Two Years Influence of Composted Crop Residues on the Productivity of Typic Tropaqualf and Maize Yield

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Abstract: The effect of incorporating composted crop residues on soil productivity and maize yield in south eastern Nigeria was studied for two years. The study was established in a randomized complete block design with four treatments and four replications. The treatments studied were; cassava/rice husk compost (CRPC); Cassava peel compost (CPC); rice husk compost (RPC) and control that received no application of compost. Results showed that for the 2 years study, incorporated crop residues compost significantly influenced the soil properties and the agronomic parameters tested except for gravimetric moisture content (GMC), dispersion ration (DR) and second year leaf area result. Significantly higher values of OC gkg\(^{-1}\), TN gkg\(^{-1}\), available P mgkg\(^{-1}\), ECEC cmolkg\(^{-1}\), C/N and lesser value in TEA cmolkg\(^{-1}\) respectively were recorded in amended plots relative to the control in both years. The crop residue compost was observed to have reduced the soil bulk density (BD) and increased total porosity (TP), GMC, saturated hydraulic conductivity (HC), water stable aggregates (WSA), and mean weight diameter (MWD) and DR relative to the control. The highest OC range of 1.16 – 1.28 gkg\(^{-1}\) was recorded in the RPC relative to control. Maize grain yield showed highest value of 2.80 and 1.33tha\(^{-1}\) in RPC plots in 1st and 2nd year seasons and plant height was significantly higher in the amended plots for the years under study. From the findings of the study composted crop residues are very efficient in improving soil nutrient status and maize yield in the studied area and suggested that decomposition of agricultural wastes prior to incorporation is necessary to sustain food crop production activities.

Keywords: Cassava peel, rice husk, maize, yield & soil properties.

1. Introduction

Nigeria with its increasing population, declining for capital food production and fragile resource base like the south eastern soils in particular has increased the urgency to the farmers with concern for sustainable crop production. Most tropical soils like Nigeria and south east in particular are highly weathered, low activity clays and low nutrient content and soil acidity resulting from a lot of factors such
as high rainfall, erosion and leaching, high temperature etc. The use of commercial fertilizer to replenish lost soil nutrients in these soils have witnessed some drawbacks due to its attendance problems such as unavailability especially at the needed period, high cost, nutrient imbalance and cause of acidity in soil etc. have ruled out the use of chemical fertilizer by the majority of farmers that cut across class of rich and poor resource farmers. In addition, the use of fallow periods in soil nutrient restoration have reduced drastically in Nigeria and in practical terms have reduced to zero in south east Nigeria, leading to intensive cultivation on the same available piece of land. This problem again is compounded by our traditional crop mixture system that does not guarantee appropriate nutrient requirement for each crop in the mixture. The end result of the entire scenario is soil nutrient depletion and poor performance of crops leading to low yield and in long-term soil deterioration and land degradation. These are the challenges for the sustainability of soil and crop production and any other agricultural development programmes in soils of south eastern, Nigeria.

Soil fertility programmes aims at improving soil nutrients and its availability to crops in their right proportion and balances. Compost is an organic material that have been decomposed and recycled as soil amendment and biofertilizer an important component in organic agriculture. Compost according to USSC Factsheet (2008) bears little physical resemblance to the raw material from which it originated. Compost is an organic matter resource that has the unique ability to improve the physiochemical and biological characteristics of soils. Compost help improves soil structure and nutrient availability to plants, support healthy growth of plants and yield and will be very beneficial in areas prone to erosion like the south eastern soils. Compost even has strong influence on soil pollutants, plant diseases and numerous kinds of soil microbes that influence various processes in soil. Compost amendments to soils have been shown to stimulate specific nematode trapping fungi, higher number of fluorescent pseudomonas species and actinomyces, inhibit plant diseases, bind and degrade specific pollutants (Aryantha, et al., 2000; Bulluck et al., 2002; EPA, 2012).

Therefore, it is important to note that compost is an essential method of improving the soil nutrient status after much have been lost through crop harvest and other means. So the use of simple and easily affordable and degradable crop residue materials such cassava peels and rice husk should be composted and adopted by farmers especially those in the southeast considering the fragile nature of their soils and easily available residue materials. This method could be possible and available for all farmers desirable for soil fertility improvement alternative and crop yield since it does not require any technical knowhow. It was based on this view, that the experiment was designed to study the effect of composted crop residues on soil productivity using maize as test crop.

2. Materials and Methods
2.1 Site Location

The experiment was set up in the experimental field of Faculty of Agriculture Chukwuemeka Odumegwu Ojukwu University Igbariam Campus Anambra State, Nigeria. Located within the latitude 5°40' and 6°45' North and longitude 6°40' to 7°20' east elevate 122m above sea level in south eastern Nigeria. The experimental site is in a rainforest zone where the precipitation during the rainy season (from mid March to late October) is high all year round with the highest (84%) during the wet season, while in the dry season the relative humidity is considerably lower (65%) and temperature range is 25°C – 35°C. The soil of the study area recorded in Table 1 is of the sandy clay loam textural class, poorly drained and hydromorphic FDALR (1985) classify the soil as typic tropaqualf.

2.2 Land Preparation/ Compost making/ Experimental Design and Treatment Allocation

A land area of 9.5m x 11m (0.105ha) was manually cleared and was mapped out. The treatments studied were cassava peel and rice husk. 4kg each of cassava peel and rice husk were weighed differently into 16 white nylon polythene bags and soaked in water for 1 week. The essence is to soften the materials and made them easy for decomposition. After 1 week of soaking the water was removed from the polythene bag. 2kg pig manure was moistened and mixed well with each of the 4kg of cassava peel and
rice husk; water was sprinkled on them and then composted for one month. The treatments are designated as: CPC – cassava peel compost, RPC – rice husk compost, CRPC – cassava peel + rice husk compost and CO – control that did not receive any treatment. The experiment was then laid out in a randomized complete block design (RCBD) with four replicates to give a total of 16 plots each measuring 2m x 2m (4m²). Plots were separated from each other by 0.5m path and each block was separated by 1m alley. After the one month the composted materials were incorporated into the soil in their respective plots and allow for 7 days for ageing before planting maize seeds at 2 seeds per hole and later thinned down to one plant per stand 2 weeks after planting. Weeding was done manually by use of hoe at 2 weeks interval till harvest. Soil samples were collected randomly from the field site at the depth of 0 – 25cm before cultivation and bulk together as composite sample. After harvest soil samples were collected from three different spots in each plot using soil auger to a depth of 0 – 25cm. These soil samples were air dried and sieved with 2mm mesh sieve and used to analyze selected soil chemical properties and core samples used for the analysis of selected physical properties of the soil. The analysis of both physical and chemical properties follow the method outlined in Black (1965ab) data generated were subjected to analysis of variance test based on randomized complete block design (RCBD), statistical significance difference between treatment means was estimated using least significance difference (LSD 0.05).

3. Results

The results presented in Table 1, showed the physical and chemical properties of the soil before the initiation of the study. The result indicated the class of the soil to be sandy clay loam, acidic, very low in nutrient content. The initial properties of cassava peel (CP) and rice husk (RH) showed increase in nutrient content (Table 2). Therefore, it is expected that the studied soil will benefit from the crop residues compost.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silt</td>
<td>220 gkg⁻¹</td>
</tr>
<tr>
<td>Fine sand</td>
<td>422 gkg⁻¹</td>
</tr>
<tr>
<td>Coarse sand</td>
<td>140 gkg⁻¹</td>
</tr>
<tr>
<td>Textural class</td>
<td>Sand clay loam</td>
</tr>
<tr>
<td>Dispersion ratio</td>
<td>0.77%</td>
</tr>
<tr>
<td>Bulk density</td>
<td>1.39 gcm⁻³</td>
</tr>
<tr>
<td>Total porosity</td>
<td>50.70%</td>
</tr>
<tr>
<td>Moisture content</td>
<td>20.79%</td>
</tr>
<tr>
<td>Aggregate stability</td>
<td>18.83</td>
</tr>
<tr>
<td>Hydraulic conductivity</td>
<td>4.49 cmhr⁻¹</td>
</tr>
<tr>
<td>Mean weight diameter</td>
<td>2.77</td>
</tr>
<tr>
<td>Ph(H2O)</td>
<td>4.90</td>
</tr>
<tr>
<td>OM</td>
<td>1.6 gkg⁻¹</td>
</tr>
<tr>
<td>OC</td>
<td>0.94 gkg⁻¹</td>
</tr>
<tr>
<td>TN</td>
<td>0.196 gkg⁻¹</td>
</tr>
<tr>
<td>Avail. P</td>
<td>2.80 mgkg⁻¹</td>
</tr>
<tr>
<td>Total exchangeable acidity(TEA)</td>
<td>1.63 cmolkg⁻¹</td>
</tr>
<tr>
<td>C/N</td>
<td>12:1</td>
</tr>
</tbody>
</table>
3.1 Two years influence of composted crop residues on growth and yield of maize

The result presented in Table 3, indicated significant (P < 0.05) differences in plant height, leaf area and grain yield in both years except for the leaf area result of the 2nd year. The observed plant height and leaf area in the study ranged between 154.03cm to 253.33cm and 257.88cm² to 563.85cm² respectively in the first cropping year. At the second year, the order of plant height increase was CRPC > CPC > RPC > CO. The highest leaf area was observed in CPC of which was 45.99% higher than the value obtained from CO plots. The result in Table 3 also show that the highest grain yield of maize was obtained from RPC plots in both 1st and 2nd year with a value of 2.8 tha⁻¹ and 1.33 tha⁻¹ respectively.

Table 3 Two years influence of composted crop residues on maize growth and yield

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant Height (cm)</th>
<th>Leaf area (cm²)</th>
<th>Grain yield (tha⁻¹)</th>
<th>Plant Height (cm)</th>
<th>Leaf area (cm²)</th>
<th>Grain yield (tha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>154.03</td>
<td>257.88</td>
<td>1.22</td>
<td>112.16</td>
<td>228.65</td>
<td>0.67</td>
</tr>
<tr>
<td>CRPC</td>
<td>216.60</td>
<td>563.85</td>
<td>2.22</td>
<td>166.66</td>
<td>319.88</td>
<td>1.07</td>
</tr>
<tr>
<td>CPC</td>
<td>185.62</td>
<td>388.59</td>
<td>2.10</td>
<td>138.41</td>
<td>431.35</td>
<td>0.98</td>
</tr>
<tr>
<td>RPC</td>
<td>253.33</td>
<td>437.71</td>
<td>2.80</td>
<td>134.16</td>
<td>295.74</td>
<td>1.33</td>
</tr>
<tr>
<td>LSD0.05</td>
<td>23.65</td>
<td>53.53</td>
<td>0.30</td>
<td>10.95</td>
<td>NS</td>
<td>0.26</td>
</tr>
</tbody>
</table>

CO = Control, CRPC = Cassava peel + Rice husk compost, CPC = Cassava peel compost, RPC = Rice husk compost

3.2 Two years influence of composted crop residues on soil chemical parameters

The results in Table 4 present the chemical parameters of the amended soil. The values of the amended plots visa-vie the control plots and also the statistical significant differences among the treatment showed that the crop residues composts enriched the studied soil. The OC content of the soil was observed to be highest in RPC both for 1st and 2nd year cropping. These values gave an increase of 35.34% and 47.66% over the control plots. The total N content of the soil in the 1st cropping year showed that CRPC and CPC values were statistically similar but significantly better than the control value. The percentage increase in value of TN relative to control in 1st cropping year were 42.86% (RPC); 36% (CRPC); 33.33% (CPC) respectively, the 2nd year cropping result showed a practical increase in the TN value in all the treatments when compared with 1st year cropping result except for the control result that decreased. The highest value of TN was recorded in CRPC of which was 59.38% higher than the control value while CPC and RPC values showed statistically similar results though significantly better than the control value. The result of available P was noted to be highest in CRPC plots in both 1st and 2nd year cropping. The increase in value for the two cropping years were CRPC > RPC > CPC > CO and higher value was recorded in the 2nd year as against 1st year value.

The effective cation exchange capacity (ECEC) result variations for the 1st cropping year were 4.32cmolkg⁻¹ (CO); 7.18 cmolkg⁻¹ (CPC); 8.04 cmolkg⁻¹ (RPC) and 10.46cmolkg⁻¹ (CRPC). From the recorded result, the CRPC value topped the list and was 23.14%; 31.36%; and 58.70% higher than the values obtained from RPC, CPC and CO respectively. The 2nd year result showed decrease in value in the treatments compared to 1st year result. Statistically, similar results were recorded in RPC and CPC, with
the highest value observed in CRPC plots (Table 4). The C/N value of the amended plots range between 8.35 – 12.09 and 8.10 – 11.69 in 1st and 2nd year respectively. The C/N values obtained from CRPC plots increased by 56% (1st year) and 55.87% (2nd year) relative to the control plots. The total exchangeable acidity (TEA) was observed to be highest in control plots in both 1st and 2nd year cropping with least values of 1.53cmolkg⁻¹ (1st year) and 1.49cmolkg⁻¹ (2nd year) recorded in RPC.

Table 4 Two years influence of composted crop residues on soil chemical properties

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Year 1 OC gkg⁻¹</th>
<th>Year 1 TN gkg⁻¹</th>
<th>Year 1 Avail P Mgkg⁻¹</th>
<th>Year 1 ECEC Cmolkg⁻¹</th>
<th>Year 1 C/N</th>
<th>Year 1 TEA Cmolkg⁻¹</th>
<th>Year 2 OC gkg⁻¹</th>
<th>Year 2 TN gkg⁻¹</th>
<th>Year 2 Avail P Mgkg⁻¹</th>
<th>Year 2 ECEC Cmolkg⁻¹</th>
<th>Year 2 C/N</th>
<th>Year 2 TEA Cmolkg⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>0.75</td>
<td>0.16</td>
<td>3.60</td>
<td>4.32</td>
<td>7.75</td>
<td>1.85</td>
<td>0.67</td>
<td>0.13</td>
<td>2.85</td>
<td>3.48</td>
<td>7.50</td>
<td>1.89</td>
</tr>
<tr>
<td>CRPC</td>
<td>0.98</td>
<td>0.25</td>
<td>18.65</td>
<td>10.46</td>
<td>12.09</td>
<td>1.62</td>
<td>1.20</td>
<td>0.32</td>
<td>27.70</td>
<td>7.01</td>
<td>11.69</td>
<td>1.56</td>
</tr>
<tr>
<td>CPC</td>
<td>0.87</td>
<td>0.24</td>
<td>12.96</td>
<td>7.18</td>
<td>8.35</td>
<td>1.62</td>
<td>1.04</td>
<td>0.26</td>
<td>16.95</td>
<td>5.81</td>
<td>8.10</td>
<td>1.57</td>
</tr>
<tr>
<td>RPC</td>
<td>1.16</td>
<td>0.28</td>
<td>15.09</td>
<td>8.04</td>
<td>10.63</td>
<td>1.58</td>
<td>1.28</td>
<td>0.29</td>
<td>21.15</td>
<td>6.06</td>
<td>9.25</td>
<td>1.49</td>
</tr>
<tr>
<td>LSD0.05</td>
<td>0.14</td>
<td>0.03</td>
<td>0.49</td>
<td>0.19</td>
<td>1.86</td>
<td>NS</td>
<td>0.19</td>
<td>0.05</td>
<td>1.07</td>
<td>0.69</td>
<td>1.35</td>
<td>0.05</td>
</tr>
</tbody>
</table>

CO = Control, CRPC = Cassava peel + Rice husk compost, CPC = Cassava peel compost, RPC = Rice husk compost

3.3 Two years influence of composted residues on the physical properties of the studied soil.

The tested physical parameters of the studied soil presented in Table 5 showed that the composted crop residues enrich the soil. Apart from the gravimetric moisture content (GMC) and dispersion ratio (DR) result that showed non-significant differences among the treatments in both 1st and 2nd year cropping, every other tested parameter in the study showed statistically (P < 0.05) significant differences among the treatments. Observed BD values range between 1.29 – 1.48gcm⁻³ (1st year) and 1.22 – 1.49gcm⁻³ (2nd year), there was decrease in value in the second year in the amended plots. The soil bulk density value was reduced by 14.73% (1st year) and 22.13% (2nd year) in plots amended with RPC. The total porosity value of 55.31% (1st year) and 57.89% (2nd year) was highest in CRPC. These values were higher than the control by 20.01% and 25.89% respectively for the years under study. The order of GMC result observed were RPC > CRPC > CO > CPC (1st year) and RPC > CRPC > CPC > CO (2nd year). The hydraulic conductivity (HC) value showed increased result in CRPC amended plots in both 1st and 2nd year cropping, though the values recorded in CRPC and RPC, CPC and CO in 1st year cropping were statistically similar while CPC and RPC; CPC and CO in the 2nd year cropping also recorded similar results. Water stable aggregates (WSA) improved in all the amended plots with the greatest improvement in plots amended with CRPC in both 1st (24.03%) and 2nd (23.71%) year cropping. The mean weight diameter (MWD) value was observed to be highest in plots treated with RPC in 1st year (3.98mm) and 2nd year (4.98mm). The mean weight diameter increased in all the amended plots as the cropping year observed increased. The DR result showed a similar result for CRPC and RPC plots in the 1st year cropping and CRPC > RPC > CPC > CO in the 2nd year cropping.

Table 5 Two years influence of composted crop residues on physical properties of soil

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Year 1 BD gcm⁻³</th>
<th>Year 1 TP %</th>
<th>Year 1 GMC %</th>
<th>Year 1 HC cmhr⁻¹</th>
<th>Year 1 WSA %</th>
<th>Year 1 MWD mm</th>
<th>Year 1 DR %</th>
<th>Year 2 BD gcm⁻³</th>
<th>Year 2 TP %</th>
<th>Year 2 GMC %</th>
<th>Year 2 HC cmhr⁻¹</th>
<th>Year 2 WSA %</th>
<th>Year 2 MWD mm</th>
<th>Year 2 DR %</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>1.48</td>
<td>44.24</td>
<td>20.67</td>
<td>9.80</td>
<td>19.44</td>
<td>2.14</td>
<td>0.782</td>
<td>1.49</td>
<td>42.90</td>
<td>20.50</td>
<td>9.30</td>
<td>18.62</td>
<td>2.05</td>
<td>0.759</td>
</tr>
<tr>
<td>CRPC</td>
<td>1.33</td>
<td>55.31</td>
<td>20.83</td>
<td>11.64</td>
<td>24.03</td>
<td>3.13</td>
<td>0.838</td>
<td>1.27</td>
<td>57.89</td>
<td>22.50</td>
<td>12.90</td>
<td>23.71</td>
<td>3.34</td>
<td>0.849</td>
</tr>
<tr>
<td>CPC</td>
<td>1.33</td>
<td>50.61</td>
<td>19.33</td>
<td>10.23</td>
<td>20.43</td>
<td>2.53</td>
<td>0.808</td>
<td>1.31</td>
<td>54.59</td>
<td>21.67</td>
<td>10.68</td>
<td>19.74</td>
<td>2.72</td>
<td>0.819</td>
</tr>
<tr>
<td>RPC</td>
<td>1.29</td>
<td>47.37</td>
<td>22.67</td>
<td>11.40</td>
<td>21.24</td>
<td>3.98</td>
<td>0.838</td>
<td>1.22</td>
<td>52.24</td>
<td>22.83</td>
<td>11.48</td>
<td>20.63</td>
<td>4.98</td>
<td>0.848</td>
</tr>
<tr>
<td>LSD0.05</td>
<td>0.04</td>
<td>0.63</td>
<td>NS</td>
<td>1.32</td>
<td>2.07</td>
<td>0.28</td>
<td>NS</td>
<td>0.06</td>
<td>2.51</td>
<td>NS</td>
<td>1.41</td>
<td>2.30</td>
<td>1.27</td>
<td>NS</td>
</tr>
</tbody>
</table>
CO = Control, CRPC = Cassava peel + Rice husk compost, CPC = Cassava peel compost, RPC = Rice husk compost

4. Discussion

The results of the initial soil properties tested before the commencement of the study in Table 1 are below their critical levels. The soil is considered strongly acidic in reaction based on the ratings of Chude et al., (2012), that soil of pH 5.0 – 5.5 are acidic in reaction. The implication of the result is that the studied soil is well leached and strongly weathered. The organic matter, total nitrogen and available phosphorus values are below the critical value for crop production purposes in soils of south eastern Nigeria (Enwezor et al., 1986; FMANR, 1990; Defoer et al., 2000). The result of the bulk density value is relatively good for root penetration, development and proliferation; however the value of hydraulic conductivity indicated low which indicates difficult for the soil to transmit water under saturated condition. These results attest to water logged condition of the studied soil. Table 2 showed higher values in the entire nutrient tested in both cassava peels and rice husk used as soil conditioner. Though rice husk show higher values compared to cassava peels. The variation in the values obtained is dependent on the type of crop residues used for composting and their C/N ratio has great effect on their rates of decomposition. Materials with a low C/N ratio decompose relatively faster than the ones with a higher C/N ratio.

The yield and yield components of maize found to be increased in amended plots relative to the control plots, both 1st and 2nd year and at the same time significantly different could be attributed to higher content of nutrients due to enrichment of the amended soil with organic matter by the compost materials. Organic matter impact water holding ability to soils it applied, mobilizes plant nutrients of which are mineralized in the process of organic matter breakdown. It provide food for soil microbes which by increased activity help in converting the unavailable plants nutrients into available forms, that is from organic to inorganic forms (Paul, 2011) and practically supply all the elements of fertility of which the plant requires for adequate development and yield (Zia et al., 2012). The differences in values obtained may be attributed to difference in plant nutrients and availability status in the type of compost applied. The reduction in values obtained for the parameters assessed in the 2nd year of maize production may be as a result of non application of the compost in the 2nd year. This notwithstanding, the composts applied have strong residual effect on the maize production of which the greatest was observed in RPC (Rice husk compost) with regard to maize yield. The implication being that without further application, a farmer can still realise reasonable yield.

The result of soil chemical properties (Table 4) assessed in this study showed that compost applied enriched the soil with nutrients that are significantly different with the values obtained from the control plots of which attest that the soil was highly ameliorated by the compost materials. The organic carbon content of the 1st planting year was found to be lower than the values obtained from the 2nd year planting in all the amended plots. This may be attributed to high productivity and reduced decomposition of compost materials in the 1st year planting. Krasilinkoff et al., (2002), observed that soils with low OC have low ability to hold cations in the exchangeable forms. This might explain why the amended plots with increased carbon content have higher nutrients compared to the control plots of which its low OC content might have resulted from OC decomposition. The application of rice husk and cassava peel composts increased the total nitrogen and available phosphorus content of the soil beyond their critical value of 0.17% and 15mgkg⁻¹ for crop production in the area. The mean total nitrogen level was directly proportional to OC content in the soil of the study area, hence the higher the OC, the higher the total nitrogen. The low phosphorus values in the 1st planting year may be attributed to low absolute content of P in the soil or P-sorption by Fe and Al-phosphate due to the high acidity of the studied soil. The reduction in control may be due to removal by maize plant without external addition. The addition of organic waste increased the amount of soluble organic matter which is mainly acid that increase the rate of desorption of phosphate thus improving the availability of P content in the soil (Zsolnary et al., 1994). The ECEC of the soil was enriched though to moderate level which may suggest the influence of low organic matter in the studied soil before compost application. The value obtained from the amended plots however indicated that
the amended plots could withstand heavy leaching of nutrients. Sanchez (1997) reported that soils with ECEC value above 4.0cmolkg\(^{-1}\) could withstand heavy leaching of nutrients of which translated to increased yield compared to yield obtained from control plots. Total exchangeable acidity (TEA) of 2.8 – 4.8cmolkg\(^{-1}\) was rated low – moderate by the rating of Brady and Weil (2007). Thus, the TEA of the studied soil is generally rated low indicating the absence of possibility of Al toxicity. The C/N ratio of the amended plots varies according to the compost types used and this practically influenced the rate of decomposition and mineralization of nutrients reflected in the values of nutrients tested in this study. The application of rich, low C/N ratio of crop residues composts lead to rapid mineralization and an increase in soil mineral N. Residues with very high C/N ratio according to Simard et al., (1998), can lead to net immobilization of nitrogen in the short to medium term.

The physical parameters of the soil were observed to be significantly influenced by the composts except for GMC and DR values of the soil. Compost reduced the bulk density (BD) value of the soil and increased the total porosity as well as the hydraulic conductivity (HC) of the studied soil of which was in line with the observations of (Edward et al., 2000; Aggelides and Londra 2000; Guisquiani et al., 1995; Nweke et al., 2016). The improvement in these parameters is very critical as roots of plant penetrate easily, develop and proliferate in soil bulk densities that are not impediment to their growth. This increase their ability to pick up nutrients from the soil solution of which variable increases with growth as more biomass is produced, thus increasing the functional surface area. Tinker et al., (2016) opined that plants obtain water and all the nutrients required for their nutrition from the soil solution through the root. The improvement in the hydraulic conductivity of the amended plots via the initial value (Table 1) indicated that composts enhanced the transmission of water and all that dissolved there in of the studied soil. The work of Pfister et al., (2014) showed that dissolved nutrient absorption cannot be disassociated from water transmission in soil. This as well can be used to predict plant responses to changing soil moisture conditions thereby increasing our understanding of the soil – root – leaf continuum according to the report of Evaristo et al. (2015) and Foster et al. (2016). The crop residue composts significantly increased the water stable aggregates (WSA) and mean weight diameter (MWD) of the soil (Table 5). The increases may be as a result of cementing effects of the OM from the compost in soil particles; this resulted to an increase in total OC leading to an increase in the size of the aggregates. According to Caron et al., (1996), soil OC influences stability by reducing the rate of wetting and increasing the resistance to stress generated during wetting. The positive influence of the composts was also observed in the result of MWD as the result of the organic matter increase that bound smaller aggregates into larger ones. This was necessary for good soil tilt, increased aggregation and aggregate stability for crop production according to Mbagwu et al. 1991 and Mbagwu and Piccolo, (1998). The addition of compost failed to improve the GMC and DR of the soil, this probable may be due to the type of compost used, period of composting observed before application and the soil textural class (Table 1) for Aggelide and Londra (2000) noted that magnitude of change in soil physical properties is dependent on the soil textural class.

5. Conclusion
The findings from the study are of evidence that cassava peel and rice husk composts improved soil physical and chemical properties assessed. The improved soil properties lead to increased maize growth and yield. Compost practice had much more room for supporting food crop production that can check or support human population increase in the study area. Therefore, farmers in the area are encouraged to utilize the compost technique especially with regard to the studied compost (rice husk and cassava peel which are abundant in the study area) in their soil for fertility and crop yield enhancement. Also, with this technique, more fragile and marginal land can be brought into crop production.

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