# Development Indices of *Gongronema latifolium* Benth Domesticated in Otuoke Terrestrial Habitat, Bayelsa State, Nigeria

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**Abstract**

The effects of physico-chemical properties of two soil sampling locations on the proximate and mineral nutrients contents of *Gongronema latifolium* Benth were examined in Otuoke secondary forest habitat, in Bayelsa State, Nigeria. Leaf samples of G*ongronema latifolium* and soil (0-20 cm depth) samples were randomly collected from two sites in the study area. Three replicates were maintained for each treatment using randomized complete block design. The pH of 5.10 was recorded at location 1 while that of location 2 was 5.00. The contents of calcium, magnesium, sodium, phosphorus, iron, copper and zinc were higher in leaves of *G. latifolium* at location 1 than those of location 2, while the content of potassium was higher in leaves of *G. latifolium* at location 2 than those of location 1. The moisture, protein, lipid and fibre contents in leaves of *G. latifolium* were higher at location 1 than those of location 2, while the contents of ash and carbohydrate in leaves of *G. latifolium* were higher at location 2 than those of location 1. This study showed that the nutritional status of *G. latifolium* was affected by the sampling locations of the study area, hence, appropriate cultural practices are needed in the area in order to create favourable soil conditions for optimum growth and development of the test plant.

**Keywords:** Development, *Gongronema latifolium*, Otuoke

## Introduction

The tropical rainforest in Nigeria is the habitat wide biodiversity of plants and animals. Plants growing in various habitats are influenced by soil, atmospheric and climatic factors (Osuagwu *et al*., 2013, Etukudo *et al*., 2015).

Temporal variations in soil physico-chemical properties such as pH, moisture, total organic matter and total nitrogen availability have been reported to influence living organisms (Bhattacharyya and Jha, 2011; Das and Dkhar, 2011). Soil is a medium for plant growth, thus its composition has a significant influence on the growth and development of plants (Agbede, 2009), The variation in soil components such as organic matter, microbial populations, relative amount of pore spaces and mineral nutrients among different soil types have been reported to influence plant growth and development (Brady and Weil, 2004). Even a small proportion of organic matter are known to have a noticeable effect on the physical, chemical, and biological properties of soil (Brady and Weil, 2004, Agbede, 2009), with a corresponding on plant growth.

Research on medicinal plants has increased in recent times due to the importance attached to human well being. *Gongronema latifolium* Benth (Asclepiadaceae) is regarded as a non-wood forest product of West African origin (Agbo and Omaliko, 2006). It has been utilized over the years in ethnomedicine for treatment of various ailments and diseases (Eleyinmi, 2007). It leaf extracts are used in the treatment of malaria, diabetes, and hypertension (Edet *et al*., 2011). It is regarded as one the species that is highly cherished by the local people due to it medicinal values. Its leaf extracts have been reported to exhibit significant effects in inhibition of arthritis formation (Morebise and Fafunso, 1998). In Nigeria, the plant is utilized various medicinal and nutritional purposes (Ugochukwu *et al*., 2003).

The study area, Otuoke, is a tropical climatic region with characteristic ecological problems resulting from irregular marshy terrains, and seasonal flooding, in addition to the general petroleum oil exploration activities in the Niger Delta region. This study becomes increasingly important because it takes into account the relationship between two soil conditions and development indices of *G. latifolium* in the study area.

## Materials and Methods:

**Study area**: This study was carried out in otuoke secondary forest habitat, Ogbia, Bayelsa State, Nigeria. Ogbia is located at coordinates of 4º47′n and 6º20′E, and Bayelsa state lies in the heaviest rainfall area of Nigeria with a mean minimum monthly temperature ranging from 25ºC to 31ºC (Niger Delta Source, 2014).

## Collection of Samples

Plant (leaves of *Gongronema latifolium*) and soil (0-20 cm depth) samples were randomly collected from two sites in the study area. Three replicates were maintained for each treatment using randomized complete block design.

**Analysis of Soil Samples:** Chemical properties of soil samples were analysed using standard procedures (A.O.A.C, 2003).

**Analysis of Nutrient element**

The plant samples of *G. latifolium* were dried after rinsing thoroughly with distilled water. The plant materials were crushed into powdered form followed by sieving through a 0.001mm wire mesh to obtain a fine powdered form. The samples were placed in small bottles for analysis. Ammonium-vanadate-molybdate method was used to determine phosphorus content by spectrophotometry. Potassium was determined by frame photometer, while other elements were assayed by atomic absorption spectrophotometer (A.O. A.C, 2003, Hack, 2000).

**Proximate Analysis**

Proximate values of the plant material were determined using standard procedure (A.O.A.C, 2003, Hack, 2000).

**Statistical Analysis**

The data generated from this study were evaluated using Analysis of variance (ANOVA) and differences in the means were tested using Least Significant Differences (LSD) at probability level of 5% (Ogbeibu, 2005).

**Results:**

The physical and chemical properties of the study area are presented in Table 1. The contents of sand, organic carbon, nitrogen, phosphorus, calcium, magnesium, sodium and potassium were higher at location 1 than location 2, while the contents of clay, silt and aluminium were higher at location 2 than location 1 (Table 1). The pH of 5.10 was recorded at location 1 while that of location 2 was 5.00 (Table 1). The contents of calcium, magnesium, sodium, phosphorus, iron, copper and zinc were higher in leaves of *Gongronema latifolium* at location 1 than those of location 2, while the content of potassium was higher in leaves of *Gongronema latifolium* at location 2 than those of location 1 (Table 2). The moisture, protein, lipid and fibre contents in leaves of *G. latifolium* were higher at location 1 than those of location 2, while the contents of ash and carbohydrate in leaves of *G. latifolium* were higher at location 2 than those of location 1 (Table 3).

**Table 1:** Soil physical and chemical properties of the study area

| Parameters | Location 1 | Location 2 |
|---|---|---|
| Depth (cm) | 0-20 | 0-20 |
| Colour | Very dark greyish brown | Yellowish brown |
| Clay (g/kg) | 39.00±0.21 | 47.00±0.25 |
| Silt (g/kg) | 153.00±0.45 | 186.00±0.32 |
| Sand (g/kg) | 808.00±0.41 | 767.00±0.33 |

| | | |
|---|---|---|
| pH | 5.10±0.74 | 5.00±0.87 |
| Org. C (%) | 1.95±0.34 | 1.44±0.21 |
| N (%) | 0.13±0.02 | 0.12±0.05 |
| P (mg/kg) | 9.09±0.54 | 5.16±0.43 |
| Ca (c mol/kg) | 3.60±0.67 | 2.24±0.73 |
| Mg (c mol/kg) | 2.48±0.31 | 0.48±0.75 |
| Na (c mol/kg) | 0.38±0.07 | 0.21±0.30 |
| K (c mol/kg) | 2.05±0.22 | 1.46±0.18 |
| Al (c mol/kg) | 0.40±0.06 | 0.60±0.09 |

Mean ± standard error from three replicates

**Table 2:** Mineral nutrients in leaves of *Gongronema latifolium* Benth in the study area

| Mineral nutrients | Location 1 | Location 2 |
|---|---|---|
| Ca (mg/100g) | 20.21±0.22 | 18.43±0.30 |
| Mg (mg/100g) | 7.65±0.45 | 6.17±0.28 |
| Na (mg/100g) | 11.12±0.54 | 10.21±0.42 |
| K (mg/100g) | 13.61±0.33 | 15.26±0.93 |
| P (mg/100g) | 0.69±0.04 | 0.62±0.02 |
| Fe (mg/100g) | 0.46±0.07 | 0.42±0.06 |
| Mn (mg/100g) | 0.34±0.04 | 0.37±0.03 |
| Cu (mg/100g) | 0.17±0.02 | 0.15±0.04 |
| Zn (mg/100g) | 0.43±0.05 | 0.42±0.09 |

Mean±standard error from three replicates

**Table 3:** Proximate contents in leaves of *Gongronema latifolium* Benth in the study area

| Proximate contents | Location 1 | Location 2 |
|---|---|---|
| Moisture (%) | 3.09±0.27 | 2.90±0.34 |
| Ash (%) | 0.74±0.03 | 0.82±0.08 |
| Protein (%) | 8.30±0.42 | 7.26±0.18 |
| Lipids (%) | 1.56±0.72 | 1.43±0.30 |
| Fibre (%) | 2.66±0.81 | 2.49±0.48 |
| Carbohydrate (%) | 86.74±0.56 | 88.02±0.23 |

Mean±standard error from three replicates

## Discussion

In this study, significant variations existed in the soil physical and chemical properties between the two locations. This variations may be due to differences in both cultural and ecological conditions in the two sampling locations. Soil characteristics have been reported to be influenced by cultural practices (Agbede, 2009, Maynard and Hochonuth, 2007). Soil physical characteristics such as pore space are known to be influenced by soil texture and soil management (Crouse, 2017). In addition, parent material can vary based on soil location, while the general properties of soil may vary with depth (Crouse, 2017, Agbede, 2009). Differences in even one of the factors that influence soil formation such as parent material, biological activity, climate, topography and time can result in a different soil type (Brady and Weil, 2007, Dune, 2007).

The soil physical and chemical characteristics of the sampling locations also affected the mineral nutrients and the proximate contents in leaves of *G. latifolium*. This result is in line with the work Ohshiro *et al*. (2016) that the contents of elements such as Na, K, and Ca in amaranth plants were higher when cultivated in soils with higher levels of available minerals-Na, K and Ca. Nutrient availability, absorption, and plant growth differ significantly with the physical, chemical, and biological factors of soil (Donald and Katherine, 1999). Similarly, the proportion of sand, silt and clay which depict the textural status of soil also affect nutrient absorption and plant growth (Hossain and Ishimine, 2005, Agbede, 2009).

**Conclusion:**

This study showed that the nutritional status of *G. latifolium* was affected by the sampling locations. The soil is a medium for plant growth, hence, its physical and chemical properties affect the nutrient availability, absorption as well as plant growth and development.

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