 1.48ppm in shoot, and1.66ppm in the seed respectively.

DISCUSSION

The analysis was carried out and the result were which shows the presence and absence of some heavy metals in the soil, root, shoot, and seed in the three local government areas of the state. In table 4.1 shows the level of heavy metals in soil, root, shoot, and seed sample from (Azbak, Azam, Garin Lamido) ward of Bade local government area of Yobe state.

The concentration of arsenic ranges from 3.20ppm, 5.20ppm,4.23ppm in soil, 2.15ppm, 3.15ppm, 3.98ppm in root, 2.01ppm, 2.98ppm, 2.05ppm in shoot, and 1.98ppm, 1.08ppm, 1.78ppm in seed which shows the highest concentration in Azam ward with the value of 5.20ppm, 4.23ppm in Garin Lamido and 3.20ppm in lowest concentration in seed 1.98ppm, 1.08ppm, and 1.78ppm. Arsenic is regarded as human carcinogen from extremely low levels of exposure, having no possible beneficial metabolic functions for humans (H. F. Li, S. P. McGrath, 2008). Its low level exposure cause nausea and vomiting decreased production of RBCs and WBCs, abdominal pain and its long term exposure causes darkening of skin and appearance of small corns on palm soles. Other affect includes abnormal ECG, anorexia, fever, fluid loss, goitre, hair loss, headache, herpes, im-paired healing, jaundice, keratosis, kidney and liver damage, muscle spasms, pallor, peripheral neuritis, sore throat, weakness and interferes with the uptake of folic acid (NAS/NRC, 1999). Arsenic is extremely toxic. The concentration of arsenic below the maximum permissible limit (20.0mg/kg in soil) in foodstuff (Joint FAO/WHO, 1999) cause short term (nausea, vomiting, diarrhea, weakness, and loss of appetite, cough and headache) and long term (cardiovascular diseases, diabetes and vascular diseases) health effects (M. Abbas, Z. Parveen, 2010).

Cadmium, the concentration of cadmium from the three wards was found to be 1.58ppm, 3.58ppm, 4.78ppm in soil, 1.08ppm, 2.06ppm, 3.16ppm in root, 0.98ppm, 1.98ppm, 2.98ppm in shoot, and 0.56ppm, 0.56ppm, 1.56ppm in seed, cadmium is a heavy metal naturally present in soils. It may also be added to the soil as a contaminant in fertilizer, manure, sewage sludge and from aerial deposition. The amount of cadmium contributed from each source varies with location due to differences in soil formation, management practices and exposure to pollution sources, but the level of Cd in the soil appears to be increasing over time (K. C. Jones, A. Jackson, 1992). Although plants do not require Cd for growth or reproduction, the bioaccumulation index of Cd in green plants exceeds that of all other trace elements (A. Kabata-Pendias and H. Pendias, 1992). Plants can accumulate relatively high levels of cadmium, without adverse effects on growth (T. Kuboi, A. Noguchi, 1986). Cadmium is retained for many years in the human body, so consumption of foods high in Cd may induce chronic toxicity (A. P. Jackson, and B. J. Alloway, 1992). The World Health Organization set a maximum 3-8ppm. Under such conditions, some crops such as durum wheat, flax, sunflowers and potatoes can accumulate amounts of Cd which exceed current and proposed maximum acceptable Cd concentrations. Uptake of Cd by the plant increases with increasing concentration of Cd in the soil solution and is influenced by the size and uptake characteristics of the plant root system (G. L. Mullins, and L. E. Sommers, 1986). Therefore, Cadmium accumulation in crops is a function of the complex interaction of soil, plant and environmental factors which influence Cd phytoavailability.

Nickel plays its role as a coenzyme in different enzymes. Deficiency of Ni can lead to increased blood sugar level, hypertension and deficient growth in human but increased uptake of Ni in fruits and vegetables can reduced the blood glucose level, difficulty in breathing, nausea etc. According to (ATSDR, 1999) the acceptable range of Ni daily intake is 3-7 mg/day. Ni is one of the essential element which is present in the environment in trace amount as well as it is considered as indispensable for number of metabolic reactions in living beings (P. H. Brown, R. M. Welch, 1997). Ni is usually accumulated in vegetative part of the plant body and it is mobile through the plant structure, translocated and concentrated in the leaves but after ageningness of the leaves it is moved to the seeds for accumulation (D. A. Cataldo, and T. R.Garland, 1978). In this study nickel was found to be ranges from 2.01ppm, 1.98ppm, 2.98ppm in soil, 1.89ppm, 1.04ppm, 2.04ppm in root, 1.02ppm, 0.98ppm, 1.98ppm in shoot, and 1.00ppm, 0.40ppm, 1.40ppm in seed and

Chromium is present in human tissues in variable concentrations and its deficiency is characterized by disturbance in glucose, lipid and protein metabolism (M. Schumacher, J. L. Domingo, 1993). It is an element occurring in food products of both plant and animal origins. It is regarded as an essential trace element in humans and animals, taking part in various metabolic processes. As an element, it has been reported that it is usually present in food in the trivalent form; the hexavalent form of it however, is toxic and not normally found in food (L. Noël, J. C. Leblanc, 2003). It has been reported to cause skin rashes, stomach ulcer, kidney, liver damages, lungs cancer and ultimate death (M. Z. Kirmani, S. Sheikh Mohiuddin, 2011). Chromium (VI) can easily penetrate the cell wall and exert its noxious influence in the cell itself, being also a source of various cancer diseases (United State Environmental Protection Agency, 1998). It has been reported that the daily dietary intake of 0.05-0.2 mg of chromium contributes to well being of the human. In this study the concentration of chromium in soil was found to be 0.65ppm, 4.56ppm, 4.66ppm and in root, 0.60ppm, 3.60ppm, 3.89ppm, and in shoot 0.51ppm, 2.51ppm, 3.00ppm, and 0.40ppm,1.40ppm, 2.40ppm in seed.

Lead is a serious cumulative body poison which enters into the body system through air, water and food and cannot be removed by washing fruits and vegetables (F. Itanna, 2002). Lead in some plants may probably be attributed to pollutants in irrigation water, soil or due to pollution from the highways traffic (M. K. Ladipo and V. F. Doherty, 2011). In many plants, Pb accumulation can exceed several hundred times the threshold of maximum level permissible for human consumption (F. Muhammad, and A. Farooq, 2008). The contamination of agricultural soils is often a direct or indirect consequence of anthropogenic activities (M. J. McLaughlin, D. R. Parker,). Trace elements are the natural constituents of the soil and due the variation in atmospheric condition their plant uptake equally varies through root to the shoot (M. B. McBride, 2003). Other sources of anthropogenic contamination include the addition of manures, sewage sludge, fertilizers and pesticides to soils, with a number of studies identifying the risks in relation to increased soil metal concentration and consequent crop uptake (M. B. McBride, 2003, M. S. Whatmuff, 2002). The levels observed however, in this study, were lower than the WHO safe limit of 2.0 mg kg-1 (M. Muchuweti, and J. W. Birkett, 2006), which ranges from 0.69ppm, 0.69ppm, 0.50ppm soil, 0.59ppm, 0.59ppm, 0.03ppm in root, 0.45ppm, 0.05ppm, and not detected in Garin Lamido in shoot, and 0.40ppm, and not detected in Azam and Garin Lamido in seed respectively.

SUMMARY, CONCLUSION, AND RECOMMENDATION

SUMMARY

The concentration of arsenic from bade local government area of yobe state from the three wards which consists of (Azbak, Azam, and Garin Lamido) has the value of 3.20ppm, 6.70ppm, 4.23ppm which is higher than that of potiskum (deguli, kukar gadu, and badejo) with the values of 5.20ppm, 1.00ppm, and 3.87ppm but lower than that of nguru(Bambori, Garbi, and tukuikui) with the values of 6.27ppm, 5.40ppm and 5.60ppm respectively, but all are below the permissible limit of WHO with the value of 20.00ppm in soil. The concentration of arsenic seed from the three local government areas were all below the permissible limit of WHO 18 - 480µg/kg, the seed contain the values of 1.98ppm, 1.08ppm, and 1.78ppm from (Azbak, Azam and Garin Lamido) and 2.78ppm, not detected in kukar gadu and 2.00ppm in badejo of potiskum and 3.40ppm, 1.08ppm, 2.78ppm from Bambori, Garbi and tukuikui of nguru. The concentration of Cd in soil were found to be (3.81ppm in deguli, 2.81ppm in kukar gadu and 4.86ppm in badejo), (3.00ppm in Bambori, 3.68ppm in Garbi and 3.81ppm in tukuikui) and (1.58ppm in Azbak, 3.56ppm in Azam, and 4.78ppm in Garin Lamido) that of seed are 0.56ppm in Azbak, 1.08ppm in Azam,and 4.23ppm in Garin Lamido in soil and in seed 0.35ppm in Azbak, 0.56ppm in Azam, 2.00ppm in Garin Lamido, and 2.50ppmin deguli, 0.25ppm in kukar gadu, 2.53ppm in badejo and 1.56ppm in Bambori, 1.00ppm in Garbi, 2.56ppm in tukuikui and the concentration of Cr in soil was found to be 0.65ppm in Azbak, and that of seed is 0.40ppm, 4.65ppm and 1.40ppm in Azam, 4.66ppm, 2.40ppm in Garin Lamido, deguli 4.75ppm, 3.40ppm, kukar gadu 1.35ppm and not detected in seed, badejo 3.35ppm and 1.00ppm, Bambori 5.65ppm, 2.40ppm, Garbi 6.67ppm, 2.40ppm and tukuikui 4.00ppm 3.00ppm and the concentration of nickel are 2.01ppm, 1.98ppm, 2.98ppm in soil and seed 1.00ppm, 0.40ppm, and 1.40ppm (Azbak, Azam, and Garin Lamido), that of deguli, badejo, and Garin Lamido are 2.98ppm, 1.87ppm and 3.87ppm in soil and seed 1.70ppm, 0.90ppm, 1.44ppm and Bambori, Garbi and tukuikui are 4.16ppm, 1.98ppm, 2.98ppm, in soil and seed 1.60ppm, 0.70ppm, and 1.40ppm respectively and Pb which found to be 3.69ppm, 0.69ppm, and 0.50ppm in Azbak, Azam and Garin Lamido and 2.53ppm, 1.47ppm, 3.57ppm in deguli, kukar gadu and badejo, in Bambori, Garbi and tukuikui are 1.69ppm, 0.09ppm, and 2.53ppm in soil. The seed contain 0.40ppm, not detected in both Azam and Garin Lamido, in deguli, kukar gadu and badejo are 1.56ppm, 0.06ppm and 1.26ppm and in Bambori, Garbi and tukuikui were found to be 0.20ppm, not detected in deguli and 1.16ppm in tukuikui respectively.

CONCLUSION

From this study, it can be concluded that, the soil from bade (Azam, Azbak, and Garin Lamido), potiskum (Deguli, Kukar Gadu and Badejo), and nguru (Bambori, Garbi and Tukuikui) site is safe for farming and the legumes (beans) is safe consumption, this indicates below maximum permissible limits, this could be due to atmospheric deposits. Generally, the variation in the levels of the metals could be attributed mostly to atmospheric deposition

REFEREENCE

A. Kabata-Pendias and H. Pendias, (1992). Trace elements in soils and plants. Chpt. 5. CRC Press, Boca Raton, FL. 1992.

A. P. Jackson, and B. J. Alloway, (1992). The transfer of cadmium from agricultural soils to the human food chain. Pages 109–158 in D. C. Adriano, ed. Biogeochemistry of trace metals. Lewis Publishers, Boca Raton, FL. 1992.

B. Freedman and T.C. (1980). Hutchinson, Pollutant inputs from the atmosphere in soils and vegetation near a nickel, copper smelter at Sudburg, Canada. *Canadian journal of botany*, 58, 1980, 108-132

Bhatkhande, C.Y.; Joglekar, V.D. (1977). "Fatal poisoning by potassium in human and rabbit". Forensic Science. 9 (1): 33–36. doi:10.1016/0300-9432(77)90062-0. ISSN 0300-9432. PMID 838413.

D. A. Cataldo, T. R.Garland and R. E. Wildung, Nickel in plants. Plant Physiology. 62, 1978, 563-570 [37]. S. Singh, M. Zacharias, S. Kalpana, and S. Mishra, Heavy metals accumulation and distribution pattern in different vegetable crops. Journal of Environmental Chemistry and Ecotoxicology Vol. 4(10), 2012, pp. 170177.

F. Muhammad, A. Farooq and R. Umer,(2008). Appraisal of Heavy Metal Contents in different Vegetables grown in the Vicinity of an Industrial Area. Pakistan Journal of Botany, 40(5), 2008, 2099-2106

G. L. Mullins, L. E. Sommers and S. A. Barber, (1986). Modelling the plant uptake of cadmium and zinc from soils treated with sewage sludge. Soil Science Society of America Journal, 50, 1986, 1245–1250.

I*nstitute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D Calcium; Ross, A. C.; Taylor, C. L.; Yaktine, A. L.; Del Valle, H. B. (2011).* Dietary Reference Intakes for Calcium and

Vitamin D, Chapter 6 Tolerable Upper Intake Levels pages 403–456. *Washington, D.C: National Academies Press.* doi:10.17226/13050. ISBN 978-0-309-16394-1. PMID 21796828.

K. C. Jones, A. Jackson, and A. E. (1992). Johnston, Evidence for an increase in the Cd content of herbage since 1860's. Environmental Science and Technology, 26, 1992, 834–836.

L. Noël, J. C. Leblanc, T. Guérin, (2003). Determination of several elements in duplicate meals from catering establishments using closed vessel microwave digestion with inductively coupled plasma mass spectrometry detection: estimation of daily dietary intake. Food Additives & Contaminants, 20, 2003, 44– 56.

Lorient, Denis; Linden, G. (1999). New ingredients in food processing: biochemistry and agriculture*. Boca Raton: CRC Press. p.* 357. ISBN 978-1-85573-443-2*. ... in dietary food containing potassium chloride, thaumatin added in the ratio of 1 ppm considerably reduces the sensation of bitterness. ...*

M. Abbas, Z. Parveen, M. Iqbal, and Riazuddin, (2010). Monitoring Of Toxic Metals (Cadmium, Lead, Arsenic and Mercury) In Vegetables Of Sindh, Pakistan, Kathmandu University, Journal Of Science, Engineering And Technology, Vol. 6, No. II, 2010, Pp 60-65

M. B. McBride, (2003).'Toxic metals in sewage sludgeamended soils: has promotion of beneficial use discounted the risks?' Advances in Environmental Research, 8, 2003, 5–19

M. J. McLaughlin, D. R. Parker and J. M. (1999). Clarke 'Metals and micronutrients – food safety issues', Field Crops Research, 60, 1999, 143–163.

M. K. Ladipo and V. F.(2011). Doherty, Heavy Metals Levels in Vegetables from selected Markets in Lagos, Nigeria. *African Journal of Food Science and Technology*. 2(1), 2011, 018-021

M. Muchuweti, J. W. Birkett, E. Chinyanga, R. Zvauya, M. D. Scrimshaw, J. N. Lester, (2006). Heavy metal content of vegetables irrigated with mixtures of wastewater and sewage sludge in Zimbabwe: Implications for human health. Agriculture, Ecosystems & Environment 112, 2006, 41–48.

M. S. Whatmuff, (2002). 'Applying biosolids to acid soil in New SouthWales: Are guideline soil metal limits from other countries appropriate?', Australian Journal of Soil Research, 40, 2002, 1041–1056.

M. Schumacher, J. L. Domingo, J.M. Llobet and J. Cobella, (1998). Chromium copper and zinc concentrations in edible vegetables grown in tarragona province Spain. Ull. Environmental Contamination and Toxicology, 50, 1993, 514-521.

M. Z. Kirmani, S. Sheikh Mohiuddin, F. Naz, I. I. Naqvi and E. (2001). Zahir, Determination of some toxic and essential trace metals in some medicinal and edible plants of Karachi city Pakistan, Journal of Basic and Applied Sciences, Vol. 7, No. 2, 2011, pp. 89-95.

Nutrition, Center for Food Safety and Applied. "GRAS Substances (SCOGS) Database - Select Committee on GRAS Substances (SCOGS) Opinion: Potassium chloride"*. www.fda.gov. Archived from* the original *on 31 October 2017*. Retrieved 21 July 2019*.*

S. Tokalioglu, S. Kartal and A. Gültekin, (2006). Investigation of heavy-metal uptake by vegetables growing in contaminated soils using the modified BCR sequential extraction method. International journal of environmental analytical chemistry. 86 (6), 2006, 417430

Sinopoli, Dominique A.; Lawless, Harry T. (2012). "Taste Properties of Potassium Chloride Alone and in Mixtures with Sodium Chloride Using a Check-All-That-Apply Method". Journal of Food Science. 77 (9): S319–22. doi:10.1111/j.1750-3841.201PMID 229010842.02862.x..

T. Kuboi, A. Noguchi, and J. Yazaki, (1986). Family dependent cadmium accumulation characteristics in higher plants. Plant Soil 92, 1986, 405–415.

Weast, Robert (1984). CRC, Handbook of Chemistry and Physics. Boca Raton, Florida: Chemical Rubber Company Publishing. pp. E110. ISBN 0-8493-0464-4*.*

World Health Organization *(2019). World Health Organization model list of essential medicines: 21st list 2019. Geneva: World Health Organization.* hdl*:*10665/325771*. WHO/MVP/EMP/IAU/2019.06. License: CC BY-NC-SA 3.0 IGO.*