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Proximate Analysis of Ipomea Batatass L. Grown in Two Different Zones in Imo State

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Abstract

Proximate analysis of *Ipomea batatass* L. grown in two different locations in Imo State were investigated. Standard soil analytical method was used to determine the physiochemical contents of the two soil sample collected from Mgbidi and Orji *Ipomea batatass* L. farm land. The soil sand from *Ipomea batatass* L. root in Orji farm recorded highest percentage value of 75.00% compared to the soil sand *Ipomea batatass* L. root in Mgbidi farm with 27.00% value. The percentage value of silt was different as the soil *Ipomea batatass* L. root in Mgbidi farm had high value of 29.40% while soil silt of *Ipomea batatass* L. root in Orji farm had 13.40%. The soil clay, pH, Phosphorus and Nitrogen from *Ipomea batatass* L. root in Mgbidi farm recorded highest percentage value of 43.60%, 5.7, 23.20 and 0.35 compared to the soil sand *Ipomea* root in Orji farm with 11.60%, 5.4, 16.70 and 0.09 value respectively. Ca, Mg, K, and Na analyzed followed the same trend as the soil from *Ipomea* root in Mgbidi farm had high percentage value of Ca (10.00), Mg (1.60), K (0.54) and Na (0.43) respectively. The systematic study of physiochemical of the *Ipomea* soils could help in understanding the nutritional composition, the basic characteristics of the soils and the constraints associated with the management of the soils from the two locations.

Keywords: Proximate Analysis, *Ipomea batatass*, Different Zones.

Major classification: Health Science.

1. Introduction

There were marked variations in mineral nutrients composition in seeds of *Gnetum africanum* and *Telfairia occidentalis* from two ecological zones. Variations in nutrient contents in plants due to ecophysiological factors have been reported (Osim, Odoemena, Etukudo, Okonwu, & Eremrena, 2010; Apoxi, Long, Castro, & Orakor, 2000). The nutrient composition of plant materials vary with age, cultural practices, environment, the season and the varieties (Apoxi et al., 2000). Similarly, different plants and even different parts of some plant species differ widely in the amount of various elements which they absorb (Agbede, 2009). Mineral elements play different but important roles in plants, some of which include structural, catalytic and electro-chemical functions (Anoliefo, 2006). Structurally, elements may be incorporated into the chemical structure of biological molecules or become part of a structural polymer needed for membrane, while in catalysis, elements are involved in the active sites of enzymes and the enzyme reactions (Anoliefo, 2006).

An interplay between nutrient status of soil and soil pH has been identified as a contributory factor to metabolic status in plants, thus the building up of complex molecules (Agbede, 2009). High pH can decrease the solubility of nutrient elements such as Fe, Mn, Zn and B in growth medium and this induces deficiencies for macro-nutrients and toxicity of nutrient elements such as Al (Anoliefo, 2006; Etukudo, Ilesanmi, Stephen, 2015). In addition, transport of some nutrients may be affected by competition between cation resulting in nutrient deficiency. Thus, uptake of Mg2+ has been shown to be seriously affected by any excess of other cations especially of K+ and NH4 + while high level of Zn, Mo, Cu, and Mn interfere with the translocation of Fe in plants (Etukudo et al., 2015; Pajevic, Vasic, & Sckulic, 2004). Therefore, an interaction between soil factors might have contributed significantly to the differences in nutrients composition between the ecotypes. The physiological reaction of mineral salts has been identified as one of the major factors determining the uptake of nutrients by plant, hence may affect the nutritional values and essential biochemical attributes in plant parts (Munns, James, Lauchi, 2001, Osim et al., 2010; Rengasamy, 2006). High salt availability to plant has been shown to be one the contributing factors to increase in protein synthesis. Complex molecules such as carbohydrate and proteins play some crucial roles in the body of plants. Carbohydrate constitutes the supporting framework of plant in the form of cellulose, and help plants store
the abundant energy, which are trapped in the product of photosynthesis (Anoliefo, 2006; Esenowo, 2004). Proteins are an essential part of the metabolic machinery with catalytic activities, and contribute to the structural intergrity of membranes (Anoliefo, 2006; Esenowo, 2004).

This investigation was undertaken with the aim based on the ecophysiological studies on physiochemical content of potato specie from two ecological zones in Imo State. Specific objectives are: (a) to determine the physiochemical content of soil sample around *Ipomea batatass* L. root from Mgbidi and Orji in Imo State.
(b) to determine and compare the nutritional composition of *Ipomea batatass* L. harvested from Mgbidi and Orji in Imo State.

2. Materials and Methods

2.1. Study Area

The research was carried out in Orji and Mgbidi ecological zones of Imo State, Nigeria. Imo State is situated between latitude $4^0 45^1 5.5037^0$N and $7^0 15^1 6.453^0$N and longitude $6^0 50^1 7.0438^0$E and $7^0 25^1 8.1330^0$E. The area has an annual rainfall of about 2500mm, temperature range from 270C to 300C with a relative humidity of 75%.

2.2. Collection of Samples

Tubers of *Ipomea batatass* L. (sweet potatoes) were collected from two ecological zones of Orji and Mgbidi in Imo State. Similarly, soil samples of these ecological zones were collected to determine their physiochemical properties. Each treatment was replicated five times using completely randomized design.

2.3. Analysis of Soil samples / Soil Physiochemical analysis

Top soils of about 0-15cm depth collected from the study area were analysed for soil-chemical properties (pH, available P, total N, organic C, Ca, Mg, Na, and K) using standard procedures (A.O.A.C, 1999).

2.4. Determination of Nutrient Contents of Plant Material

In the determination of mineral nutrients, tubers of the test crop were harvested, rinsed with distilled water and dried. Pestle and mortar was used to grind the dried tubers of each sample into powdered form. Fine powdered form of the sample was obtained by sieving it through a 0.002mm wire mesh. The fine powdered form of each sample was kept in small bottles for analysis. Standard methods of Hack (2000) and A.O.A.C. (1999) were used for the determination. Total nitrogen concentration in plant dry matter was estimated by standard Micro Kjeldahl method. Phosphorus was assayed spectrophotometrically by ammonium-vanadate-molybdate method, potassium by using a frame photometer and other elements by atomic absorption spectrophotometer. Proximate compositions of the tubers were determined using standard methods (A.O.A.C. 1999).

2.5. Proximate Analysis

The following were obtained: Moiture Content Determination, Crude Protein Determination, Fat Content, Carbohydrate Content

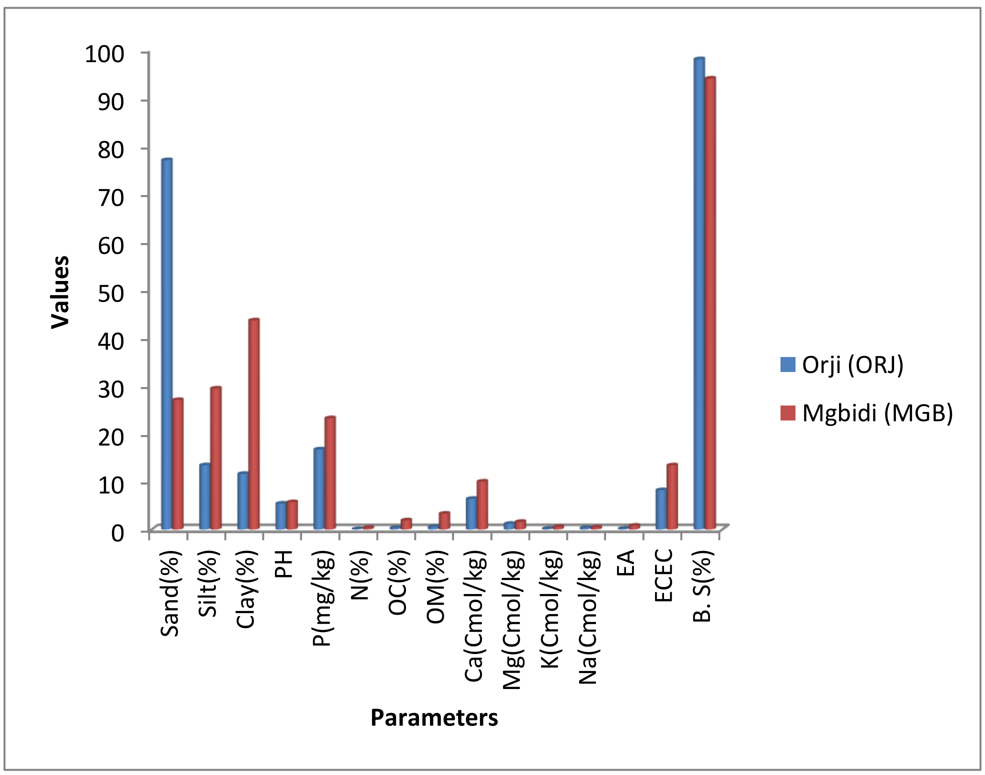
2.5. Statistical Analysis

Standard errors of the mean values were calculated for the separate readings and data were subjected to analysis of variance (ANOVA) to compare the means at 0.05 confident intervals (Obi, 2002).

3. Results

The soil physiochemical of two areas Orji (ORJ) and Mgbidi (MGB) were investigated and summarized and illustrated in Figure 1. The soil pH was 5.4 for ORJ and 5.7 for MGB. The percentage of sand was 75% in ORJ and 27% MGB (Fig.1). The silt percentage was 13.40% and 29.40% in ORJ and MGB respectively. The percentage of clay was 11.60% in ORJ and 43.60% in MGB (Fig.1). Soil texture was sandy-loamy in ORJ but clay in MGB. The Phosphorous concentration in ORJ was 16.70mg/kg while in MGB 23.20mg/kg. Also, the concentration of Calcium (Ca) was 6.40 Cmol/kg and 10 Cmol/kg in ORJ and MGB respectively (Fig.1). Magnesium (Mg) concentration was 1.20 Cmol/kg in ORJ but 1.60 Cmol/kg in MGB. The concentration of Potassium (K) recorded was 0.153 Cmol/kg in ORJ while 0.546 Cmol/kg in MGB. The Sodium (Na) concentration varied from 0.304 Cmol/kg in ORJ to 0.435 Cmol/kg in MGB. Active Energy (EA) concentration was 0.16 Cmol/kg in ORJ but 0.80 Cmol/kg in MGB. The concentration of Effective Cation Exchange Capacity (ECEC) was recorded as 8.21 in ORJ and 13.38 in MGB (Fig.1). The B. S. percentage was 98.05% in ORJ and 94.02% in MGB (Fig.1).

The proximate analysis of *Ipomea batatass* L. obtained from the two locations (Orji and Mgbidi) was summarized and shown in Figure 2. Proximate analysis of the sample was carried out and the following were presented: Moisture, crude protein, carbohydrate, ash and fibre while crude fat was absent in the two samples. Moisture content was 64.60% in ORJ, and 63.63% in MGB. Crude protein was 0.42%in ORJ and 1.82 % in MGB. In ORJ, total ash content was 0.48% while it was 0.98% in MGB (Fig.2). Fibre content was recorded as 0.50% in ORJ while 0.97% in MGB (Fig.2).



K-Potassium, N- Nitrogen, OC-Organic Carbon, OM- Organic Matter, Ca-Calcium, Mg-Magnesium, P-Phosphorus, Na-Sodium

Figure 1: Soil Physico Chemical properties of two soil samples from Orji and Mgbidi

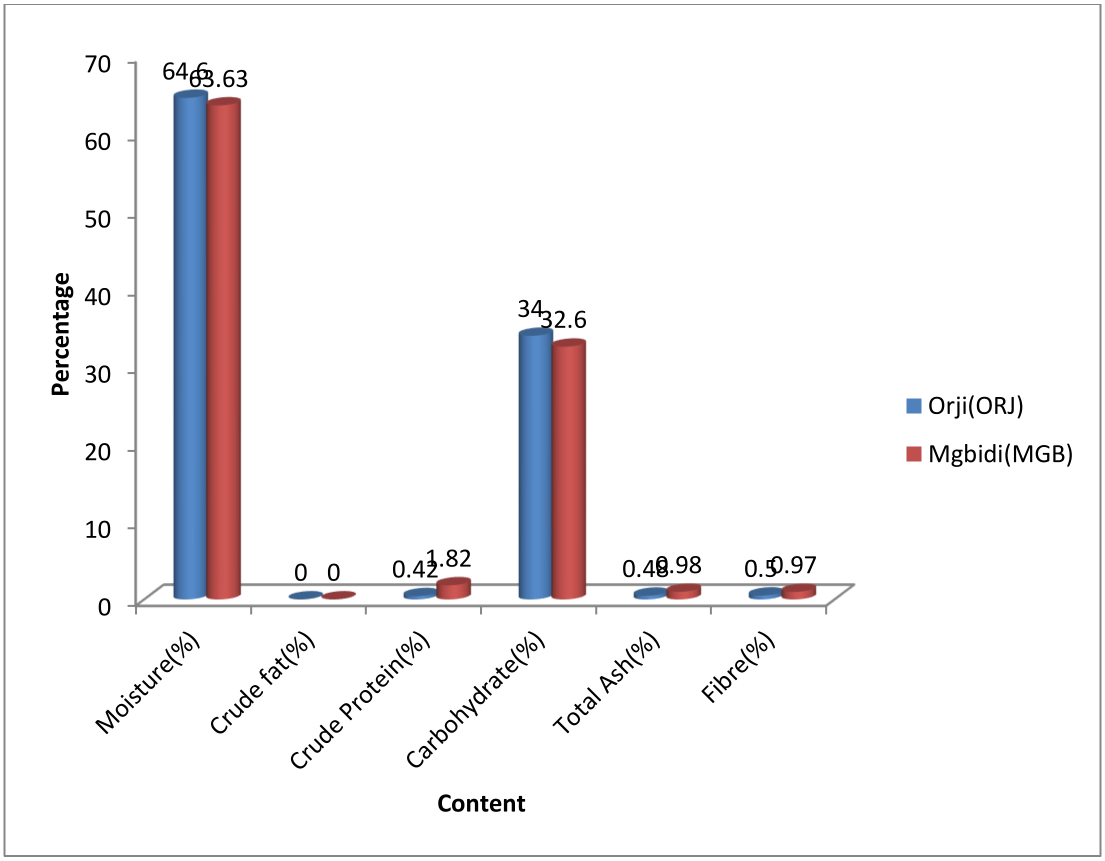


Figure2: Proximate Analysis of Sweet Potato from two locations in Imo state

3. Discussion

The physiochemical observation of two different agricultural locations in Imo State showed that Orji (ORJ) had sand 75%, silt 13.40%, and clay 11.60% and for Mgbidi (MGB), the sand 27%, silt 29.40% and clay 43.60%. In this study, the nature of the soil in the two areas indicates ORJ is sandy-loamy while MGB is clay. The soil textures of the areas were sandy-loamy in ORJ and clay in MGB. The result showed that MGB soil has the greater capacity to hold water than ORJ soil. According to Brady (1996), the soil with high percentage of clay has the potential to hold more water. Sandy soil retain little water, thus percolation of water through it is high (Ahn, 1993). The soil pH indicated that ORJ (5.4) and MGB (5.7) were acidic in nature. The acidic nature of soil plays an important role in the metal bioavailability to plant, toxicity and leaching capacity of soil to surrounding area (Hartemink, 2006). According to Arias, Gonzalez-Perez, Gonzalez-Villa, and Ball (2005), soil pH (acidity and alkalinity) play the greatest influence on availability of nutrients to plants and the type of organism found in the soil. Therefore, soil pH determines the diversity and number of organisms found in the soil. According to Edoris and Iyama (2017), areas with high rainfall, soil tend to be more acidic in nature. The two areas under review fall within the region known for heavy rainfall. This can account for their soil acidic nature.

The Phosphorous and Nitrogen concentration of MGB (23.20mg/kg, 0,350%) were higher when compared with that obtained from ORJ (16.70mg/kg, 0.098%). Nitrogen is required for proper growth of plant (Edoris & Iyama, 2017). According to Lamb, Fernandez, and Daniel (2014) when Nitrogen is present in the soil, it undergoes different transformation which determines its availability to plants. Phosphorous promotes plant growth in soils. Inadequate phosphorous in the soil leads to plants suffer, growth will be stunted, leaves colour changes to purple and flowering time and growth of new shoots are delayed (Sideman, 2010).

The organic carbon content was higher in MGB (1.91%) than in ORJ (0.31%). Similarly, the organic matter was recorded higher in MGB (3.30%) than in ORJ (0.54%). According to Edori and Iyama (2017) organic carbon, organic matter and total hydrocarbon are used to express the organic richness of the soil. Therefore, this study revealed that MGB soil has richer organic component than ORJ. The amount of total organic matter in any soil determines the nutrient content and any changes will alter the quality and quantity of soil fertility (Edori & Iyama, 2017). Thus, MGB soil contains more nutrient than ORJ soil.
The metal content recorded included Calcium (Ca), Magnesium (Mg), Potassium (K) and Sodium (Na) in the two areas sampled. All the metals were observed to be significantly higher in MGB soil than ORJ. This indicates that soil metallic content is higher in clay soil than sandy-loamy soil. Similarly, Active Energy and Effective Cation Exchange Capacity of MGB soil (0.80 Cmol/kg, 13.38) were significantly higher than ORJ soil (0.16 Cmol/kg, 8.21). This showed that the greater the Effective Cation Exchange Capacity, the greater the clays and organic matter content. The physiochemical properties showed that MGB soil is more preferred for agricultural purposes than ORJ soil.

The moisture content of the *Ipomea batatass* L. indicated that they contain high moisture. The moisture was higher in ORJ (64.60%) than in MGB (63.63%). The high moisture content of the two *Ipomea batatass* L. indicates they are suitable for microbial attack and easily spoiled during storage. The high moisture content recorded in this study agreed with some report by researchers. In their study, Endrias, Negussie, and Gulelat (2016) reported moisture content ranging from 68.58% to 76.97% in some varieties of sweet potato they studied. There was no crude fat present in the *Ipomea* samples investigated. Similar result was reported by Rodrigues, Barbosa Jr, and Barbosa (2016) in their work on various varieties of potatoes. The crude protein content of MGB *Ipomea* (1.82%) was significantly higher than that of ORJ *Ipomea* (0.42%). The difference in protein could be as a result of environmental factor. MGB soil contains higher organic matter and organic carbon in their soil than ORJ, thus, indicating greater soil fertility. The protein content of *Ipomea* in this study is below the recommended daily requirement of 45 – 50% for a healthy person (Fisher & Bender, 1972), therefore, *Ipomea batatass* L. cannot be said to be a good source of protein. Similarly, total ash content of MGB (0.98%0 was significantly higher compared to that of ORJ (0.48%). Also, the crude fibre content was observed to be significantly higher in MGB (0.97%) compared to ORJ (0.50%). The presence of fibre in *Ipomea batatass* L. has been reported by authors such as Endrias et al. (2016) and Olayiwola, Abubakar, Adebayo, and Oladipo (2009). The fibre content of *Ipomea batatass* L. is not high.

The carbohydrate content was higher in ORJ *Ipomea batatass* L. (34.00%) than in MGB *Ipomea batatass* L. (32.60%). The high content of Carbohydrate suggested that potato is a good source of Carbohydrate. The main function of dietary Carbohydrate is simple energy (UNICEF, 2000). The Carbohydrate recorded in the study is higher than that reported by some authors in sweet potato. Wenkam (1983) stated that *Ipomea batatass* L. contains 27% of Carbohydrates, FAO (2001) reported 28% Carbohydrate while Mohammad, Ziaul, and Sheikh (2016) reported between 21 – 25% Carbohydrate in various varieties of *Ipomea batatass* L. they studied. The variation in Carbohydrate content could be attributed to factors such as environment, varieties and stages of maturity of the roots (Mohammad et al., 2016).

Finally, it was observed that *Ipomea batatass* L. obtained from MGB is more nutritional than that from ORJ as nutrient content such as protein, ash and fibre were high. Therefore, clay soil cultivation of *Ipomea batatass* L. tends to yield high quality *Ipomea batatass* L. than sandy-loamy.

4. Conclusion

Ipomea batatass L. are essential nutrition staple crop. In this study, the presence of protein and carbohydrate showed that *Ipomea batatass* L. are rich in nutrition. This study showed that physiochemical content of the soil influenced the nutritional content of the *Ipomea batatass* L. root.

5. Recommendation

I, therefore recommend further study using other locations and soil types to determine areas that can produce better nutritionally valued *Ipomea batatass* L. Also, fertilizers and organic manures can be applied to determine their effect in the nutrient quantity of *Ipomea batatass* L. in further studies.

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