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EFFECT OF SAWDUST ON SOIL NUTRIENTS STATUS IN ICHAKOBE, IBILLA IN OJU LOCAL GOVERNMENT AREA OF BENUE STATE

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ABSTRACT

The effect of sawdust on soil nutrients in Oju Local Government Area of Benue State was examined. Three composite soil samples of 500 g were collected each from sawdust dumpsites and adjacent normal sites in Ichakobe Ibilla using a soil auger and stored in a polyethene bag. Soil samples were air-dried and sieved. Physical, chemical and microbial characteristics soil samples were determined according to standard methods. Data were analyzed using analysis of variance (ANOVA) and a follow-up test done using Duncan Multiple Range for any significant difference. The soil colour from normal sites were reddish, reddish-yellow and brownish red while they were ash, brownish and yellowish-brown in soils from sawdust dumpsites. *Pseudomonas aurogenous,* and *Baccilus sp* were common to normal and sawdust dumpsites while *Entrobacter sp* and *Escherichia coli* were only foun4d in the normal sites and *Salmonella sp* was seen only in soils from the sawdust dumpsites. Yeast cells and *Rhizopus sp* were common to soils from normal and sawdust dumpsites while *Mucor sp* was specific to soils from normal sites. *Aspergillus sp* was found in soils from sawdust dumpsite. Nitrogen, Phosphorus, Potassium, organic matter, Organic Carbon, Water, and Cation Exchange Capacity tend to be higher in sawdust dumpsites than in the normal site. SO_3, Na_2O, CaO, Fe_2SO_4 and MnO were all higher in soils from sawdust dumpsites than soil from soils normal sites. In conclusion, soils from sawdust dumpsites had more nutrient than the normal adjacent soil and as such, it is better for the growth of forestry and crops.

Keywords: Soil, sawdust dumpsite, soil nutrient, bacteria, fungi

INTRODUCTION

Sawdust is a small piece of wood waste that is generated as powder from wood when sawn by an industrial or normal saw. This power wood is often produced from sawmills, timber sheds either from the band or circular saw (Rominiyi *et al.,* 2019). Sawdust is usually regarded as waste which is normally disposed of by dumping and burning. This act results to environmental pollution. Sawdust has been suggested as an effective method of improving the physical and chemical properties of soils. Amelioration of soil properties is largely based on increasing organic carbon in the soil (Allison, 2012). Sawdust from certain trees or shrub species is becoming an increasingly important source of organic amendment in agricultural and forest soils.

In Nigeria, there are enormous quantities of wood shaving and sawdust as by-products from wood preparation factories, Timber sheds and furniture factories. Due to the high cost and scarcity of chemical fertilizers, it has become necessary to source agro-industrial wastes which could be used as manure for crops in tropical countries. In recent times, researchers are focusing on the potential of these wastes as soil improvers and sources of nutrients. Sawdust has been proven as an effective organic fertilizer for soil amendment (Bendfeldt, 2012).

Studies on the use of sawdust as waste in many sawmills, carpenter sheds and furniture factories as plant nutrient sources have not received much attention. Bidegain *et al.* (2000) found that sawdust ash at 2 to 8 t ha^{-1} increased the yield of pepper (*Capsicum annum*) and tomato (*Lycopersicon esculentum*) significantly and also increased soil nutrients and plant Nitrogen, Phosphorus, Potassium, Calcium and Magnesium contents.

In some wood manufacturing industries, sawdust can be a significant fire hazard and source of occupational dust exposure. Sawdust waste constitutes environmental hazards in terms of pollution when they are burnt and produce a foul smell when soaked by rain in their heaps. Sawdust heaps negatively affect the beauty of the natural environment and sometimes release unpleasant odour because of its chemical constituents which may affect human health and animals. Therefore, the objective of this study was to determine the effect of sawdust on soil nutrient status in Ichakobe, Ibilla in Oju Local Government Area of Benue State to recommend it to farmers for better performance of forestry and crops.

MATERIALS AND METHODS

Study Area

This research was carried out in Ichakobe, Ibilla in Oju Local Government Area (LGA) of Benue State. Oju LGA is one among the twenty-three (23) LGAs of Benue State located within Longitude 8° 25' 0" and 8° 41'67 E, and Latitude 6° 51' 0" and 6° 85'0'' N. The LGA has a rich historical background. At the 2006 census, the population of Oju LGA was estimated to be three hundred thousand, three hundred and seventy-seven (300,377) people (Ikyaagba *et al.,* 2019).

Soil sample collection and preparation

Three composite soil samples of 500 g were collected each from sawdust dumpsites and adjacent normal sites in Ichakobe, Ibilla using a soil auger and stored in a polyethylene bag. Each soil sample was air-dried in the laboratory at room temperature and was passed through a 2 mm sieve before laboratory analysis.

Preparation of culture media

The glassware used were washed and sterilized in the hot air oven at 121°C for six (6) hours. Media were prepared according to the manufacturer's instructions by weighing 14 g of nutrient agar and dissolving into 500 ml of distilled water and autoclave it at 121°C for fifteen (15) minutes, allowing to cool at 45°C at room temperature before pouring plate was done.

Mac Conkey Agar
Mac Conkey Agar media was also prepared according to the manufacturer's instructions by weighing 24 g of the powder into 500 ml of distilled water heat and autoclave at 121°C for fifteen (15) minutes, allowing to cool at 45°C at room temperature.

Experimental Design
Different soils samples were collected using Complete Randomized Design (CRD). Three sites of sawdust sites and three adjacent normal sites were identified and chosen for the study. Nine samples of soil were obtained from sawdust dumpsites from three locations around the dumpsite and from three soil layers and the same with soils from normal adjacent sites without sawdust which served as the control. Each soil sample was replicated three times according to the soil depth (Table 1). For each experimental site, three soil samples were collected at three layers from 0 – 20 cm, 21 – 40 cm and 41 – 60 cm depths (Table 1).

Table 1: Locations and Depts of soil sample collection in each experimental site

Location	Normal site (cm)	Sawdust site (cm)
A	0-20	0-20
	21-40	21-40
	41-60	41-60
B	0-20	0-20
	21-40	21-40
	41-60	41-60
C	0-20	0-20
	21-40	21-40
	41-60	41-60

Microbial analysis of Sawdust
The **s**erial dilution method was employed for microbial analysis. One gram (1 g) of each soil sample collected was weighed, crushed and fill into 9 ml of sterile distilled water in a test-tube making a dilution of 10°. Then 1 ml from 10° was taken to the second tube of 10^{-1} dilution and was serially diluted into 5 folds of 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} respectively. Thereafter, two replicates of 10^{-2} and 10^{-4} were used to pour the plate by dispensing 1 ml of each dilution into Petri dishes and pour plate was done. After which the plates were incubated at 37 °C for 24 hours.

Total heterotrophic count
The pour plate method was used for the enumeration of heterotrophic bacteria count on nutrient agar after incubation at 37 °C for 24 hours (Geraldine *et al.,* 2008). After incubation, plates containing colonies between 30 and 300 colonies were counted. Viable count of bacteria present in each sample was expressed as colony-forming units per milliliter.

$$(CFU/ml = colony\ counted \times dilution\ factor /Actual\ volume\ of\ sample\ plate\ (ml).$$

Identification of bacteria isolates
Bacteria isolates were characterized and identified by observation of colonial and morphological characteristics were done by gram staining. The two days old bacteria cultured on nutrient agar and Mac Conkey Agar was gram stained. One loop full of distilled water was placed on a clean microscope slide and a colony was picked with a wire loop and smears and fixed on the slide by:

i. Passing it through the flame
ii. Crystal violet was poured over and observed for sixty (60) seconds then flooded with water.
iii. After that, add Lugol's iodine was added for sixty (60) seconds rinse and decolorized with alcohol for two minutes and flood with water.
iv. Then, counter stain with safranine for sixty (60) seconds then rinsed and blott dry view under objective × 100 with inversion oil.

Identification of fungi Isolates
After culturing in Saborainal Dextrose Agar (SDA) fungi Isolates were obtained and identified based on colonial appearance and microscopic characteristics by wet mount preparation of slide using lactophenol cotton blue. This was accomplished using an appropriate scheme for yeast and molds respectively.

Biochemical Tests
Catalase Test
A drop of hydrogen peroxide (H_2O_2) was placed on the inoculums of 24 hours old culture picked and immersed in the solution of the hydrogen peroxide. A positive result was the rapid evolution of bobbles within 5-10 seconds according to Cheesebrough (2006).

Citrate Utilization Test
The agar slant of Simon Citrate agar was prepared according to manufacturer's instructions. A sterile wire loop was used to picked an aliquot of twenty-four (24) hour bacteria Isolates and streaked on the agar slant and incubated for twenty-four (24) hours after which the result was observed by a colour change to blue shows a positive result no blue color change indicates a negative result.

Triple Sugar Iron Test
Simon Citrate was diluted in 100 mL of distilled water autoclave for 15 minutes then allowed to cool then fill 12 test tubes with it and slant the test tubes to solidify. A wire-loop was used to pick colonies from the slants and streak on the solidified Simon Citrate in the test tubes then stored at room temperature for twenty-four (24) hours. Any samples that changed colour from green to blue were positive while those that maintain their green colours were said to be negative.

Indole Test
The Indole Test was carried out to determine the species of bacteria that can to split the aromatic amino acid, tryptophan into Indole, pyruvic acid and ammonia using Kovac's reagents. Red colouration in the layer indicated a positive result (Cheesebrough, 2006).

Data analysis
Data on the elemental and chemical composition of soil samples were analyzed using analysis of variance (ANOVA) and a follow up test was done using Duncan Multiple Range for any significant difference. Other results were presented in Tables.

RESULTS
Table 1 shows the result of physical features of soil samples obtained from experimental sites. The result shows that soils from normal site were reddish (0 - 20 cm), Reddish yellow (21 – 40 cm) and Brownish red (41 – 60 cm). Soil samples from sawdust dump sites had Ash (0 – 20 cm), Brownish (21 – 40 cm) and Yellowish brown (41 – 60 cm) colours. Results further shows that the texture and particle size were similar.

Table 2: Physical features of soil samples

Type of Site	Dept of soil (cm)	Colour	Texture	Particle Size
Normal site	0 - 20	Reddish	Sandy	Loose
	21 - 40	Reddish yellow	Sandy clay	Compacted
	41 - 60	Brownish red	Clayey	Highly compacted
Sawdust	0 - 20	Ash	Sandy	Loose
Dump Site	21 - 40	Brownish	Clayey	Compacted
	41 - 60	Yellowish brown	Clayey	Highly compacted

Results from the bacteria growth characteristics, morphology and biochemical tests in soil samples are presented in Table 3. The result indicated that soil samples both in the normal site and sawdust dump site had the presence of some bacteria species which were isolated. Hence, the presence of bacteria in the normal site were *Staphylococcus aureus sp*, *Entrobacter sp* within the depth of 0-20, only *Bacillus sp* was found in the depth of 21-40 and *Escherichia coli sp* was isolated from a depth of 41-60. In the sawdust dump soil, the depth of 0-20 had only *Samonella sp*, *Bacillus sp* was present in the depth of 21-40 and *Pseudomonas aurogenous* sp was found in depths of 41-60 cm.
Results from the macroscopic and microscopic examinations of fungi from test soil samples are presented in Table 4. As Yeast cells and *Rhizopus sp* were found in both normal and sawdust dump sites, *Mucor sp* was only found within Normal site (21- 40 cm) and *Aspergillus sp* in the sawdust dump site (0 – 20 cm).
The chemical composition of soil from the sawdust dump site and the adjacent normal site are presented in Table 5. Soil nutrient status decreased from the top (0-20 cm) to lower (41-60 cm) soil layers horizon. The nutritional chemical compounds such as SO_3, Na_2O, CaO, Fe_2SO_4 and MnO were all higher in the sawdust dump soil than the normal soil of the same depths. At 0 - 20 cm in normal site, Sodium oxide (0.70 %), Phosphorus pentoxide (2.24% cm) and Potassium (ii) oxide (7.50 cm) were present. While a dump site had 1.00% of Sodium oxide, Phosphorus pentoxide (2.96%) and Potassium (ii) oxide is (8.43%). At depth of 21- 40cm in normal site, Sodium oxide (0.65%), Phosphorus pentoxide is 2.00, Potassium (ii) oxide is 7.30. While in dump site, Sodium oxide is 0.90, Phosphorus pentaoxide is 2.50, and Potassium (ii) oxide (8.00%) were recorded. While at depth of 41- 60 cm in normal site, Sodium oxide (0.50%), Phosphorus pentoxide (1.90%) and Potassium (ii) oxide (6.90 cm) were recorded while in sawdust dump site, Sodium oxide (0.70%), Phosphorus pentoxide (2.00% and Potassium (ii) oxide (7.20%) where recorded. There was significant a difference ($p<0.05$) in the values of Al_2O_3, SiO_2, and MgO chemical compounds between soil samples from the normal and sawdust dump sites.
Results from the elemental composition of soil from sawdust dump and normal sites are presented in Table 6. Micro elements tend to be higher in sawdust dumpsites than in the normal site. In the normal site the mean values of elements were Nitrogen (0.08 - 0.68 %), Phosphorus (3.33 – 4.00 mg/L Potassium (0.23 - 0.28 mmol/L), organic matter (0.18-0.66%), Organic Carbon (0.10 – 0.38%), Water (6.00 1:1) and Cation Exchange Capacity (5.00 – 7.00 cmol/kg), respectively.
Soil from sawdust dump site had Nitrogen (0.28- 0.38%), Phosphorus (4.00– 4.67 Mgl) Potassium (1.80- 3.00 Col/kg), organic matter (0.14 - 0.65%), Organic Carbon (0.11 – 0.20%), Water (6.00- 7.00) and Cation Exchange Capacity (19.33 – 21.00 cmol/kg), respectively. There were no significant differences between the means of elements in normal soil and soil from sawdust dump soil.

Table 3: Morphology, growth characteristics and biochemical of bacteria test from soil samples

Soil Type	Dept of Soil sample (cm)	Dilution factor	Number of colonies	Colour	Elevation	Form	Gram reaction	Biochemical test						Suspected organism
								Cat	Coa	Indole	Citrate	TSI	Oxidase	
Normal Site	0-20	10^{-2}	116	Creamy	Raised	Spherical	+	+	-	-	-	-	-	*Staphylococcus aureus*
		10^{-4}	48	Creamy	Raised	Spherical	+	+	-	+	-	-	-	*Entrobacter sp*
	21-40	10^{-2}	112	Whitish Whitish	Flat	Lobate	+	+	-	-	-	-	-	*Bacillus sp*
		10^{-4}	80		Flat	Lobate	+	+	-	-	-	-	-	*Bacillus sp*
	41-60	10^{-2}	180	Pinkish Pinkish	Raised	Spherical	-	-	+	+	-	-	-	*Escherichia coli*
		10^{-4}	64		Raised	Spherical	-	-	+	+	-	-	-	*Escherichia coli*
Sawdust Dump Site	0-20	10^{-2}	98	Black,	Flat	Lobate	-	+	-	-	+	+	-	*Salmonella sp*
		10^{-4}	40	Black	Flat	Lobate	-	+	-	-	+	+	-	*Salmonella sp*
	21-40	10^{-2}	30	Whitish Whitish	Flat	Lobate	+	+	-	-	-	-	-	*Baccilus sp*
		10^{-4}	19		Flat	Lobate	+	+	-	-	-	-	-	*Baccilus sp*
	41-60	10^{-2}	23	GreenishGreenish	Flat	Lobate	-	-	-	-	-	-	+	*Pseudomonas aurogenous*
		10^{-4}	9		Flat	Lobate	-	-	-	-	-	-	+	*Pseudomonas aurogenous*

Table 4: The macroscopic and microscopic examination of fungi from soil samples

Type of Site	Name of sample	Dilution factor	Number of Colonies	Macroscopic growth appearance	Microscopic growth appearance
Normal site	0 - 20	10^{-5}	92	Deep creamy growth	Yeast cells
	21- 40	10^{-5}	60	Whitish cottony growth	*Mucor sp*
	41- 60	10^{-5}	35	Black growth with endo-spores and sporangium	*Rhizopus sp*
Sawdust Dump Site	0 - 20	10^{-5}	40	Deep black cottony growth with conidiophone	*Aspergillus sp*
	21- 40	10^{-5}	55	Black growth with endo-spore and sporangium	*Rhizopus sp*
	41- 60	10^{-5}	65	Deep creamy growth	Yeast cells

Table 5: Means of chemical composition of soil from sawdust dump site and the adjacent normal site

Soil type	Depth of soil samples (cm)	Al_2O_3 (%)	SiO_2 (%)	SO_3(%)	P_2O_5 (%)	Na_2O (%)	K_2O (%)	CaO (%)	MgO (%)	TiO_2 (%)	Fe_2SO_4 (%)	MnO (%)
		Mean±Sdv										
Normal Site	0-20	17.33±1.16[b]	73.00±1.00[b]	0.00±0.00[a]	2.00±1.00[a]	1.00±0.00[a]	7.33±1.16[a]	7.00±1.00[a]	4.00±1.00[b]	0.00±0.00	2.00±1.00[a]	0.00±0.00
	21-40	17.00±1.00[b]	70.00±1.00[b]	0.00±0.00[a]	2.00±1.00[a]	1.00±0.00[a]	7.00±1.00[a]	7.00±1.00[a]	5.00±1.00[b]	0.00±0.00	2.00±1.00[a]	0.00±0.00
	41-60	13.00±1.00[a]	60.00±10.00[b]	0.00±0.00[a]	2.00±1.00[a]	0.33±0.58[a]	7.00±1.00[a]	6.67±1.16[a]	4.00±1.00[b]	0.00±0.00	2.00±1.00[a]	0.00±0.00
Sawdust dump site	0-20	13.00±1.00[a]	53.00±10.00[a]	1.00±0.00[b]	3.00±1.00[a]	1.00±1.00[a]	8.00±1.00[a]	7.00±1.00[a]	2.00±1.00[a]	0.00±0.00	3.00±1.00[a]	0.33±0.58
	21-40	13.33±1.16[a]	51.00±10.00[a]	1.00±0.00[b]	2.67±1.16[a]	1.00±0.00[a]	8.00±1.00[a]	6.00±1.00[a]	2.00±1.00[a]	0.00±0.00	2.00±1.00[a]	0.00±0.00
	41-60	12.00±1.00[a]	46.00±10.00[a]	0.33±0.58[b]	2.00±1.00[a]	0.67±0.58[a]	7.00±1.00[a]	7.00±1.00[a]	2.67±1.16[ab]	0.00±0.00	2.00±1.00[a]	0.00±0.00
	Total	**14.28±2.32**	**58.83±12.28**	**0.39±0.50**	**2.28±0.96**	**0.83±0.51**	**7.39±0.98**	**6.78±0.94**	**3.28±1.45**	**0.00±0.00**	**2.17±.92**	**0.06±0.24**

Key: ***N*** *= Normal Site;* ***D*** *= Sawdust Dump Site*

Table 6: Elemental composition of soil from dump and normal sites

Soil Type	Dept of Soil sample (cm)	Nitrogen (%)	Phosphorus (mg/L)	Potassium (mmol/L)	Organic Matter (%)	Organic Carbon (%)	Water (1:1)	Cation Exchange Capacity (CEC) (cmol /kg)
		Mean±Sdv	Mean±Sdv	Mean±Sdv	Mean±Sdv	Mean±Sdv	Mean±Sdv	Mean±Sdv
Normal Site	0-20	0.08±0.12 [a]	4.00±1.00[a]	0.28±0.10 [a]	0.66±0.10 [c]	0.38±0.10 [b]	6.00±1.00[a]	5.00±1.00 [a]
	21-40	0.53±0.49 [a]	4.00±1.00 [a]	0.26±0.10 [a]	0.21±0.10 [a]	0.12±0.10 [a]	6.00±1.00 [a]	6.00±1.00[ab]
	41-60	0.68±0.74 [a]	3.33±1.16 [a]	0.23±0.10 [a]	0.18±0.10 [a]	0.10±0.10 [a]	6.00±1.00 [a]	7.00±1.00[a]
Sawdust Dump Site	0-20	0.38±0.10 [a]	4.67±1.16 [a]	3.00±1.00 [b]	0.14±0.10 [a]	0.20±0.10 [a]	6.00±1.00 [a]	21.00±1.00[c]
	21-40	0.34±0.10 [a]	4.00±1.00 [a]	2.50±1.00 [b]	0.40±0.10 [b]	0.15±0.10 [a]	6.67±1.16[a]	20.00±1.00[c]
	41-60	0.28±0.10 [a]	4.00±1.00 [a]	1.80±1.00 [b]	0.65±0.10 [c]	0.11±0.10 [a]	7.00±1.00[a]	19.33±1.16[c]
	Total	**0.38±0.37**	**4.00±0.98**	**1.35±1.32**	**0.37±0.24**	**0.18±0.13**	**6.28±0.96**	**13.06±7.35**

DISCUSSION

Colour of soil samples from the normal site were reddish, reddish-yellow and brownish red while soil samples from sawdust dump sites had ash, brownish and yellowish brown. Gatiboni, (2018) reported that the conditions that influence soil colour include organic matter, soil minerals, and soil drainage. He further claimed that colour was not the only indicator of soil quality, but provide indications on certain conditions of the soil. Dark soil colours may result from poor drainage or high organic matter content (Gatiboni, 2018). Based on the finding from this study, the ash and brownish colour of soil from the sawdust site suggests that the soil was richer in organic matter than soil from the normal site.

Pseudomonas aurogenous, and *Baccilus sp* bacteria were common to both normal and sawdust dump sites. However, *Entrobacter sp* and *Escherichia coli* were only found in the normal soil while *Salmonella sp* was only detected in the sawdust dump soil. Hayat *et al.* (2010) reported that soil bacteria were involved in numerous biogeochemical cycles, and have been used for crop production. They also affirmed that soil bacteria play a major role in ecological and biodegradable function processes in contaminated soils. Microorganisms keep soils healthy and productive. *Pseudomonas aurogenous,* and *Baccilus sp* are examples of decomposer bacteria. *Pseudomonas* is frequently resistant to many commonly used antibiotics, such as penicillin and the majority of related beta-lactam antibiotics (Iglewski, 1996). *P. aeruginosa* though present in the soil is common in humans with compromised host defence mechanisms and is the most common pathogen isolated from patients who have been hospitalized longer than one week. It plays a vital role in the biodegradation and bioremediation of these toxic compounds found in soil and water by utilizing pesticides as its carbon source and energy. Therefore, *P. aeruginosa* hold a lot of promise in the biodegradation of chemicals of environmental concerns into innocuous substances. Saxena *et al.* (2019) reported that *Bacillus* spp. serve multiple ecological functions in the soil ecosystem from nutrient cycling to conferring stress tolerance to plants. Miljakovi´c *et al.* (2020) reported that *Bacillus spp.* produce a diversity of compounds involved in the biocontrol of plant pathogens and the promotion of plant growth, which makes them potential candidates for most agricultural and biotechnological applications. *Bacillus spp.* also improves plant response to pathogen attack by triggering induced systemic resistance (ISR). It promotes plant growth through nitrogen fixation, phosphate solubilization, and phytohormone production. *Bacillus spp.* represent an alternative to plant growth enhancement agrochemicals which include synthetic pesticides and fertilizers. Jha *et al.* (2011) reported that *Enterobacter spp.* provides numerous plant growth promoting (PGP) features that involve nitrogen fixation, soil phosphorus solubilisation and production of antibiotics. It also can secrete siderophore produce, chitinase, ACC deaminase and hydrolytic enzymes besides exopolysaccharides and in the enhancement of soil porosity. Ishii *et al.* (2006) reported that *E. coli* has been found in tropical and subtropical soils. The introduction of *Escherichia coli* to agricultural soil, through contaminated water, compost, or raw manure, exposes the bacterium to a medley of ecological forces not found in a mammalian gut environment (Cutler, 2016).

According to Jechalke *et al.* (2019), organic fertilizers can increase the persistence of *Salmonella* in soil. Soil type and plant species can play a crucial role in the interactions between human pathogens and crop plants. Potential sources of soil contamination with human pathogens are manure, used as organic fertilizer, and contaminated irrigation water (Beuchat, 2002). Pigs are typical hosts of Salmonella. This could imply while soil in sawdust site which may have come with human waste contained *Salmonella sp.*

This study has shown that yeast cells and *Rhizopus sp* fungi were common in soils from normal and sawdust dump sites. *Mucor sp* was specific to soils from the normal site and *Aspergillus sp* was found in soils from sawdust dump site which agree with the finding of Yurkov (2018). Vadkertiová *et al.* (2017) and Yurkov (2017) reported that many yeast species have been isolated from soils. Yeasts have been frequently observed in the surface layers but rarely in the deeper soil layers. They were also found in soils of vineyards and orchards down to a depth of 12 - 13 and 20 - 30 cm which conforms with the finding from this study which recorded the presence of yeasts between 0 – 20 cm and 41 – 60 cm depths, respectively.

Hoorman (2016) observed asserted that fungi are an important part of the microbial ecology. Most of them are said to decompose lignin and the hard-to-digest soil organic matter, but some fungi consume simple sugars. Lavelle and Spain (2005) noted that fungi dominate in low pH or slightly acidic soils where soils tend to be undisturbed. Fungi break down the organic residues so that many different types of microbes can start to decompose and process the residues into usable products. Nayak *et al.* (2020) also referred to fungi as an important component of the soil microbiota and fundamental for soil ecosystem functioning especially in forest and agricultural soils. *Aspergillus niger* has been known to be responsible for high solubilization activity of insoluble phosphates, such as Ca, Fe and Al phosphate. Nayak *et al.* (2020) also reported that species of Aspergillus have been involved in the purification of soil contaminated with heavy metals, oil spills and microbial toxins. Botha and du Preez (1999) revealed that *Mucor* and some other mucoralean fungi were generally the first saprophytic colonizers on dead or decaying plant material.

Chemical composition of soil such as Al_2O_3, SiO_2, K_2O and MgO, decreased from soils from normal Site to sawdust dump site. This finding might be that oxides were not carbonates based which are commonly found in wood products as reported by Adetayo *et al.* (2019). The composition of Nitrogen was higher in soil from the normal site than soil in the sawdust dump site. The mean value of nitrogen in soil samples of depths 0 – 20 and 21 – 40 cm from the normal site were significantly different (<0.005) from soils from 14 – 60 cm of the normal site and soils from all depths (0 – 60 cm) in the sawdust dumpsite.

Phosphorus, potassium, organic matter, Water and Cation Exchange Capacity (CEC) were higher in soils sawdust dump sites compared to soils from normal site. However, there were no significant differences ($p>0.005$) between the means of elements in normal soil and soil from the sawdust dump soil. This higher elemental composition of soil from sawdust site could be the presence of sawdust in the soil. Gatiboni (2018) noted that soils with high CEC hold more nutrients. Therefore, this study has proved that soils from sawdust site were better in nutrients compared to soils from normal sites. The presence of bacteria in wood sawdust facilitates the degradation of the wood sawdust which releases nutrients like organic matter, phosphorous and potassium into the soil. This implies that the sawdust dumpsites could be used for forestry and agricultural production.

CONCLUSION

The colour of soil of samples from normal site were reddish, reddish yellow and brownish red while soil samples from sawdust dump sites had ash, brownish and yellowish brown. *Pseudomonas aurogenous,* and *Baccilus sp* bacteria were common to both normal and sawdust dump sites. However, *Entrobacter sp* and *Escherichia coli* were only found in the normal soil while *Salmonella sp* was only detected in the sawdust dump soil. Yeast cells and *Rhizopus sp* fungi were common to soil samples from normal and sawdust dump sites. *Mucor sp* was specific to soils from normal site and *Aspergillus sp* was found in soils from the sawdust dump sites. Chemical composition of soil such as Al_2O_3, SiO_2, K_2O and MgO decreased from soils from normal Site to sawdust dump site. Phosphorus, potassium, organic matter, Water and Cation Exchange Capacity (CEC) were higher in soil samples from sawdust dump site compared to soils from the normal sites. Therefore, soil samples from sawdust dumpsites had more nutrient than the normal adjacent soil and as such it is better for the growth of forestry and crops.

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