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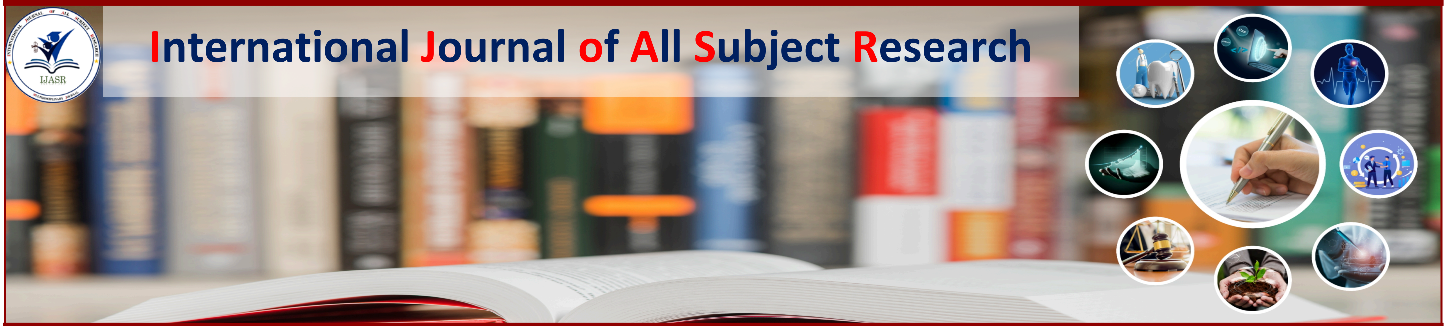

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Physical and Chemical Condition, Metal Material, and Possible Environmental Risk of Hydrated Peri-Urban Farms in Ilorin, North-Central, Nigeria

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Abstract
Standard analytical techniques were used to examine the physicochemical features of soils and irrigation water as well as a few specific heavy metals in thirteen peri-urban garden soils in Ilorin, Kwara State. The analyses were conducted to look into the soils and irrigation water of the gardens' potential ecological risks. The findings demonstrated that, with the exception of turbidity (88.67 mg/l), which was greater than the advised standard limit, all of the examined physicochemical parameters for agricultural soils and water were within the WHO standard limits. The majority of the water samples utilized for irrigation in both seasons were contaminated with cadmium and lead, and the soils indicated a potential for substantial cadmium deposition. This suggested there may be a health risk from eating crops that have been irrigated using water from these sources When the study's data were analyzed, it was discovered that there were substantial variations in the parameters between sites and seasons (p 0.05). There were also generally low to moderate potential ecological concerns associated with metals in soils across sites. From site to site and from one season to the next, the physicochemical characteristics and heavy metal concentrations of the soils and irrigation water used in the gardens exhibited noticeable fluctuations and non-uniform distribution.

Keywords: Heavy metals, possible ecological concern, and irrigation water are among the physicochemical factors

Introduction

Due to the potential risk to both human life and ecosystems, human activity in peri-urban areas has drawn a lot of attention. According to reports, industrialization, urbanization, deforestation, and a number of agricultural practices all contribute to the environment's toxic chemical loads, which have a serious negative impact on the ecosystem's flora, fauna, food webs, and ecosystem function (Afyuni, 2001; Afshari *et al*., 2016).

Urbanization and other anthropogenic activities have been implicated in a significant amount of the heavy metal contamination in peri-urban areas, which has a significant impact on the physicochemical variability of the soil and water (Burmamu *et al*., 2014). According to a study by Moradie *et al*. (2016), heavy metals' interactions with soil and water may alter their physicochemical characteristics and have a negative impact on plants, animals, and people via the food chain. According to Michael (1999), there is a correlation between irrigation water's physical and chemical characteristics and its quality. According to the researcher, if the values do not fall within the acceptable limits for agricultural irrigation Water, the growth of the plants may be influenced (Zhang *et al*., 2011).

The purposes of this study were to evaluate the physiochemical characteristics of the soils and irrigation water utilized in these gardens, to identify the main sources of heavy metal pollution, and to look into the potential ecological concerns associated with specific heavy metals present in these gardens.

Materials and Methods

Soil Sampling and Analysis: A stainless steel shovel was used to remove three to five subsoils from the topsoil (0-15 cm) at each sampling location. Each site yielded one kilogram of topsoil. A composite sample was created by thoroughly combining these sub-samples. Each sample was transferred to the lab in a zipped-lock polyethylene bag that was clearly labeled. To eliminate unwanted particles and components, the soil samples were sieved through a 2 mm nylon mesh in the lab after being oven-dried at 80°C for 72 hours. For additional analysis, the dried soils were put through 63 m sieves and stored in the refrigerator (USEPA, 2016).

Physicochemical Analysis of Soil: The pH was measured using the Brady and Weil (1999) method, and the soil's physicochemical composition was examined. The soil's texture was assessed qualitatively by touching and quantitatively by hydrometer. To calculate the Bulk Density, the Cresswell and Hamilton (2002) approach was used; Using

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Jenway 4010 Conductivity, electrical conductivity was determined according to Brady and Weil's (1999) approach; Brady and Weil (1999) technique was used to measure soil moisture content; The method of Shailesh *et al*.,1997 was used to calculate the total acid value. Organic matter was calculated using Reddy's (2002) Ignition method. Total nitrogen content was calculated using Bremner and Mulvaney's (1982) method. Exchangeable cations (Ca2+, Mg2+, Na+, and K+) were calculated using Thomas' (1983) method. Available phosphorus (AP) was spectrophotometrically analyzed using Dick

Sampling and Analysis of Water: Before collection, sample bottles were labeled, cleaned, and rinsed several times with deionized water. At each irrigation water source in the research locations, a representative one-litre water sample was taken in triplicate from six different places. For further investigation, the samples were brought to the lab and kept in the refrigerator at 4 C. With the addition of a few drops of sulphuric acid (H2SO4), the water samples were made acidic.

Heavy Metal Analysis of Soil and Water Samples: In order to remove the heavy metals, a wet digestion method (3:1) with 65% nitric acid and 37% hydrochloric acid was used (Burt *et al*., 2003).Using a PerkinElmer Analyst 200 Atomic Absorption Spectrophotometer, the amounts of three chosen heavy metals-copper, cadmium, and lead (Cd, Cu, and Pb)-in soil and water samples were examined.

Discussion

The physical, chemical, and heavy metal composition of the soil samples from both seasons revealed that the soil texture ranged from loamy-sandy to sandy loamy, indicating that the soils are descended from a single common parent. This study's findings echo those of Jones and Wild (1975), who claimed that the cultivated soils in West Africa's savannah region are primarily loamy sand to sandy loam in composition. The soils in this study are distinguished by low to moderate moisture content between sites and seasons, with higher moisture content in the rainy season than in the dry season, demonstrating seasonal change in the moisture content of soils between sites. According to Udo *et al*. (2007), the sites' soil moisture content in both seasons fell below the range that is acceptable for agricultural soils (21-80%). The colloidal characteristics and aggregation of the soil attributes of the soils may differ, which may account for this. According to Njoyim *et al*. (2016), the soils at the study sites had a pH range of 6.59 to 7.18, which fell within the range of 6.5 to 8.0 that is acceptable for agricultural soil. The soils were classified as slightly acidic to slightly alkaline, with the soils of the rainy season being slightly more acidic than the soils of the rainy season. This could be caused by the increased levels of organic matter decomposing in soil during the rainy season, which could have produced more carbon dioxide and hydrogen ions (H+). Decomposing organic matter may also have combined with water in the soil to produce weak acids termed carbonic acid. (2004) Tematio *et al*. Different soil particles, pH levels, and organic matter concentrations could be to blame for the disparity. The nitrogen content of the soils in this study was lower than the values found in the work of Abdulkareem *et al*. (2012), which found higher nitrogen levels in a few garden soil samples in the Giabshi and KofarKware areas of the Sokoto metropolis, but lower nitrogen levels than the permitted limit of 4.6% for agricultural soil. The results can change as a result of a higher rate of organic and inorganic fertilizer application in the research area's soils.

In comparison to the wet season (178.6617.15 and 194.334.60 mS/m), the range of soil electrical conductivity was somewhat higher in soils between sites during the dry season (171.85 0.51 and 199.100.10 mS/m). Both seasons' average electrical conductivity ratings for soils were all below the 250 mS/m safe limit for agricultural soil. poor effective nitrogen availability in the soils of the study sites was indicated by the soils' poor electrical conductivity. With all measurements falling below the acceptable level for agricultural soil, 2 dSm-1 or 200 mS/m, the soils at the research locations could be classified as non-saline. It has been stated that soils with 2.5 dSm-1 or 250mS/m (2 dSm-1 or 250mS/m) are appropriate or good for agricultural use.

Conclusion

A majority of the physicochemical parameters of soil samples in both seasons were found to be within the FAO and WHO permissible limits for agricultural soils, according to experimental findings, but some water samples had values that were above the safe limits for irrigation or agricultural activities. Through parameter interactions, the soil quality and irrigation water productivity were shown by this study. Between locations and seasons, irrigation water's physicochemical characteristics varied significantly.

The study also revealed that, although most of the parameters compared favorably with acceptable standards for agricultural purposes, some parameters in some soils and irrigation water of the sites or gardens and seasons showed levels above acceptable limits. These variations in the parameters between sites and seasons were only marginal, at p 0.05. In order to prevent heavy metal bioaccumulation by plants, it is crucial to advise against activities that may result in deviation from the permitted values of the parameters for adequate water for irrigation. Although the irrigation water sources were heavily contaminated with Cd and Pb, the selected heavy metals exhibited low to moderate potential ecological harm in soils in both seasons. The report recommends proper waste disposal, regular examination of the quality of irrigation water and agricultural soils, and regular monitoring of activity at agricultural locations. These will assist in preventing high values of the physicochemical characteristics of the soils and water that are beyond the permitted limits, preventing potential risk of the heavy metals in those places, reducing the negative impacts on health via agronomy, and also protecting the environmental quality for improved sustainability.

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