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# Evaluation of the Nutrient Properties of Different Biodegradable Waste Composts and Sawdust

**Omosebi, F. T[1]*. and Adekunle, V. A. J.[2]**

[1] National Environmental Standards and Regulations Enforcement Agency (NESREA) Ondo State Field Office, Akure, Nigeria
[2] Department of Forestry & Wood Technology, Federal University of Technology, Akure, Nigeria
*Corresponding author: afunny500@yahoo.com

## ABSTRACT

*This study was carried out to examine the nutrient composition of biodegradable waste composts and sawdust. Three types of compost were produced from sawdust only, sawdust mixed with poultry litter and sawdust mixed with domestic and market wastes. The physical, chemical and nutrients properties, before and after composting for approximately seven months using outdoor windrow composting methods, were determined using standard methods. Other quality parameters determined were C: N ratio, pH, density, odour, smell, color, enzymatic activity and temperature at maturity time. The results were compared using the one-way analysis of variance to confirm the suitability of sawdust for soil fertility management. The results revealed that non-lumbered wood fiber can be converted to higher-value product through composting to enhance soil fertility. The use of compost on a farmland has a various application. It remediates soils which are important to rural livelihood, reducing the need for chemical fertilizers and the amount of nutrient runoff. It is also environmentally friendly and controls environmental pollution. Sawdust is also put into judicious use when used as compost material.*

**Key words**: Environmental pollution, Organic compost, Rural livelihood, Sustainable development, Synthetic fertilizer

## INTRODUCTION

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (DFID, 1999). Wood is a naturally occurring bio-material. Wood, as a forest resource is important for the economic wellbeing of every nation. Wood and wood products have played a critical role in the evolution of mankind (Shmulsky, 2011). Unsustainable developments have led to reduction in capacity utilization in the wood and wood products sector (Ogunwusi, 2011). There is increasing awareness and recognition that throughout Nigeria, forests contribute significantly to rural economy, providing non-timber forest products and subsistence goods and services as well as marketed items with a great diversity of products. Non-timber forest products, according to Etukudo (2001), can be defined as all the biological materials (other than industrial round wood and derived sawn timber, wood chips, wood-based panels and pulps) that may be extracted from forest ecosystems and as utilized within the household, or are marketed (Okunomo, 2010). Although the size and quality of forest resources in most countries of the world have been reduced, their potential is now being recognized (Okunomo, 2010). There are five major activities associated with reusing and recycling of wood: refurbishing, processing, manufacturing, composting and incineration for energy.

Waste wood has been defined as all wood, wood fibre and bark that is discarded, unused or unwanted by manufacturing, construction or demolition operation, domestic and marketity, government agency or other organization (Ontario Ministry of the Environment, 1991). The manufacturing, construction and demolition, and forestry sectors all produce waste wood along with domestic and marketities. The manufacturing sector generates sawdust, shavings, bark, end cuts, chips, pallets and skids. The construction and demolition industry produce framing, lumber, end cuts, plywood, particleboard, moulding and wood used to form concrete. Tree branches, brush from trimming operations, damaged guard rails, hydro poles and Christmas trees are generated by domestic and marketities. The pulp and paper, and lumber industries generate waste in the form of tree limbs and brush, stumps and lumber. Sawdust can often be diverted from landfills through refurbishing and reprocessing to create wood-based products such as pallets, particleboard, fire logs, animal bedding and landscaping material. Using wood as a drying agent is a common practice in large-scale composting.

The quest to develop better and more efficient renewable products is ongoing. In an effort to better utilize agricultural byproducts, materials such as vegetables waste, banana peels and household wastes are being researched as supplemental fiber sources in wood-based composts. Wood is the most versatile material that has ever been known and a material that has contributed immensely to the development of nations that are richly endowed with it (Adekunle, 2011).
Among the practices recommended for improvement of the soil quality and soil fertility in tropical regions is the application of composted organic wastes, which slowly release significant amounts of nitrogen and phosphorus (Eghball, 2001). Management of soil organic matter by using composted organic waste is the key for sustainable agriculture as reported by Nyamangara *et al.* (2003). Constraints on composting such as inadequate attention to the biological process requirements and poor feed stock which yields poor quality finished compost necessitate the main motivation of examining and comparing the chemical and physical properties of wood-based composts. Increasing soil organic matter has the added benefit of improving soil quality and thereby enhancing the long-term sustainability of agriculture (Laird *et al.*, 2001). Sawdust as part of the wastes generated from sawmill is utilized for cooking, fireworks, steam turbine, poultry etc, and mostly burnt in an exposed area. The resultant ashes that are usually washed away by rain and the fumes produced during combustion have harmful effects on lives within the environment (Ajueyitsi and Onipede, 2005). Compost does several things to benefit the soil that synthetic fertilizer cannot do. First, it adds organic matter, which improves the way water interacts with the soil. In sandy soils, compost acts as sponge to help retain water in the soil that would otherwise drain down below the reach of plant roots, protecting the plant against drought. In clay soils, compost helps to add porosity to the soil, making it drain easier so that it does not stay waterlogged and does not dry out into a bricklike substance (Mohammed, 2004).
The use of composted organic waste as fertilizer does not only result in an economic benefit to the small-scale farmers, but it also reduces pollution due to reduced nutrient run-off, and N leaching (Nyamangara *et al.*, 2003). The composted organic matter has the potential to reduce the pH to an acceptable value where soils are alkaline (Rainbow and Wilson, 2002). Land application of composted material as a fertilizer source provides essential nutrients to plants and improves soil quality. It serves as an alternative to synthetic fertilizers for improving crop production while conserving resources and preserving environmental quality (Mohammad et al., 2004). Because composting is environmentally friendly and allows reuse of natural resources, it is becoming a popular waste management option (Governo *et al*, 2001).
Organic manures maintain and restore the active soil life and health (Jagat et al, 2012). The use of compost on a farmland has a multitude of applications, such as suppressing plant diseases and pests, reducing the chemical/synthetic fertilizers, promoting a higher yield of agricultural crops, and remediating soils which are important to rural livelihood. Composting is a useful method of waste removal from the environment.

This study examined and compared the chemical and physical properties of composts made from sawdust, domestic and market waste and poultry dung mixed with sawdust. This was achieved by preparing composts from sawdust, domestic and market waste and poultry litters mixed with sawdust.

## METHODOLOGY

### The study area

This study was carried out in Akure, Ondo State, Nigeria located at Lat +007$^0$252′5″, Long +005$^0$193′12″. The average elevation of Akure, Nigeria is 353 meters. The climatic condition of Akure follows the pattern of southwestern Nigeria. High temperatures and high humidity also characterize the climate. There are two distinct seasons, the rainy and dry seasons. The rainy season lasts for about seven months [April to October]. The rainfall is about 1524mm per year. The atmospheric temperature ranges between 28ºC and 31ºC and a mean annual relative humidity of about 80%

### Compost Formation

This study focused on three types of composts based on the materials used. The first type was the sawdust compost, the second type was the domestic and market wastes compost and the third type was the combination of poultry litters and mixed sawdust at ratio 3:1(i.e. 3 of the carbon-rich waste and 1 of the nitrogen-rich waste). Saw dusts were combination of different (unidentified) hardwood species obtained from carpenters' workshop and sawmill factories. The domestic and market wastes were collected from the fruits and vegetables market located at NEPA and Afunbiowo Neighborhood markets and poultry litters were obtained from a poultry farm located in Akure metropolis.
For domestic and market waste, 100kg of this waste was measured using weighing scale and was thoroughly mixed together. For poultry litters with sawdust, 10 kg of poultry dung and 30 kg of sawdust were measured to meet up with the standard of C/N ratio of 3:1 and were thoroughly mixed together. For sawdust, 110 kg of sawdust and 46 kg of wood shavings were measured and thoroughly mixed together. The saw dusts were from mixed tropical hardwood species. The density, temperature, texture, moisture content and pH

of the materials before composting were determined. The materials were felt by hand to note the texture and rated as either smooth (fine) or rough (coarse).

### Windrow Composting

The outdoor windrow composting method was used for each of the waste fractions. The compost materials were built up into large piles, the windrow was physically turned regularly and allowed to stay for 27 weeks with regular upkeep of the process to mature the windrow. The material was transferred to the curing bay after maturity for the final stage of composting to cure and dry the compost. The matured samples of each compost types were analyzed of the following nutrients properties: Carbon, Nitrogen, Phosphorus, Sodium, Potassium, Cation Exchange Capacity, Calcium and Magnesium, and Extractable Micronutrients such as Iron, Manganese, and Zinc. The Carbon-Nitrogen ratio was also determined.

## RESULTS

### The Physical and chemical Properties before Composting

The results of the physical properties of the samples before composting presented in Table 1 showed that the mixed domestic and market waste is rough, while that of poultry litters is sticky and sawdust is coarse. The density of the sawdust for composting was discovered to be 0.13g/cm$^3$ and that of the domestic and market waste was 0.30 g/cm$^3$ while poultry litter for the composite had a density of 0.32 g/cm$^3$. The sawdust had the least amount of moisture (14.8%) and maintained a normal room temperature of 27$^o$C while the domestic and market waste had 73.1% moisture content and a temperature 33.3$^o$C. The sawdust mixed with poultry litters had the highest temperature of 42.2$^o$C and moisture content level of 64.4%. The pH of the three samples is 5.36, 6.25 and 4.36 for mixed domestic and market waste, poultry litters with mixture sawdust and sawdust respectively. The result of the one-way analysis of variance shows a significant difference in these properties as shown in Table 2.

### Windrow Composting Results

Upon completion of decomposition of the materials, the pile shrunk to about half of its original size, the individual materials were no longer easily distinguishable, the pile no longer generates heat, and the material has a dark, earthy appearance and odor.

### Macro Chemical Properties of the Composts

As shown in Table 2, the results of the One-way Analysis of Variance for the comparison of the macro nutrients namely sodium, phosphorus, potassium, calcium, magnesium, carbon and nitrogen in the three composite types indicated that there was no significant difference (P >0.05) in the amount of these elements in the three compost types.
Table 3 showed that the mean carbon value in the three samples are in increasing order of 0.83%, 0.84% and 0.85% in domestic and market waste, poultry litters + sawdust and sawdust, respectively. The highest mean nitrogen value of 2.22% was found in the poultry liters + sawdust. This was followed by 2.03% in the domestic and market waste compost and the least (1.80%) in sawdust composts. Similarly, the highest mean phosphorus value of 76.33mg/kg was recorded for the poultry liters + sawdust compost and this was followed in a decreasing order by the amount in the composts from and domestic and market waste with mean values of 74.93 mg/kg and 68.63 mg/kg, respectively.

Also, mean CEC values of 70.89 cMol/kg, 57.83 cMol/kg and 50.37 cMol/kg were recorded in sawdust, poultry litters + sawdust and domestic and market waste composts. Domestic and market waste compost had the highest amount of sodium (2.02 mg/kg), followed by Poultry liters + sawdust (1.91 mg/kg) and the least in sawdust (1.87 mg/kg).

**Table 1:** The Physical and Chemical Properties of the Materials before Composting

| Materials | Texture | Density g/m$^3$ | Temperature $^o$C | pH | Moisture Content (%) |
|---|---|---|---|---|---|
| Mixed Domestic + Market Waste | Rough | 0.30±0.01a | 33.3a | 5.36±0.01a | 73.1±0.01a |
| Poultry litters+ Sawdust | Sticky | 0.32±0.01a | 42.2b | 6.25±0.01a | 64.4±0.01a |
| Saw dusts | Coarse | 0.13±0.01b | 27.0c | 4.36±0.01b | 14.8±0.01b |

Means followed with the same letter along the column are not significantly different (p<0.05)

**Table 2:** ANOVA Table for Comparing the Major Chemical Properties of the composts

| Chemical properties | SV | Df | Sum of Squares | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| | Treatment | 2 | 0.03 | 0.02 | 0.06 | 0.95 |
| Sodium (mg/kg) | Error | 6 | 1.83 | 0.3 | | |
| | Total | 8 | 1.86 | | | |
| | Treatment | 2 | 100.93 | 50.47 | 0.08 | 0.93 |
| Phosphorus (mg/kg) | Error | 6 | 3935.01 | 655.84 | | |
| | Total | 8 | 4035.95 | | | |
| | Treatment | 2 | 0.14 | 0.07 | 0.11 | 0.9 |
| Potassium (ppm) | Error | 6 | 3.89 | 0.65 | | |
| | Total | 8 | 4.03 | | | |
| | Treatment | 2 | 14.54 | 7.27 | 0.27 | 0.77 |
| Calcium (%) | Error | 6 | 159.5 | 26.58 | | |
| | Total | 8 | 174.04 | | | |
| | Treatment | 2 | 11.62 | 5.81 | 0.7 | 0.53 |
| Magnesium (%) | Error | 6 | 49.98 | 8.33 | | |
| | Total | 8 | 61.6 | | | |
| | Treatment | 2 | 0 | 0 | 0.01 | 0.99 |
| Carbon (%) | Error | 6 | 0.15 | 0.03 | | |
| | Total | 8 | 0.15 | | | |
| | Treatment | 2 | 0.27 | 0.13 | 0.63 | 0.57 |
| Nitrogen (%) | Error | 6 | 1.27 | 0.21 | | |
| | Total | 8 | 1.54 | | | |

**Table 3:** Summary of the Major Chemical Properties of the Composts

| Chemical properties | Composite types | Mean | Std. Error |
|---|---|---|---|
| | Domestic and market waste | 2.03 | 0.35 |
| Sodium (mg/kg) | Poultry litters + Sawdust | 1.91 | 0.31 |
| | Sawdust | 1.87 | 0.29 |
| | Domestic and market waste | 68.63 | 14.53 |
| Phosphorus (mg/kg) | Poultry litters + Sawdust | 76.33 | 16.06 |
| | Sawdust | 74.93 | 13.66 |
| | Domestic and market waste | 1.67 | 0.49 |
| Potassium (ppm) | Poultry litters + Sawdust | 1.69 | 0.59 |
| | Sawdust | 1.41 | 0.25 |
| | Domestic and market waste | 9.64 | 3.84 |
| Calcium (%) | Poultry litters + Sawdust | 7.32 | 2.13 |
| | Sawdust | 6.69 | 2.7 |
| | Domestic and market waste | 4.38 | 1.26 |
| Magnesium (%) | Poultry litters + Sawdust | 6.21 | 1.89 |
| | Sawdust | 7.11 | 1.79 |
| | Domestic and market waste | 0.83 | 0.15 |
| Carbon (%) | Poultry litters + Sawdust | 0.84 | 0.04 |
| | Sawdust | 0.85 | 0.02 |
| | Domestic and market waste | 2.03 | 0.32 |
| Nitrogen (%) | Poultry litters + Sawdust | 1.8 | 0.15 |
| | Sawdust | 2.22 | 0.29 |

**Table 4:** ANOVA Table for Comparing the Minor Chemical Properties of the Composts

| Chemical Properties | SV | Df | Sum of Squares | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| | Treatments | 2 | 0.09 | 0.04 | 0.01 | 0.99 |
| **Manganese (ppm)** | Errors | 6 | 39.07 | 6.51 | | |
| | Total | 8 | 39.15 | | | |
| | Treatments | 2 | 22085.67 | 11042.84 | 0.08 | 0.92 |
| **Zinc (ppm)** | Errors | 6 | 829083.23 | 138180.54 | | |
| | Total | 8 | 851168.91 | | | |
| | Treatments | 2 | 1.27 | 0.63 | 0.31 | 0.75 |
| **Iron (ppm)** | Errors | 6 | 12.4 | 2.07 | | |
| | Total | 8 | 13.67 | | | |
| | Treatments | 2 | 647.56 | 323.78 | 0.59 | 0.58 |
| **CEC (cMol/kg)** | Errors | 6 | 3282.28 | 547.05 | | |
| | Total | 8 | 3929.84 | | | |
| | Treatments | 2 | 0.01 | 0.01 | 0.15 | 0.87 |
| **C:N** | Errors | 6 | 0.21 | 0.04 | | |
| | Total | 8 | 0.22 | | | |

The mean calcium (9.64%) in the domestic and market waste compost was not significantly higher ($p>0.05$) when compared to the amount in the composts from sawdust (6.69%) and poultry liters + sawdust (7.32%). Sawdust compost had the highest amount of magnesium (7.11%). This was followed by compost from poultry litters + sawdust (6.21%) and domestic and market waste (4.38%).

The highest potassium content of 1.69 ppm was recorded for the poultry liters + sawdust compared to the other two compost types. It was reducing in domestic and market waste and sawdust with mean values of 1.67 ppm and 1.41 ppm, respectively. The composts had very low amount of C: N ratio of 0.40, 0.46 and 0.48 for saw dusts, domestic and market wastes and poultry litters+ sawdust composts respectively.

### Micro Chemical Properties of the Composts

As shown in Table 4, there was no significant difference ($p>0.05$) in the quantity of the minor nutrients namely manganese, zinc and iron in the three compost types.

According to Table 5, the mean iron values of 1.19 ppm, 2.11 ppm, and 1.57 ppm were found in saw dusts, poultry liters + sawdust and domestic and market waste composts, respectively. The highest mean manganese value of 2.93 ppm was found in the saw dusts compared to the two other types with 2.91 ppm and 2.71 ppm for poultry liters + sawdust and domestic and market waste, respectively. The highest mean zinc value of 532.77 ppm was recorded in poultry litters+ sawdust, followed by the compost of the domestic and market waste (433.76 ppm) and that of the sawdust (422.53 ppm).

Table 6 revealed the chemical composition of composts by other workers. The nitrogen (3.5) and potassium (2.5) values of Ayeni et al. (2012) and the nitrogen (2.5) of Luong and Heong (2005) were higher than the values obtained in this study. But the potassium value in this study that varied between (1.41 – 1.69) is higher than the potassium value (1.5) of Luong and Heong (2005).

## DISCUSSION

The physical properties, texture, density and moisture content and the chemical property pH of these compost materials before composting (Table 1) revealed that the material are very suitable for composting. These properties are very essential and vital aid in soil management. They govern the rate and extent of physical and chemical reactions in the material (Ibitoye, 2008). Also microorganism activity releases energy in the form of heat which is dissipated by water evaporation (Daniel *et al*, 2000), moisture dissipates heat and serves as a medium to transport critical nutrients.

### Windrow Composting

After composting, the pile stopped to generate heat and formed humus (material of a dark earthy appearance and odor). This helped to eliminate or reduce any potential health risks arising from the presence of pathogenic macro-organisms associated with reusing raw organic waste and also reflect the characteristics of mature and stable compost (Barry and Chair, 2005).

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**Table 5**: Summary of the Minor Chemical Properties of the Composts

| Chemical properties | Composite types | Mean | Std. Error |
|---|---|---|---|
| | Domestic and market waste | 2.71 | 0.1 |
| Manganese (ppm) | Poultry litters + Sawdust | 2.91 | 1.7 |
| | Sawdust | 2.93 | 1.63 |
| | Domestic and market waste | 433.76 | 160.09 |
| Zinc (ppm) | Poultry litters + Sawdust | 532.77 | 285.06 |
| | Sawdust | 422.53 | 176.9 |
| | Domestic and market waste | 1.57 | 0.65 |
| Iron (ppm) | Poultry litters + Sawdust | 2.11 | 1.14 |
| | Sawdust | 1.19 | 0.59 |
| | Domestic and market waste | 50.37 | 13.78 |
| CEC (cMol/kg) | Poultry litters + Sawdust | 57.83 | 11.01 |
| | Sawdust | 70.89 | 15.36 |
| | Domestic and market waste | 0.46 | 0.17 |
| C:N | Poultry litters + Sawdust | 0.48 | 0.06 |
| | Sawdust | 0.4 | 0.05 |

**Table 6:** Comparison of Nutrient Composition of Composts of this Study with Other Studies

| Compost types | Nutrient composition | | | Sources |
|---|---|---|---|---|
| | N | P | K | |
| Organic Fertilizer | 3.5 | 1 | 2.5 | Ayeni et al., 2012 |
| Four animal manure compost | 2.5 | 2.25 | 1.5 | Luong and Heong (2005) |
| Domestic and market waste compost | 2.03 | 68.63 | 1.67 | This study |
| Poultry manure and sawdust | 1.8 | 76.33 | 1.69 | This study |
| Sawdust compost | 2.22 | 74.93 | 1.41 | This study |

The pile shrunk to about half of its original size and the individual materials were no longer easily distinguishable due to the biological decomposition or breakdown of organic waste materials by a mixed population of micro-organisms in a warm, moist, aerated environment as also reported by Asomani-Boateng and Haight (2004).

## Chemical Properties Analysis

The low carbon mean values recorded for the three composite types were due to the most important role of carbon and nitrogen (primary nutrients) in composting process. Daniel *et al*, (2000) noted that carbon is used by microorganisms for energy during the reproduction period and growth. There was no significantly difference ($p>0.05$) in phosphorus mean value of the composts. Also, the CEC mean values of the composts were not significantly different ($p>0.05$). This could be attributed to the high rate of exchangeable cations present in the samples which gives the total CEC (Ibitoye, 2008). The difference in sodium mean value was not significant in the samples. The calcium mean value was higher in the domestic and market waste compared to sawdust and poultry litters + sawdust and the mean value of calcium was not significantly different. This result could be due to the fact that bacteria, during decomposition of organic material, only need trace amount of sodium, calcium, magnesium, and iron which are usually present in adequate quantities in the organic material (Daniel *et al*, 2000).

The mean value of magnesium was not significant in the samples, so also the mean potassium value. The composts contained the amount of iron, manganese and zinc required by plants to survive if applied as fertilizer. These are micronutrients required by animals and humans (Barry and Chair, 2005). The low C: N ratio mean value of the samples may be as a result of loss of ammonia and gain of nitrate which is a mark of maturing and mineralization in composting (Brinton, 2000). This confirmed the fact that grass clippings and other green vegetation tend to have a higher proportion of nitrogen (and therefore a lower C/N ratio) than brown vegetation such as dried leaves or wood chips (Richard and Trautmann, 1996).

Therefore, the composts from domestic and market waste, poultry litters+ sawdust and sawdust are of the quality parameters. There C: N ratio, pH, density, odorless smell, brown color, enzymatic activity and normal to cool temperature at maturity time made them very adequate for soil management by rural farmers. They could be mixed together to have an improved organic fertilizer for sustainable management of a degraded soil. Jagat *et al.* (2012) reported that the presence of these nutrients and their readily availability to crop are indicators of good quality composts.

The efficacy of compost for soil fertility enhancement compared with inorganic fertilizer has been reported. Ayeni et al (2012) compared the effect of industrial manufactured organic fertilizer and organo-mineral fertilizer to determine the chemical properties, nutrient uptake, growth and yield of maize in Ondo, Southwestern Nigeria. He discovered that they significantly ($P < 0.05$) increased plant N, P, K, Ca, Cu, Fe, Zn and Mn. He also reported that they significantly increased ($P < 0.05$) maize plant height, number of leaves, leaf area, stover yield, root dry matter and grain yield when compared with plants without any fertilizer application.

The research of Luong and Heong (2005) was carried out to address the effect of organic fertilizers on rice insect pests and diseases. The treatments included a combination of four animal manure composts, four organic fertilizers and NPK fertilizer as comparison treatment. The results showed that organic fertilizers affected the rice plant growth and minimized the outbreak of insect pests and diseases such as brown plant hopper, stem borer, leaf folder, blast and sheath blight. As shown in table 6, the nitrogen (3.5) and potassium (2.5) values of Ayeni *et al.* (2012) and the nitrogen (2.5) of Luong and Heong (2005) were higher than the value obtained in this study. But the potassium value in this study that varied between (1.41 – 1.69) is higher than the potassium value (1.5) of Luong and Heong (2005). The slight differences in the chemical compositions of the composts could be attributed to the content of the composite, ratio of mixture of the composite, duration and method of composting and method of nutrients analysis. This shows that organic fertilizer can replace the inorganic fertilizer used by Ayeni *et al* (2012).

Mansoor, (2004) noted that majority of farmers responded that they are willing to use compost in amounts equivalent to their current use of fertilizer because there are no general negative attitudes or cultural barriers towards compost. Therefore, Organic fertilizers could be used to increase plant nutrients in the absence of inorganic fertilizer by small holders.

## CONCLUSION AND RECOMMENDATION

This study has shown the importance of sawdust in compost production for soil fertility maintenance. Considering the environmental impacts of disposing saw dusts, domestic and market waste and poultry dung, it is better to find a good alternate uses for them. In addition, by reusing and recycling discarded wood add more values to trees with other functions it serves, such as wildlife habitat, soil erosion minimization, climate change mitigation and air quality maintenance. There is an inexhaustible and readily-available supply of sawdust and high organic content solid waste which constitute a major health and environmental hazards but could serve as an excellent raw material for composting for reuse as fertilizer (recovery). If therefore used as an organic fertilizer, however, they will cease to be the environment's principal contaminant. Promoting the use of organic fertilizer will minimize the need for expensive imported chemical fertilizers which is not environment friendly, always in short supply and poses lots of health risks to the farmer and other living organisms in the ecosystem. This study therefore suggests that government should imbibe the technology of composting to promote interest in the use of sawdust as compost material to support rural farmers' livelihood and enhance sustainable development. Land filling charges and tipping fees should be increased and used to fund composting to assist rural farmers who could not afford the cost of inorganic fertilizer. Farmers should be adequately informed and trained on the benefits of compost and promote its uses.

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