



## Effects of Compost and Urea Fertilizer on Growth and Biomass Formation of Ofada Rice (*Oryza Sativa*) in Yewa North Local Government, Ogun State

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### Abstract

Experiment was carried out at the Teaching and Research Farm of Olabisi Onabanjo University, Ayetoro, Ogun State, Nigeria. The objective was to assess the effects of compost and urea fertilizer on the initial growth and biomass production of Ofada rice (*Oryza sativa*) within Yewa North Local Government, Ogun State. The experimental was arranged a 7 x 4 factorial design, fitted in to a randomized complete block design and replicated four times. Factor A comprised of an improved Ofada rice varieties line sourced from the Faculty of Agriculture Olabisi Onabanjo University, Ayetoro, Ogun State, Nigeria. Factor B comprised two fertilisers (Compost and Urea). The treatments were control, T1: Compost applied at 15 t/h, T3: Compost applied at 10t/h, T3: Compost applied at 5t/h, T4: Urea applied at 10 kg/h, T5: Urea applied at 20k g/h, T6: Urea applied at 30kg/h. Data were collected on Plant height (cm), Stem diameter (mm), Number of leaves and Leaf area (cm<sup>2</sup>) and all the data collected were subjected to analysis of variance while Fisher's least significant difference (LSD) was used to compare means at 5% probability level. The results showed a substantial and noteworthy influence of compost and urea application on the growth and development of rice plants. Optimal growth and development were observed with the application of urea at a rate of 10 kg/ha application rate, Application of compost at 15 t/ha enhance maximum growth maximum growth and maximum production of Ofada rice. As a result, these 15 t/ha of compost application are recommended for successful rice cultivation in the designated study area.

**Keywords:** Compost, Ofada rice, Urea, growth, Biomass

### Introduction

Rice (*Oryza sativa* L.) is a widely cultivated crop across the globe and is readily available in markets throughout Africa. It can be cultivated in both wetland and upland environments (William Ubi *et al.*, 2016). Given its increasing significance and prominent role among staple foods in Nigeria, Rice is being considered as part of the FGN's ATA initiative. Nigeria has a historical background of indigenous rice production and a strong demand for it. Johnson Takeshima and Gyimah-Brempong, (2013). Rice serves as the primary food source for about half of the world's population and a primary cereal crop capable of thriving in waterlogged regions with flat, low-lying tropical soils. Projections by the West African Rice Development Association (WARDA) in 2003 estimated a substantial increase in rice consumption in Nigeria, potentially reaching 4.5 percent per year. However, the rice subsector in Nigeria has faced obstacles including inconsistent government policies, improper

production techniques, high input costs, scarcity of essential production elements, challenges related to post-harvest handling and marketing Boansi (2014). Past reports indicated a consistent rise in rice production and consumption within Nigeria Imolehin and Wada (2000). Upland rice, occupying nearly 20 million hectares of global rice cultivation, constitutes a significant portion of production areas. These lands are distributed approximately as follows: 60% in Asia, 30% in Latin America, and 10% in Africa. However, upland or dryland rice yields are relatively low, accounting for only 5% of worldwide production. This insufficiency has been unable to meet the increasing demand for rice due to the burgeoning population in Nigeria. Nitrogen and phosphorus fertilizers are vital plant nutrients and essential inputs for enhancing crop yield Dastan *et al.*, (2012); Alinajoati sisie and Mirshekari (2011); Alam *et al.*, (2009).



A deficiency in nitrogen generally leads to stunted growth and the development of chlorotic leaves due to inadequate assimilate formation. This results in premature flowering and a shortened growth cycle. Farmers often adhere to a uniform recommendation and application of nitrogen fertilizer, which does not promote efficient utilization of the applied nitrogen Zahiru *et al.*, (2007). To address the issue of uniform nitrogen recommendations, various studies have introduced the concept of multi-split nitrogen application. This approach involves dividing the nitrogen application and applying it at different growth stages of the rice plant. It has been reported that employing this method leads to increased yields compared to the traditional blanket recommendation Yutiao *et al.*, (2015). Utilizing fertilisers judiciously and appropriately can significantly enhance rice yield and improve its overall quality Alam *et al.*, (2009). Fertiliser plays a crucial role in intensive rice production, as the profitability of rice production systems hinges on both yield and input quantities. Therefore, selecting the appropriate fertilizer input is not only crucial for achieving high grain yield but also for maximizing overall fertility Khuang *et al.*, (2008). Therefore, this project aimed to assess the effects of compost and Urea fertiliser on the initial growth and Biomass production of Ofada rice in the Yewa North Local Government area, Ayetoro, Ogun State.

### Materials and methods

The experiment was carried out at the Teaching and Research Farm of Olabisi Onabanjo University, Ayetoro, Ogun State, Nigeria. It lies on the latitude 70 12'N and longitude 30 3' E in a deciduous- derived savannah zone. The climate is sub-humid tropical with a longtime average annual rainfall of 1,909.30mm of this area is deemed suitable for cultivating crops (FGN, 2009). Temperature fluctuations span between 20°C and 30°C, with the highest levels observed in March and the lowest in July.

### Pre - Physico - chemical properties of the soil

The initial soil samples were gathered prior to land preparation, originating from a depth of 0-15 cm. An auger was used to collect these samples from various points across the entire experimental site, and were meticulously blended to create a unified composite sample. Once the soil collection was completed, plant roots and leaves were eliminated. Subsequently, the samples underwent an air-

drying process before being sifted through a 10-mesh sieve. The sample were stored in a pristine plastic container for physical and chemical analysis in the laboratory.

**Experimental design:** The experiment was factorial experiment fitted in to Randomized Complete Block Design with seven treatments and replicated four times,

### Seed collection

The Ofada rice seeds were obtained from the Faculty of Agriculture, Olabisi Onabanjo University, Ogun State. The seeds were chosen using the specific gravity technique. Subsequently, soaked in water within a bucket for a duration of 24 hours. Following this, the seeds were removed from the water and securely placed in gunny bags. Within 48 hours, the seeds initiated the germination process, rendering them ready for planting within 72 hours.

### Sowing Operation

The land was cleared and ploughed from the onset of the rains while seedlings were sown at the rate of 3 to 5 seedlings per stand using a spacing of 15cm x 15cm,

### Fertilisers application

**Compost** were applied at two week before sowing at rate of 5, 10 and 15 t/h and Urea were applied at weeks after planting at the following rate 10, 20 and 30 kg/ha and Control (No treatments).

### Data Collection

- i. **Plant height (cm):** Plant height was assessed by measuring the distance from the ground level to the apex of the tallest leaf. This was conducted during the stages of active tillering, mid-tillering, booting, and harvest, using measuring tape.
- ii. **Leaf area:** Leaf area index (LAI) was determined by dividing the overall leaf area of the plant by the portion of the land surface occupied. The leaf area is ascertained by measuring the length and width of the leaf and multiplied by a fixed factor (0.75).
- iii. **iii. Number of leaves:** Counting the leaves on each plant by visual counting.



- iv. **Measurement of Stem Diameter:** The stem diameter was measured by vernier caliper.
- v. **Determination of Biomass Weight during Vegetative Stage**

The biomass weight was taken during the plant's vegetative stage through a method of destructive sampling. The roots were carefully isolated from the shoot, and samples were collected from five hills per plot. Subsequently, the samples were oven-dried consistently at a fixed temperature, heating each sample at 70°C continued until a consistent weight was reached. The electronic weighing balance was used to record the dry weight of each sample for a precise measurement.

**Statistical Evaluation:** All data collected were analysed using the analysis of variance (ANOVA) analysis of variance while Fisher's least significant difference (LSD) was used to compare means at 5% probability.

### Results and discussion

#### Physico - chemical properties of the soil

The analysis of the chemical characteristics of the soil utilized in the experiment revealed a slightly acidic nature, as indicated by a pH of 6.30. The soil exhibited a total organic carbon of 4.03%, a total nitrogen of 0.61%, available phosphorus at 5.59 mg/kg, and potassium at 0.58 Cmol/kg. Additionally, the base saturation was measured at 98.31%. The compost's chemical composition, showed nitrogen of 0.794%, phosphorus of 0.212%, and potassium of 0.94%. Also the physical attributes of the soil show a sandy silt in texture. (Table 4.1)

#### Growth attributes

The effects of compost and urea application on Ofada rice plant height at 4 to 9 weeks after application (WAP) as shown in Table 4.3. The result obtained showed that there was significant difference among the treatments in 4 to 8 WAP. The urea at 10 kg application produced the highest in all the weeks assessed while compost 10 t/ha application produced the least plant height. At 9 WAP, urea 10 kg application had 415.67cm and was not significantly different from other treatments while compost 10 t/ha application had the least plant height of 94.33cm. Increased plant height was attributable to an increased rate of N translocation from culms to leaves, which leads to the production of photosynthates, which

improves the transfer of nutrients to growing panicles Singh *et al.*, (2014). In an experiment, Singh *et al.*, (2014) found that more tillers were owing to the increased availability of N, which was critical for cell division.

The effects of compost and urea application on the stem diameter of Ofada rice at 4 to 9 weeks after planting (WAP) as shown in Table 4.4. At 9 WAP, the compost 15 t/ha and urea 10 kg/ha application produced the highest stem diameter at 0.77mm while compost 10 t/ha application had the least stem diameter at 0.60mm. The effect of compost and urea application on the number of leaves produced by Ofada rice, the result showed at 9 WAP, all the treatments except compost 5 t/ha application performed better than the control application (28.67). The highest number of leaves were obtained from 10 t/ha compost application rate with 57.67 leaves. These results agree with Singh *et al.*, (2014) who found that the enhanced translocation of N to the leaves results in a larger leaf area index at higher levels of N. N fertilizers have the primary impact of increasing the rate of leaf expansion, which results in enhanced canopy interception of daily solar energy and thus increased dry matter production. (Table 4.5)

The effects of compost and urea application on the leaf area of Ofada rice, result showed that there was significant difference among the treatments at 4 to 8 WAP. The Urea 10 kg/ha produced the highest leaf area in 4 to 9 WAP while the least leaf area was obtained in the control application. Similarly, these results agree with Somasundaram *et al.*, (2002) who reported that an increase in LAI with increasing fertilizer rates (Table 4.6)

#### Biomass

The effect of compost and urea application on biomass performance of Ofada rice assessed were fresh and dry weight of the shoot and root. The result showed that there was significant difference among the treatments for fresh and dry weight of the shoot and root. In the fresh root weight, compost 15 t/ha and urea 10 kg/ha application gave the highest of 4.93g while the dry root weight compost 15 t/ha application had the highest of 2.10g. In the shoot weight, the highest weight of fresh shoot was obtained from compost 15 t/ha application (50.26g) while the dry shoot, urea 10 kg/ha application had the highest of 12.06 g. The urea 30 kg/ha application produced the least for



fresh and dry weight of root respectively.  
(Table 4:7).

### Conclusion and Recommendation

The type of fertilizer and rate of application are strongly related to the growth, development, and yield of rice crops. From the result, the application of fertilisers had a significant effect on the Ofada rice production with enhanced growth and development of plant compared to the untreated plots. The application of 10 kg/ha urea application gave the maximum growth and development of the rice and the use of 15 t/ha of compost application gave maximum growth characters. Thus, the use 10 kg/ha Urea and 15 t/ha of compost application is therefore recommended for maximum production of Ofada in the region of investigation.

**Table 4.1. Chemical and physical properties of soil analysis**

| Parameters   | values |
|--------------|--------|
| pH           | 6.30   |
| Ca (cmol/kg) | 3.98   |
| Mg (cmol/kg) | 1.24   |
| Nn (cmol/kg) | 0.61   |
| K (cmol/kg)  | 0.58   |

|                      |       |
|----------------------|-------|
| Alt H (cmol/kg)      | 0.11  |
| ECEC (cmol/kg)       | 6.52  |
| Base saturation (%)  | 98.31 |
| Total N (%)          | 0.61  |
| Total Org C. (%)     | 4.03  |
| Available P. (Mg/kg) | 5.59  |
| Mn (Mg/kg)           | 58.10 |
| Fe (Mg/kg)           | 8.75  |
| Cu (Mg/kg)           | 1.19  |
| Zn (Mg/kg)           | 4.16  |
| Sand (%)             | 93.20 |
| Silt (%)             | 4.00  |
| Clay (%)             | 2.80  |

**Table 4.2: Chemical properties of Compost**

| Parameters | Values |
|------------|--------|
| N (%)      | 0.794  |
| P (%)      | 0.212  |
| Ca (%)     | 0.236  |
| Mg (%)     | 0.939  |
| K (%)      | 0.940  |
| Na (g/kg)  | 0.376  |
| Fe (g/kg)  | 3.944  |
| Cu (g/kg)  | 0.039  |
| Zn (g/kg)  | 0.276  |
| Fe (mg/kg) | 8.75   |
| Cu (mg/kg) | 1.19   |
| Zn (mg/kg) | 4.16   |

**Table 4.3: Influence of Fertiliser application on plant height (cm) at four (4) to nine (9) Weeks after planting (WAP)**

| Treatment  | 4WAP     | 5 WAP   | 6 WAP     | 7 WAP   | 8 WAP   | 9 WAP   |
|------------|----------|---------|-----------|---------|---------|---------|
| Comp 15t/h | 42.75ab  | 63.65ab | 84.55ab   | 95.00ab | 97.00ab | 109.67a |
| Comp10t/h  | 33.66b   | 50.116b | 66.572b   | 74.80b  | 78.10b  | 94.33a  |
| Comp5t/h   | 41.12ab  | 61.22ab | 81.32ab   | 91.37ab | 93.64ab | 101.00a |
| Control    | 41.865ab | 62.33ab | 82.80 7ab | 93.03ab | 95.13ab | 100.33a |
| Urea 10kg  | 47.40a   | 70.57a  | 93.75a    | 105.33a | 109.67a | 415.67a |
| Urea 30kg  | 35.34b   | 52.62b  | 69.90b    | 78.53b  | 82.03b  | 102.33a |
| Urea20kg   | 42.51ab  | 63.30ab | 84.08ab   | 94.47ab | 97.57ab | 108.33a |
| LSD        | 9.46     | 14.09   | 18.72     | 21.04   | 21.03   | 342.12  |

Mean with the same letters are not significantly different at 5% level of probability

**Table 4.4: Influence of Fertilizer application on Stem Diameter at four (4) to nine (9) Weeks after planting (WAP)**

| Treatment  | 4 WAP | 5 WAP | 6 WAP | 7 WAP  | 8 WAP | 9 WAP |
|------------|-------|-------|-------|--------|-------|-------|
| Comp 15t/h | 0.31a | 0.44a | 0.57a | 0.63a  | 0.73a | 0.77a |
| Comp10t/h  | 0.29a | 0.41a | 0.53a | 0.600a | 0.67a | 0.6a  |
| Comp5t/h   | 0.23a | 0.32a | 0.42a | 0.47a  | 0.53a | 0.67a |
| Control    | 0.26a | 0.37a | 0.48a | 0.53a  | 0.67a | 0.7a  |
| Urea 10kg  | 0.32a | 0.44a | 0.56a | 0.63a  | 0.80a | 0.77a |
| Urea 30kg  | 0.28a | 0.39a | 0.50a | 0.57a  | 0.73a | 0.67a |
| Urea20kg   | 0.31a | 0.44a | 0.56a | 0.63a  | 0.73a | 0.67a |
| LSD        | 0.19  | 0.28  | 0.36  | 0.40   | 0.37  | 0.23  |

Mean with the same letters are not significantly different at 5% level of probability



**Table 4.5: Influence of Fertilizer application on Number of leaves at four (4) to nine (9) Weeks after planting (WAP)**

| Treatment  | 4 WAP  | 5WAP   | 6WAP   | 7 WAP  | 8WAP   | 9 WAP  |
|------------|--------|--------|--------|--------|--------|--------|
| Comp 15t/h | 14.05a | 19.78a | 25.51a | 28.67a | 29.67a | 40.00a |
| Comp10t/h  | 10.62a | 14.95a | 19.28a | 21.67a | 19.33a | 57.67a |
| Comp5t/h   | 12.09a | 17.02a | 21.95a | 24.67a | 26.67a | 24.33a |
| Control    | 7.19a  | 10.12a | 13.05a | 14.67a | 15.00a | 28.67a |
| Urea 10kg  | 22.05a | 31.05a | 40.05a | 45a    | 47.33a | 54.67a |
| Urea 30kg  | 6.86a  | 9.66a  | 12.46a | 14a    | 15a    | 47.00a |
| Urea20kg   | 21.72a | 30.59a | 39.46a | 44.33a | 46.33a | 51.00a |
| LSD        | 15.98  | 22.44  | 28.94  | 35.52  | 34.17  | 35.16  |

Mean with the same letters are not significantly different at 5% level of probability

**Table 4.6: Influence of Fertilizer application on Leaf area at four (4) to nine (9) Weeks after planting (WAP)**

| Treatment  | 4WAP    | 5WAP    | 6WAP    | 7WAP    | 8WAP     | 9WAP    |
|------------|---------|---------|---------|---------|----------|---------|
| Comp 15t/h | 44.39ab | 65.18ab | 85.96ab | 94.47ab | 117ab    | 121.95a |
| Comp10t/h  | 33.76b  | 49.56b  | 65.36b  | 71.83b  | 84.44b   | 113.43a |
| Comp5t/h   | 44.80ab | 65.78ab | 86.75ab | 95.33ab | 107.21ab | 123.47a |
| Control    | 32.82b  | 48.18b  | 63.54b  | 69.83b  | 88.66b   | 100.67a |
| Urea 10kg  | 49.62a  | 72.85a  | 96.08a  | 105.59a | 131.4a   | 146.33a |
| Urea 30kg  | 37.23ab | 54.67b  | 72.10ab | 79.23ab | 91.57b   | 117.02a |
| Urea20kg   | 43.64ab | 64.08ab | 84.50ab | 92.86ab | 110.51ab | 116.7a  |
| LSD        | 34.17   | 22.01   | 29.03   | 31.90   | 37.30    | 50.37   |

Mean with the same letters are not significantly different at 5% level of probability

**Table 4.7: Influence of Fertiliser application on the Biomass Development at four (4) to nine (9) Weeks after planting (WAP).**

| Treatment  | Fresh Root weight | Dry Root Weight | Fresh shoot Weight | Dry Shoot Weight |
|------------|-------------------|-----------------|--------------------|------------------|
| Comp 15t/h | 4.93a             | 2.10a           | 50.26a             | 9.4ab            |
| Comp10t/h  | 4.10ab            | 1.63a           | 30.13ab            | 7.83abc          |
| Comp5t/h   | 3.67ab            | 1.33ab          | 29ab               | 7.33abc          |
| Control    | 2.17b             | 1.30ab          | 30.9ab             | 8.13abc          |
| Urea 10kg  | 4.93a             | 1.66a           | 47.6a              | 12.06a           |
| Urea 30kg  | 1.80b             | 0.48b           | 15.6b              | 3.70c            |
| Urea20kg   | 2.83ab            | 1.23ab          | 29.8ab             | 5.73bc           |
| LSD        | 0.99              | 2.51            | 23.66ab            | 5.26             |

Mean with the same letters are not significantly different at 5% level of probability

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