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EFFECT OF MIXTURE OF DECOMPOSED PALM BUNCH AND TOPSOIL ON YIELD AND NUTRIENT COMPOSITION OF *Pleurotus tuberregium* (FR.) SING

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ABSTRACT

The research was carried out in the screen house at the Teaching and Research Farm of Rivers State University, Port Harcourt from April to July 2016. It investigated the effect of mixtures of decomposed palm bunch refuse and topsoil on the growth yield, and nutrient composition of Pleurotus tuberregium (Fr) singer. The substrates/treatments were various mixtures of decomposed palm bunch and topsoil: T_1 (0:5), T_2 (5:0), T_3(4:1), T_4(3:2), T_5(2:3), T_6(1:4) and T_7(1:1). These treatments were replicated three times and fitted to the complete randomized design. Samples collected from each treatment were analyzed for soil particle size, pH, organic carbon content, total nitrogen, available phosphorus, exchangeable cations (k^+, mg^{2+}, Na^+, Ca^{2+}) before and after cultivation of sclerotia. Data collected showed no growth was on T_2 (decomposed palm bunch only), T_3(4:1) and T_4(3:2). Results of the study revealed that T_1(topsoil only) gave the highest wet and dry weight of 356.87g and 62.37g respectively. This was followed by T_6(1:4) with wet and dry weight of 191.95g and 31.43g respectively. There were no significance differences in moisture content, % ash, ether extract, crude protein, crude fibre and carbohydrate content of mushroom harvested fromT_1(topsoil) and T6(1:4). It was therefore observed that amongst the control used, topsoil gave the best yield and nutrient content while T_6(1:4) gave the highest yield and nutrient content amongst the various mixtures used. Cultivation of P. tuberregium using one part decomposed palm bunch and 4 parts topsoil by weight, is recommended.

Key words: Nutrient, palm bunch refuse, *Pleurotus tuberregium* , topsoil, yield

INTRODUCTION

Pleurotus tuberregium also known as sclerotia producing pleurotus or "Tiger milk mushroom" is a tuberous mushroom, (Chen and Huang 2004) belonging to the phylla Basidiomycota, order Agaricales, Class Basidiomycete, and family pleurotaceae (Kong, 2004). It is commonly found in the wild in the tropical and sub-tropical regions of the world. Isikhuemhen and LeBauer (2004) found the mushroom to be indigenous to tropical Africa and Australia. In Nigeria, it is a common indigenous mushroom but more popular among localities in Southern Nigeria. Different ethnic groups in Nigeria have different names for *P. tuberregium*. In Igbo, it is known as "Ero Osu", in Ogoni, "Zuu dugu", in Yoruba "Ohu" while the Hausa called it "Rumbayada".

P. tuberregium is an oyster mushroom with the ability to bio convert various lignocellolic materials as substrate. Oyster mushroom is found in the wild in temperature forest and some species in tropical forest. *P. tuberregium* is a white rot fungus which obtains its nutrients from degradation of lignocellolic materials buried in the soil or debris decay found in the forest. The substrate is colonized by the mycelia in the soil or airborne spores released by fruiting bodies. At the end of the life cycle, sclerotia are formed which survive unfavourable condition until the next rainy season at which they produce sporophores (Isikhuemhen and LeBauer, 2004).

Any Agricultural waste that contains cellulose and lignin is a possible substrate for growing the fungus e.g. palm fruit tree waste, sawdust, cornstalk, waste cotton, leaves of banana, cardboard paper etc. (Okhuoya and Okogbo, 1991; Isikhuemhen and LeBauer, 2004). Mushroom requires carbon, nitrogen and inorganic compound as nutritional source and the main nutrient are carbon sources such as cellulose, hemi-cellulose and lignin. According to Truong 1990, both empty fruit bunch and palm pressed fibre contain 47.2% carbon 1.4% nitrogen and 48.2% carbon and 0.2% nitrogen respectively. This means that empty palm fruit bunch and palm pressed fibres have the potential to be used as substrate for pleurotus cultivation. Okhuoya and Etugo (1993) in their work showed that loamy soil is the best type of soil for planting sclerotia, apparently due to its organic content and water holding capacity.

In Nigeria, both the sclerotium and the mushroom grown from it are eaten. Oso (1977) stated that the pileus and stipe of the mushroom are cut into pieces, boiled and added to okro, vegetable or any type of soup. The outer brown portion of the sclerotium is peeled off and the white portion cut in small pieces ground and used to thicken soup.

Isikhuemhen and LeBauer (2004) stated that analysis of both sclerotia and sporophores show that they are rich in carbohydrate, protein, vitamins and mineral while low in fats. Ogundana and Fagade (1981) reported that mushroom has 16.5% dry matter of which 7.4% is crude fibre, 4.69% crude protein and 4.48% fats and oil. However, studies conducted by Jonathan *et al.* (2006) showed that *pleurotus tuberregium* has the highest amount of crude fibre compared with edible mushroom. The sclerotia are used to solve health disorder such as skin disease, childhood malnutrition, stomach problem, cold, high blood pressure, diabetes, small pox etc. (Oso, 1977, Olawuyi *et. al.* 2010 and Oluranti, *et. al.* 2012). Cheng and Huang (2004) confirmed that the sclerotia of *P. tuberregium* is a good coagulant and disinfectant which can be used in natural water and waste water purification.

With the economic benefits of *P. tuberregium* in view and its seasonal nature, there is need to carry out research on how to make it available all year around since oyster mushroom is quite adaptable to a range of climate, and substrates materials, making itself the second most common mushroom produced worldwide following button mushroom (Kong, 2004).

The objective of this work was to investigate the effect of the various mixture of decomposed palm bunch refuse and topsoil on the yield and nutrient content of *P. tuberregium*.

MATERIALS AND METHOD

Experimental Site and Climatic Conditions

This research work was carried out in Rivers State University, Port Harcourt, in a

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screen house at an ambient temperature and atmospheric pressure. Rivers State University lies within the Nigeria Rainforest zone with an altitude of 38m above sea level and an annual rainfall of 2000mm - 2484mm, relative humidity of about 79% and temperatures of 22.6^{o}C - 31.2^{o}C(FAO, 1984). Rainfall distribution is bimodal with peaks around the month of June and September. The dry season extends from November to March with a characteristic cold dry dust-laden wind interval (Harmattan) during the months of January to February.

Sourcing of Planting Material

The planting materials (Sclerotia of *pleurotus tuberregium*) were sourced from a local market in Aba, Abia State and transported to the research site. The sclerotia were cut into sizes and weighed on the weighing balance (scale) in the Soil Science laboratory of Rivers State University, Port Harcourt to get an accurate weight of 20g of sclerotia (Ikeoba and Nwocha, 2001).

Planting Media

The planting media were decomposed palm bunch refuse and top soil, mixed in various ratios. The decomposed palm bunch refuse was collected from an oil mill at Aluu in Ikwerre Local Government Area of Rivers State while topsoil was collected from the Teaching and Research farm of Rivers State University.

Treatments

The treatments were made up of various mixtures of decomposed palm bunch refuse and top soil in the following ratios by weight; which were used for the cultivation of sclerotia.

Table 1: Treatment Combinations

Treatment	DPBR : TP				
T_1	0 : 5	0kg	decomposed palm bunch refuse	:	2kg top soil
T_2	5 : 0	2kg	decomposed palm bunch refuse	:	0kg top soil
T_3	4 : 1	1.6kg	decomposed palm bunch refuse	:	0.4kg top soil
T_4	3 : 2	1.2kg	decomposed palm bunch refuse	:	0.8kg top soil
T_5	2 : 3	0.8kg	decomposed palm bunch refuse	:	1.2kg top soil
T_6	1 : 4	0.4kg	decomposed palm bunch refuse	:	1.6kg top soil
T_7	1 : 1	1kg	decomposed palm bunch refuse	:	1kg top soil

DPBR – Decomposed Palm Bunch Refuse, TP – Top Soil

All treatments were replicated three times and bagged in separate (75 x 60)cm^2 black polythene bag.

Physico-chemical properties of the planting media

The various treatment combinations were analyzed for the following physical and chemical properties:

Particle size distribution was determined using the Bouyoucos hydrometer method as described by Gee and Bauder, (2002). Soil pH was determined in a water using 1:2:5 soil liquid ratio (Thomas, 1982). Organic carbon content was determined by the wet oxidation method (Nelson and Sommers, 1996). Total nitrogen was determined by the Kjeldahl digestion method (Bremmer, 1996). Available phosphorous was determined by Bray 2 method (Olsen and Sommer, 1982). Exchangeable cation (K^+, Ca, Mg, Na) was determined in ammonium acetate extraction procedure (Thomas, 1996).

Mushroom Cultivation

The screen house prior to the onset of the research work, was swept, cleaned and fumigated with Rambo insecticide. 10 pieces of 20g of sclerotia was planted at a depth of 5cm per perforated black polythene bags, containing the various ratios of the decomposed palm bunch refuse and topsoil. The bags were placed on a raised platform in a screen house at room temperature. Each perforated bag containing the planted sclerotia was watered daily with 50cl of water until the sclerotia began to sprout. After sprouting the volume of water for watering was decreased to 25cl, to keep it moist.

Data Collection

Mushroom Yield

The experiment was observed daily, and measurement were taken weekly from the 14 days after planting (DAP). All growth parameters were measured from 50% of the plant population per bag. Stipe height was taken using a string to measure from the base and then placed along a meter rule to get the measurement in cm.

The mushroom pileus diameter (cm) was taken from one end of the pileus to the other passing through the centre of the pileus. This was done using a string which was then placed along a meter rule to get the diameter.

The stipe girth (cm) was measured by placing a string round the circumference of the stipe and then placed along a metre rule.

Mature mushrooms were harvested before the pileus curve upward. Harvested mushroom from each bag at each harvest weighed using an electronic top loading weighing balance, to get their fresh weight. They were then oven-dried at a temperature of s80^{o}C to a constant dry weight, to get their dry weight. The total fresh and dry weight, at the end of the production period,was determined by the sum of the various harvest from each treatment.

Proximate Composition and Mineral Content of Mushroom from Each Treatment

Dry mushroom samples from each treatment were taken to the Food Science and Technology laboratory of Rivers State University for proximate analysis and mineral composition of the mushroom. The results per treatment are compared to know which has greater nutritive content. Organic carbon was determined by Walkey and Black method (1934). Total potassium and total phosphorous were determined by flame photometric method and vanado-molybdate yellow method respectively (Jackson, 1964), AOAC (2000). Total Nitrogen was determined by the regular Macrokjedahl method, Jackson (1964), Crude protein, Ether Extract (fat/oil), Crude fibre, Ash content (Total mineral) and Nitrogen free Extract were determined according to AOAC (2000). The mineral content of *pleurotustuberregium*were determined using Atomic Absorption Spectro photometric method (AOAC, 2000).

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Experimental Design/Data Analysis

The experimental design used was the completely randomized design (CRD) with 7 treatments replicated three times. Data collected were subjected to analysis of variance for a Completely Randomized Design and means were separated using the least significant difference (LSD) at (5%) probability (SAS 1999).

RESULTS

Effect of Treatments on Pileus Diameter (cm) of *P.* t*uberregium*

The effect of treatments on pileus diameter of *P. tuberregium* is as shown on Fig. 1. There were significant difference ($P<0.05$) between control T_1 (topsoil only), which gave the highest pileus diameter of 16.05 cm and T_6 (1:4) which gave a pileus diameter of 7.37cm while T_6 (1:4) with a pileus diameter of 7.37 differed significantly ($P<0.05$) from T_5 (2.3) and T_7 (1:1) with the pileus diameter of 0.56cm and 0.75cm respectively.

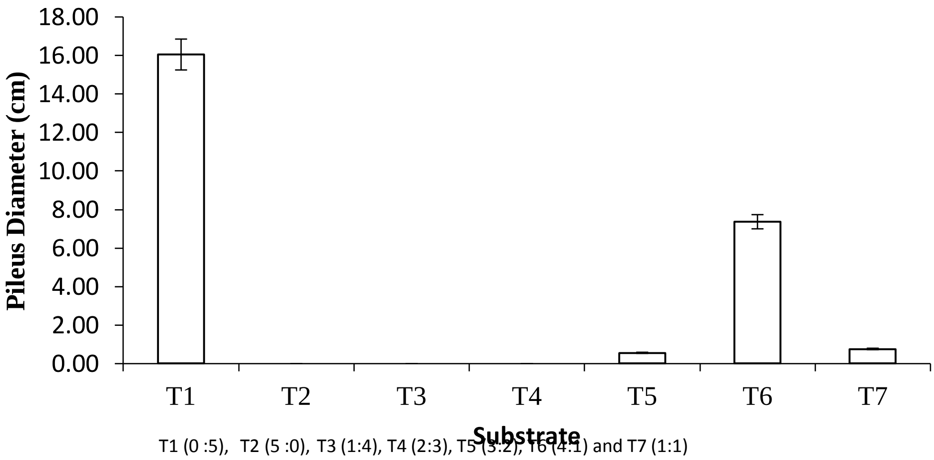

Figure 1: Effect of Treatments on Pileus Diameter (cm) of *P. tuberregium*

Effect of treatments on Stipe Height (cm) of *P.* t*uberregium.*

The highest stipe height was given by control T_1 (topsoil only) - 8.38 cm which differed significantly ($P<0.05$) from T_6 (1:4) of a stipe height of 5.22 cm (Fig. 2). The lowest heights were given by T_5 (2:3) 1.16 cm and T_7 (1:1) giving 1.72 cm. There were significant differences ($P<0.05$) between T_6 (1:4) which gave 5.22 cm and T_5 (2:3) and T_7 (1:1) which gave 1.16 cm and 1.72 cm respectively. No growth was observed in control T_2 (decomposed palm bunch only), and T_3 (4:1) and T_4 (3:2).

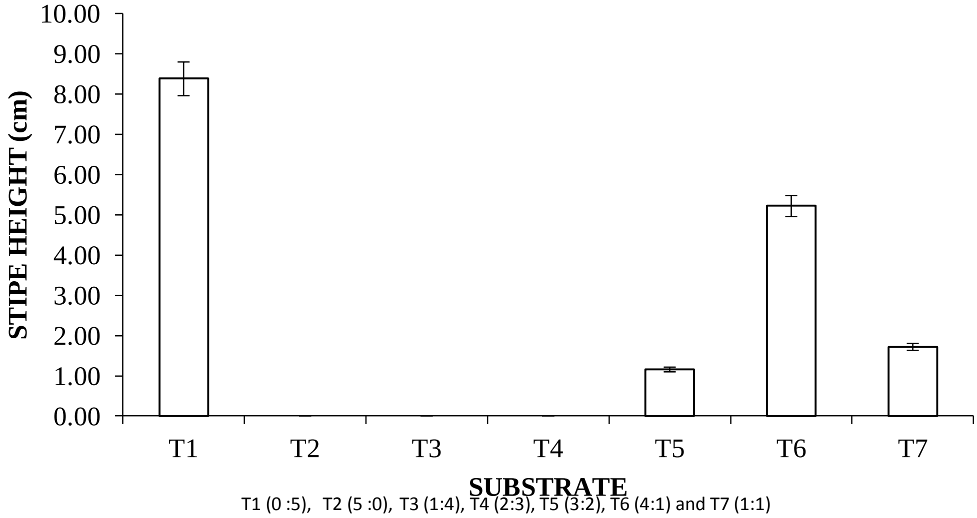

Figure 2: Effect of Treatments on Stipe Height (cm) of *P. tuberregium*

Effect of treatments on Stipe Girth of *Pleurotus tuberregium*

There was no significant difference ($P<0.05$) between control T_1 (topsoil only) which gave a stipe girth of 4.98 cm and T_6 (1:4) with a stipe girth of 4.02 cm (Fig. 3). However, both control T_1 (topsoil) with value of 4.98 cm and T_6 (1:4) with value of 4.02 cm in stipe girth differ significantly ($P<0.05$) from T_5 (3:2) with stipe girth of 0.78 cm and T_7(1:1) with stipe girth of 1.91 cm. From the result shown T_5 (3:2) and T_7 (1:1) did not differ from one another.

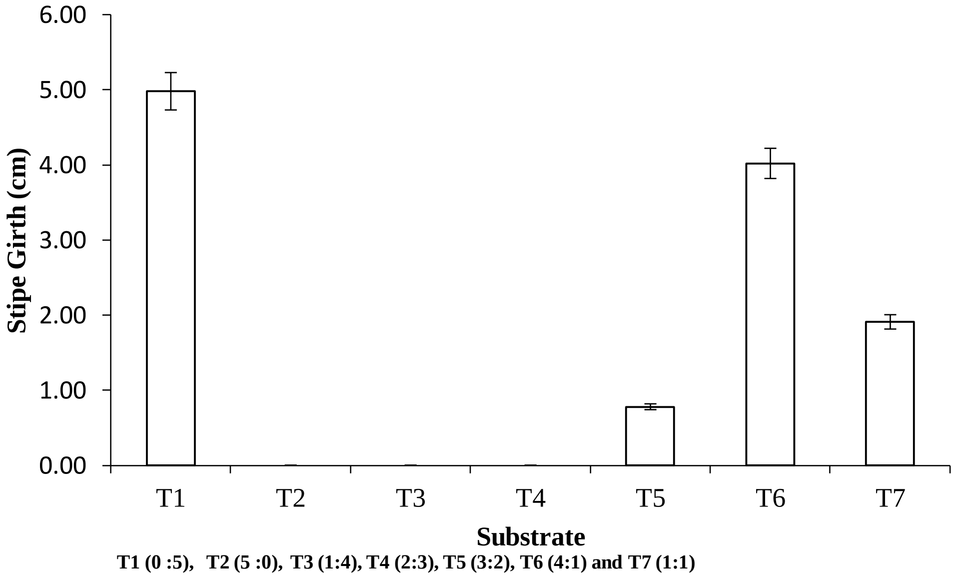

Figure 3: Effect of Treatments on Stipe Girth (cm) of *P. tuberregium*

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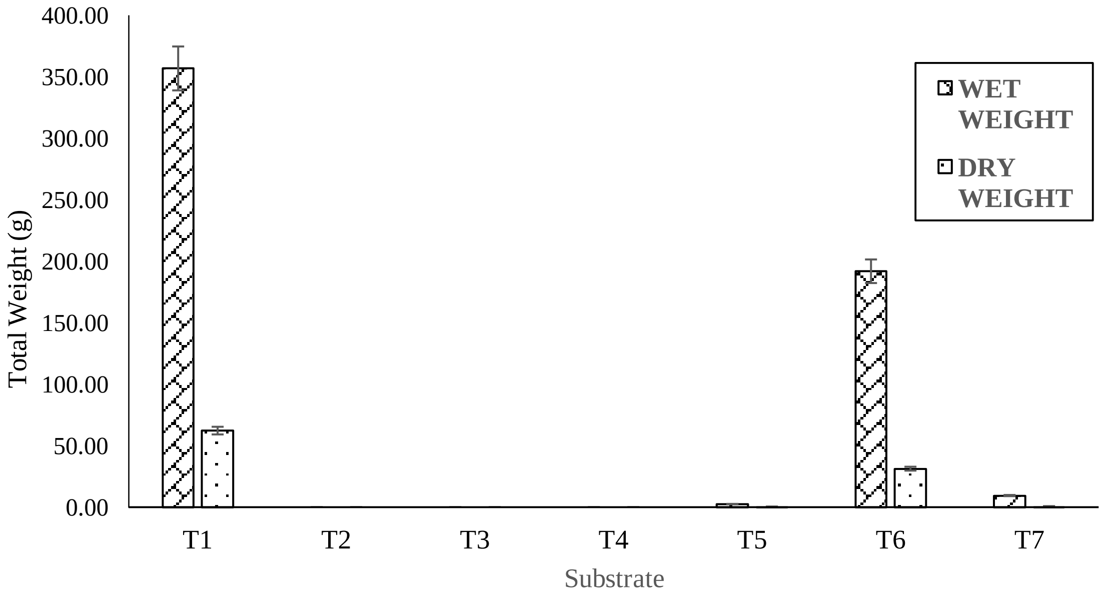
Effect of treatments on the yield of *Pleurotus tuberregium*

The effect of the various mixtures of decomposed palm bunch refuse and topsoil on the yield of *P. tuberregium* is as shown on Fig. 3. Results show that the control T_1 (topsoil) gave the highest wet and dry weight of 356.87g and 62.37g followed by T_6 (1:4) which recorded a wet and dry weight of 191.95g and 31.43g respectively. From the result control T_1 (topsoil only) was significantly higher than T_6 (1:4). The lowest value were recorded by T_7 (1:1) which gave a wet and dry weight of 1.32 and 0.32g, and T_5 (3.2) with a wet and dry weight of 2.64g and 0.45g. Nevertheless, T_1 (topsoil only) gave the highest yield.



T1 (0 :5), T2 (5 :0), T3 (1:4), T4 (2:3), T5 (3:2), T6 (4:1) and T7 (1:1)

Figure 4: Effect of Treatment on Wet and Dry Yield (g) of *P. tuberregium*

The Proximate Analysis of Harvested Mushroom

From the result shown in Table 1 the moisture content of control T_1 (topsoil only) did not differ significantly from that of T_6 (1:4). The highest percentage Ash was recorded in T_6 (1:4) while control T_1 (topsoil only) gave the lowest percentage of 2.09%. Ether Extract (fat/oil) was 2.9% in control T_1 (topsoil) while T_6 (1:4) recorded 1.43%, they were not significantly different from one another. There was no significant difference in percentage crude protein recorded between T_6 (1:4) which was 20.06% and that of control T_1 (topsoil only), 18.28%. Control T_1 (topsoil only) recorded percentage crude fibre of 58.49 while T_6 (1:4) gave percentage crude fibre of 49.73. T_6 (1:4) recorded a higher carbohydrate percentage of 11.74 while control T_1 (topsoil only) gave 9.23% carbohydrate.

Proximate composition of mushroom harvested from T_5 and T_7 were significantly low as compared to T_1 and T_6.

Table 1: Effect of the Various Ratios on Proximate Analysis of Harvested Mushroom

Substrates	Moisture Content (%)	Ash (%)	Ether Extract (%)	Crude Protein (%)	Crude Fibre (%)	Carbohydrate (%)
T_1 0:5 (Control)	8.66	2.09	2.09	18.28	58.49	9.23
T_2 5:0 (Control 2)	0	0	0	0	0	0
T_3 (4:1)	0	0	0	0	0	0
T_4 (3:2)	0	0	0	0	0	0
T_5 (2:3)	1.23	0.78	0.02	1.28	2.04	1.20
T_6 (1:4)	8.75	8.28	1.43	20.06	49.73	11.74
T_7 (1:1)	2.07	1.07	0.79	5.10	5.30	2.90
LSD P<P0.05	3.92	2.86	ns	Ns	1.26	1.31

T1 (0 :5)-Topsoil (TS), T2 (5 :0)-Decomposed palm bunch refuse (DPBR) (Control T2), T3 (1:4)-1 part DPBR + 4 part TS, T4 (2:3)-2 part DPBR + 3 part TS, T5 (3:2)-3 part DPBR + 2 part TS, T6 (4:1)-4 part DPBR + 1 part TS, T7 (1:1)-Equal part DPBR + Equal part TS

Mineral Content of *Pleurotus* tuberregium

T_1 (topsoil only) having the highest sodium (Na) value of 743.00 cmol/kg while T_6 (1:4) gave 319.10 cmol/kg. T_6 (1:4) recorded the highest potassium (k) value of 1074.12 cmol/kg while control T_1 (topsoil only) gave the highest calcium (ca) value of 2392.75 cmol/kg while T_6 (1:4) recorded calcium (ca) value of 223.73 cmol/kg. T_1 (topsoil only) recorded the highest phosphorous (p) value of 510.33 cmol/kg while T_6 (1:4) recorded phosphorous (p) value of 107.51 cmol/kg. While control T_1 (topsoil only) gave iron (Fe) content of 260.88 cmol/kg, T_6 (1:4) recorded iron value of 137.57 cmol/kg. Chromium (Cr) content found in control T_1 (topsoil only) is 1.88 cmol/kg while T_6 (1:4) had a significantly low value of <0.01. Control T_1 (topsoil only) gave zinc (Zn) content of 68.38 cmol/kg while T_6 (1:4) recorded zinc content of 26.39 cmol/kg mushroom harvested from T_5 and T_7 recorded low value in mineral content.

Table 2: Mineral Content of Harvested *Pleurotus* tuberregium

Trt	Na (cmol/kg)	K (cmol/kg)	Ca (cmol/kg)	P (cmol/kg)	Mg (cmol/kg)	Fe (cmol/kg)	Cr (cmol/kg)	Zn (cmol/kg)
T_1	743.00	240.38	2392.75	510.33	295.63	260.88	1.88	68.38
T_2	0	0	0	0	0	0	0	0
T_3	0	0	0	0	0	0	0	0
T_4	0	0	0	0	0	0	0	0
T_5	0.50	10.36	20.60	0.86	0.75	0.26	0.00	0.05
T_6	319.10	1074.12	223.73	107.51	94.35	137.57	<0.01	26.39
T_7	80.70	38.56	78.01	0.90	0.60	0.38	0.00	1.08

T1 (0 :5)-Topsoil (TS), T2 (5 :0)-Decomposed palm bunch refuse (DPBR) (Control T2), T3 (1:4)-1 part DPBR + 4 part TS, T4 (2:3)-2 part DPBR + 3 part TS, T5 (3:2)-3 part DPBR + 2 part TS, T6 (4:1)-4 part DPBR + 1 part TS, T7 (1:1)-Equal part DPBR + Equal part TS

Nutrient Composition and Particle Size of Substrates Used in Growing *Pleurotus tuberregium*

Table 4.4 shows the nutrient composition and particle size of substrates used in growing *Pleurotus tuberregium*. The result of the nutrient composition and particle sizes of all the treatment used to grow *Pleurotus tuberregium* reveals that all the treatments are alkaline in nature with pH

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value ranging from 8.5-9.6. The highest organic carbon was recorded in control T_1 (topsoil only) and the least was by control T_2 (decomposed palm bunch only) which gave 1.11%. Nitrogen content of other substrates was same range of 0.02-0.04. The highest phosphorous (p) of 842.11 cmol/kg was recorded in T_4 (3:2) while the lowest of 29.74 cmol/kg was recorded in control T_1 (topsoil only). The highest potassium (k) value of 1400.00 cmol/kg was recorded in T_6 (1:4) while the lowest potassium (k) value of 29.74 was recorded in control T_1 (topsoil only). Control T_2 (decomposed palm bunch refuse only) was highest in sodium (Na) 11.30 cmol/kg while the lowest was 0.33 cmol/kg in control T_1 (topsoil only).

Calcium (ca) content of T_3 (4:1), T_4 (3:2), T_5 (2:3) were 13.40 cmol/kg, 13.60 cmol/kg, and 13.60 cmol/kg respectively while T_7 (1:1) recorded 12.60 cmol/kg. Control T_1 (topsoil only) and T_6 (1:4) recorded calcium value of 9.60 cmol/kg and 9.20 cmol/kg respectively. Control T_2 (decomposed palm bunch refuse only) recorded 7.40 cmol/kg. For magnesium, T_6 (1:4) gave the highest magnesium (mg) value of 9.40 cmol/kg while the lowest is control T_1 (topsoil only) 0.40 cmol/kg.

Particle size analysis as shown in Table 4.4 indicates that the textural class of control T_1 (topsoil only) to be sandy loam, control T_2 (decomposed palm bunch only) is sandy clay loam, T_3 (4:1) is sandy clay loam, T_4 (3:2) is sandy clay loam, T_5 (2:3) is sandy clay loam, T_6 (1:4) is sandy loam while T_7 (1:1) is sandy clay loam.

Table 3: Nutrient Content and Particle Sizes of Substrate used in cultivation of *Pleurotus tuberregium*

S/N	Parameters	T_1	T_2	T_3	T_4	T_5	T_6	T_7
1.	Sand (%)	80.00	58.00	62.00	68.00	72.00	78.00	72.00
2.	Silt (%)	3.40	7.40	9.40	5.40	5.40	3.40	7.40
3.	Clay (%)	16.60	34.60	28.60	26.60	22.60	18.60	20.60
4.	Textural Class	Sandy loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Sandy loam	Sandy clay loam
5.	Soilp H_w(l:2.5)	8.50	9.60	9.60	9.60	9.50	9.30	9.40
6.	Organic Carbon (%)	2.44	1.11	1.58	1.83	1.79	2.36	2.30
7.	Total Nitrogen (%)	0.02	0.04	0.04	0.02	0.02	0.04	0.02
8.	P (cmol/kg)	82.46	701.75	196.49	842.11	526.32	456.14	210.53
9.	K (cmol/kg)	29.74	323.08	230.77	174.36	35.90	1400.00	117.95
10.	Na (cmol/kg)	0.33	11.30	7.83	5.57	5.04	2.09	4.52
11.	Ca (cmol/kg)	9.60	7.40	13.40	13.60	13.40	9.20	12.60
12.	Mg (cmol/kg)	0.40	3.80	0.60	0.60	3.00	9.40	2.00

T1 (0 :5)-Topsoil (TS), T2 (5 :0)-Decomposed palm bunch refuse (DPBR) (Control T2), T3 (1:4)-1 part DPBR + 4 part TS, T4 (2:3)-2 part DPBR + 3 part TS, T5 (3:2)-3 part DPBR + 2 part TS, T6 (4:1)-4 part DPBR + 1 part TS, T7 (1:1)-Equal part DPBR + Equal part TS

DISCUSSION

There were significant differences in the pileus diameter, stipe girth and stipe height of the mushroom harvested from the different substrates. This may be due to the low sodium content found in control T_1 (topsoil). The low amount of sodium may have been insignificant to interfere with the availability and absorption of essential growth nutrients such as phosphorous, potassium etc. needed by *P. tuberregium* for growth. Although control T_1 (topsoil) has the lowest nutrient as shown in table (1) yet it performed better than T_6 (1:4) with the highest amount of nutrient. This confirms the finding of Brady (1999) that the presence of sodium carbonate in soil raises soil pH, rendering nutrients like phosphorous, manganese, and zinc unavailable for plant growth. Based on Brady (1999) findings, substrates with high sodium content and higher nutrient content could not perform better because these nutrients were not made available to be absorbed by the sclerotia and therefore affect the required growth needed.

Effect of the Various Mixtures on the Dry and Wet Yield of the Mushroom

The study shows the mean wet and dry yield of mushroom harvested from each of the substrates used in this experiment. Control T_1 (topsoil) gave the highest wet and dry weight of 356.87g and 62.37g respectively followed by T_6 (1:4) which gave wet and dry weight of 191.95g and 31.43g respectively. T_5 (2:3) gave the lowest wet and dry wet of 2.64g and 0.45g. The higher yield of T_1 (topsoil) may be due to the fact that it also recorded the highest cap diameter and stipe height as there seems to be a direct relationship between stipe height, pileus diameter, stipe girth and total yield of mushroom. This observation agrees with the report of Ha Hi Hoa *et al.* (2015) that mushroom weight is influenced by the cap diameter, length and thickness of stipe and the number of effective fruiting bodies and the thickness of the cap.

Proximate Composition of Harvested Mushroom

The comparative proximate composition of *P. tuberregium* harvested from substrate T_1 (topsoil), T_5 (3:2), T_6 (1:4) and T_7 (1:1) as shown in Table (4). The moisture content of mushroom harvested from Control T_1 (topsoil) and T_6 (1:4) showed no significant difference $P<0.05$. It could therefore be assumed that both substrates have same water holding capacity. The difference in values between the proximate composition of control T_1 (topsoil), T_5 (3:2), T_6 (1:4) and T_7 (1:1) may be due to difference in the nutritional composition of each of these substrates which may have contributed immensely in the nutritional composition of the mushroom. These results are in agreement with the report of Jawad *et al.* (2013), who worked on the effect of substrate supplement on oyster mushroom production. Beluham and Ranogajee (2001) also reported that mushroom is potential source of total carbohydrate in the range of 42.62 – 66.78g/100g, very low fat content 1.34 – 6.45g/100g and also rich in protein 27.95 – 38.99g/100g depending on the type of specie. Oyster mushroom is rich in fiber and low in fat content and this character is highly beneficial for heart patients, (Jawal *et al.*, 2013).

Mineral Content of Harvested *Pleurotus tuberregium*

Result shows that Control T_1 (topsoil) produced mushroom with higher mineral content than T_6, while low mineral content were recorded in T_5 and T_7. This high mineral content of T_1 may be due to its low sodium content resulting to higher available nutrient in the substrate. The inherent nutrient in sclerotia were utilised effectively for primordial stage and formation of fruiting body with high nutrient value. These minerals found in oyster mushroom can help in supplying nutrient to the body. The high concentration of these minerals is advantageous since certain inorganic mineral elements such as potassium, zinc,

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calcium, and magnesium play important roles in the maintenance of normal glucose tolerance and in release of insulin from beta cells of islets of Langerhans (Kar *et al*., 1999, Agomuo, 2011).

The result in this study has revealed that decomposed palm bunch refuse and topsoil can be mixed into the right ratio for the cultivation of *Pleurotus tuberregium*. One part decomposed palm bunch refuse and 4 parts topsoil by weight appears to be the best mixture for increased production of *Pleurotus tuberregium*.

REFERENCES

Agomuo, E.N. (2011). Proximate, Phytochemical and Mineral Element Analysis of the Sclerotium of *Pleurotus tuberregium. International Science Research Journal*, 3, 104-107.

Association of Official Analytical Chemistry, (2000). Official Methods of Analysis (15th Edition) Washington DC: AOAC.

Beluham, S. & Ranogajee, A. (2011). Chemical Composition and Non-Volatile Components of Croatian Wild Mushrooms. *Food Chemistry*, 124, 1076-1082.

Brady, N.C. & Weil, R.R. (1999). The Nature and Properties of Soils Science. (14th Edition). New Jersey: Simon and Schuster Company.

Bremmer, J.M. (1996). *Nitrogen-Total In: Sparks*, D.L. (Ed.), Methods of Soil Analysis Part 3, Chemical Methods (pp. 1085-1121) No. 5, Madison: ASA & SSSA.

Chen, A.W. & Huang, N. (2004). Production of Tuber like Sclerotia of Medicinal Value *Pleurotus tuberregium* (Fr) Sing (Agaricomycetideae) *International Journal of Medicinal Mushrooms*, 5, 313-319.

Chiejina, N.V. & Olutokumbi, J.O. (2010). Effects of Different Substrates on the Yield and Protein Content of *Pleurotus tuberregim*. *African Journal of Biotechnology*, 9, 1573-1577.

Food and Agricultural Organisation (FAO) (1984). A Guide to Stable Food of the World. Rome, Italy: FAO.

Gee, G.W. & Or, D. (2002). *Particle Size Analysis*. In: Dane, J.H. and Topp, G.C. (Eds). Methods of Soil Analysis Part 4 Physical Methods (pp. 255-293). Madison: ASA and SSSA. WI.

Ha, H.H., Chun-li W.& Chong, H. (2015). The Effects of Different Substrates on the Growth, Yield and Nutritional Composition of two Oyster Mushroom (*Pleurotus ostreatus* and Pleurotus Cystidiosus). Retrieved from http://www.ncb.n.h.gov/pmc/articles/pmc 28th April 2016.

Ikeogu, J.E.O. & Nwocha, H.N. (2001). Development of the Yam Minituber Technologies for Seed Yam Production. *Niger Agricultural Journal*, 32, 97-108.

Isikhuemhen, S.O. & LeBauer, D.S. (2004). Grow *Pleurotus tuberregium* Mushroom. *Nigerian Journal of Edible Mushroom*, 11, 264-274.

Jackson, M.L. (1964). Soil Chemical Analysis. New Jersey: Englewood Cliff..

Jawad, A., Ali, M.A., Ahmed, W., Chauldhry, M.A.& Shafi, J. (2013). Effects of Different Substrates on Oyster Mushroom (Pleurotus Species)

Production. *Food Science and Technology*, 1, 44-51.

Jonathan, G. Adetolu, A., Ikpebivie, O. & Doubebe, W. (2006). Nutritive Value of Common Edible Mushroom from Southern Nigeria. *Global Journal of Biotechnology and Biochemistry*, 1, 16-21.

Kar, A. Chouldhary, B.K. & Bandyopadhyay, N.G. (1999). Preliminary Studies on the Inorganic Constituents of some Indigenous Hypoglycaemic Herbs on Oral Glucose Tolerance Test. *Journal of Ethanopharmacology*, 64, 179-184.

Kong, W.S. (2004). Description of Commercially Important Pleurotus Species. In *Mushroom Growers journal*, 1, 53-61.

Mangat, M., Khana, P.K., Ikapoor, S. & Sohal, B.S. (2008). Biomass and Extracellular Indicastrain, *Global Journal of Bitechnology and Biochemistry*, 3, 98-104.

Nelson, D. &Ward-Sommers, L.E. (1996). *Total Carbon Organic Carbon and Organic Matter*. In: Sparks D.L. (Ed.), Method of Soil Analysis Part 3, (pp. 901-1010). Madison: SSSA Book Series.

Ogundana, S.K. & Fagade, O. (1981). *The Nutritive Value of some Nigeria Edible Mushrooms*. In: Mushroom Science XI, Proceedings of the Eleventh International Scientific Congress on the Cultivation of Edible Fungi, Australia.

Olawuyi O.J., Jonathan S.G., Aina D.A. and Baysah G.I.(2010).Studies on antibacterial activities of Fomes lignosus-A Nigerian mushroom. Nigerian Journal of Microbiology 24(1):2153-2159.

Oluranti O.O.,Olawuyi O.J and Jonathan S.G(2012). Therapeutic properties of some Nigerian

higher fungi. Nature and Science 10(10):135-143.

Olson, S.R. & Sommers, L.E. (1982). *Phosphorous*. In: Page, A.L., Miller, R.H. & Keeney, D.R. (Eds.), Methods of Soil Analysis Part 4 (pp.15-72). Madison: American Society of Agronomy.

Oso, B.A. 1977. Pleurotus tuber-regium from Nigeria. *Mycologia*. 67(2): 271-277.

Okhuoya, J.A. & Etugo, J.F. (1993). Studies on the Cultivation of *Pleurotus tuberregium* (Fr) Sing. *An Edible Mushroom Bio-Resources Technology*, 44, 1-3.

Okhuoya, J.A. & Okogbo, F.O. (1991). Cultivation of *Pleurotus tuberregium* (Fr) Sing. On Various Farm Wastes Proceeding of the Oklahoma Academy of Science. Retrieved from http://digitallibrary.okstateedu/oas-pdf/v71/ 7th May, 2015.

Static Analysis Synposiun (SAS) (1999). Static Analysis. Retrieved from http://sas09.cs.ucdaris.edu/. 2nd February, 2016.

Thomas, G.W. (1982). *Exchangeable Bases*. In: Page A.L. Miller, R.H. and Keeney, D.R. (Eds) Methods of Analysis, Part 2 (pp.159-165). Madison: American Society of Agronomy.

Walkey, A. & Black, I.A. (1934). An Examination of the Different Methods of Determining Soil Organic Matter and a Purpose Modification of the Chromic and Acid Titration Method. *Soil Science*, 37, 28-29.