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Effects Of Some Grass Straws And *Treculia Africana* Bark On The Yield, Nutritional Value, And Mycochemical Composition Of *Pleurotus Ostreatus* Fruit-Bodies (Mont) Singer.

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ABSTRACT
Oyster mushroom *(Pleurotus ostreatus* var *florida* (fr.) singer) was cultivated on different agro- wastes. *Andropogon gayanus* straw, *Oryza sativa* straw (rice straw), *Pennisetum purpurea* straw, *Treculia Africana* bark, *Andropogon+Pennisetum*, (50:50) *Andropogon+Treculia* (50:50) and *Pennisetum* + *Treculia* (50:50). The fruit-body yield of the mushroom on the seven substrates and the effect of the substrates on the phytochemical compounds, alkaloid, flavonoid, HCN, phenol and steroid contents of the fruit-bodies were investigated. The investigation showed that *Andropogon+Pennisetum* showed a significantly higher mean number of fruit-bodies (68.65^{a}), followed by *Andropogon* + *Treculia* (60.67^{b}) while the least was from *Pennisetum* +*Treculia* (38.33^{d}).The biological efficiency (B.E) for the seven substrates are (9 ± 883^{b}) (8 ± 941^{ab}) (10 ± 307^{b}) (8 ± 767^{ab}) (12 ± 533^{c}) (7 ± 826^{a}) (7 ± 513^{a}) for the substrates respectively .The results of the myco-chemical revealed that *Pennisetum* + *Treculia* had the highest content of alkaloid (6.37 ± 0.03^{a}), followed by *Andropogon* + *Treculia* (6.26 ± 0.01^{b}) and the least from rice straw (4.84 ± 0.01^{g}). The flavonoid content ranged from rice (3.73 ± 0.01^{a}) followed by *Andropogon* (2.42 ± 0.02^{b}) and the least is *Pennisetum* + *Treculia* (1.08±0.01g). HCN content was low generally but highest in Rice,*Pennisetum* and *Treculia* (0.024 ± 0.01^{abc}) (0.024 ± 0.01^{abc}) (0.024 ± 0.01^{b}) respectively. Phenol content was highest in *Pennisetum* + *Treculia* (2.39 ± 0.02^{a}) followed by *Treculia* (2.35 ± 0.01^{b}) the least (2.08 ± 0.01^{g}) in rice straw.Steroid has(0.68 ± 0.01^{a}) contents in *Pennisetum* +*Treculia* , followed by (0.62 ± 0.01^{b}) in both *Treculia* and *Andropogon+Pennisetum* and the least (0.36 ± 0.01^{e}) in *Pennisetum.* There is significant variability in the chemical content of the substrates hence with appreciable quantities in all the substrates. The implication of this investigation shows that this substrates and their supplementation is acceptable in the production of the mushroom. They will give good and beneficial quality. Using the substrates will also help to solve waste disposal problems in our country.
Keywords: Grass straws, Oyster mushroom, *Treculia Africana* bark, mycochemical composition

INTRODUCTION

Cultivation of mushroom has been vogue for almost 300 years .Although we enjoy mushrooms today as an every-day vegetable, Mushroom recognition dated back to ancient Egyptian times was considered a rare luxury. And the use as food is attributed to one of the pharaohs who decreed them to be "too fine to be eaten by the common people (Anna, 2010). Mushrooms cultivation serves as the most efficient and economically viable Biotechnology for the conversion of lignocellulosic waste materials into high quality protein. Mushrooms are known to grow on a wide variety of substrates and habitats (Adesina *et al., 2011*). Most of the edible fungi have strong enzyme system and are capable of utilizing complex organic compounds, which occur as agricultural wastes and industrial by-product. Hence various agricultural by-products are being used as substrates for the cultivation of oyster mushrooms (Raymond *et al*., 2013). The agricultural wastes are converted into edible biomass in the form of fruit-bodies. Mushrooms, due to their documented high nutritive value, are recommended in numerous countries as an addition to the daily diet

(Kalac andsvodo,2000), (Isilogu*etal*.,2001), (Florezak*etal*.,2004), (Bernas*etal*.,2006). Many authors have investigated the cultivation of different mushrooms on different substrates (okwulehie and Nosike, 2015) documented the cultivation of *Pleurotus pulmonarius* on different barks of fruit tree like *Mangifera indica, , Elaise guineesis, Dacroyedus edulis* and *Treculia africana*.(Stanley et al. ,2011) cultivated oyster mushroom on corn cob supplemented with rice bran.

MATERIALS AND METHOD

Source of Plant Materials

Oyster mushroom spawn was purchased from Federal Research Institute Lagos State. The substrates were *Andropogon* straw(A), Rice straw(B), *Pennisetum purpurea* straw (C), and *Treculia africana* bark(D).Each of these substrate were supplemented with each other except for rice straw ,*Andropogon* and *Pennicetum* straw (X), *Andropogon* and *Treculia* bark(Y*),Pennisetum* straw and *Treculia* bark (Z)at the ratio of (50:50) In grams. The rice straw was gotten from National cereal crops Research Institute Amakama Abia State and the rest of the straw and bark were cut from a thick bush in Amawom umudike in Ikwuano L.G.A Abia State .The substrates were already dried and were spread on a cemented floor for few days, they were chopped with a sharp knife into small pieces of (1-2cm) then soaked in a different bowls of water overnight enabling water to cover the chopped substrates in the bowl. Excess water was removed the next day. The substrates were subjected up to 100^0c then steam-sterilized for 2 hours interval for the four different substrates .The subsequent pouring out the substrates from the metal drum followed covering it with a clean black water proof allowing it to cool .Then 100g of each of the substrates was weighed into a replicate of six ,except for *Andropogon* straw which was replicated into four in a perforated transparent plastic buckets and a supplementation of the substrates with each other except for rice straw were weighed into six replicate in a ratio of (50:50) making 40 replicate in total.

Innoculation

The substrates were inoculated with the spawn of the fungus *Pleurotus ostreatus*. One Bama bottle of spawn was used to inoculate four buckets of the substrates in an aseptic environment. The spawn was evenly distributed in the substrate and the inoculated substrates were placed on sterile wooden racks and covered with a thick black water proof to enhance the spread of mycelia. Sterilized water was sprayed on the inoculated substrate every two days and the cropping room was flooded to maintain a high relative humidity of (75%-80%).

Fruit-body formation

At the end of the 14^{th} day incubation period that mycelium had grown throughout the substrate and colonizes it. After the substrate has been fully colonized by the mycelium, the initial stage of fruiting is marked by the formation of primordial and continues to expand and grow larger into mushrooms.

Harvesting and Data Collection

Pleurotus ostreatus fruit primordial were allowed to grow into a recommended stage of young, firm, and fleshy (juvenile stage) and was gently detached at the base of the stipe from the buckets with hand. Dates of each harvest were also recorded for the 3 flushes. Fresh weight and numbers of the fruit-bodies were recorded, the stipe length and the pileus diameter was measured with a transparent meter rule and recorded. The fresh fruit-bodies were oven dried and the weight recorded. The dried fruit-bodies were used for the phytochemical analysis.

Table 1. Effect of Different substrates on the number of fruit body of *Pleurotus ostreatus*

	Flush 1	**Flush 2**	**Flush 3**
A	23.00[ab]	13.33a	8.00[a]
B	44.33[a]	9.00a	6.00[a]
C	33.00[ab]	14.33[a]	12.33[a]
D	20.67[ab]	12.33[a]	7.00[a]
X	40.33[ab]	14.33[a]	14.00[a]
Y	32.67[ab]	17.00[a]	11.00[a]
Z	17.33[b]	12.33[a]	8.67[a]

	Flush 1	**Flush 2**	**Flush 3**
A	17.07[b]	9.48[a]	6.43[b]
B	35.88[ab]	5.65[a]	3.38[b]
C	26.23[b]	10.27[a]	9.02[a]
D	18.67[b]	9.68a	5.67[b]
X	52.72[a]	8.67[a]	13.43[a]
Y	38.83[ab]	12.98[a]	7.53[b]
Z	16.88[b]	8.35[a]	6.13[b]

Table 3. Effect of Different Substrates on Diameter of Pileus of Fruit-body of *Pleurotus ostreatus*

	Flush 1	Flush 2	Flush 3
A	31.47[ab]	20.55[a]	11.00[b]
B	43.19[ab]	18.70[a]	7.57[b]
C	61.23[a]	21.68[a]	14.47[b]
D	29.98[ab]	16.93[a]	11.67[b]
X	56.03[ab]	21.77[a]	23.25[a]
Y	43.22[ab]	21.78[a]	13.18[b]
Z	24.62[b]	15.47[a]	10.30[b]

Table 4.Fresh weight of fruit bodies of *Pleurotus ostreatus*

	Flush 1	Flush 2	Flush 3
A	49.50[a]	30.00[ab]	19.33[ab]
B	55.41[a]	23.67[ab]	10.33[b]
C	46.07[a]	39.67[a]	17.33[ab]
D	41.00[a]	26.67[ab]	20.00[ab]
X	60.00[a]	33.33[ab]	32.00[a]
Y	44.33[a]	15.60[b]	16.33[ab]
Z	40.33[a]	21.67[ab]	13.17[b]

Table 5. Dried weight of fruit body of *Pleurotus ostreatus*

	Flush 1	Flush 2	Flush 3
A	5.67[a]	2.33[a]	2.33[abc]
B	5.33[a]	2.67[a]	1.00[c]
C	5.67[a]	3.67[a]	2.67[ab]
D	5.33[a]	3.33[a]	3.33[ab]
X	6.67[a]	3.67[a]	3.67[a]
Y	5.33[a]	3.33[a]	2.00[bc]
Z	4.67[a]	2.67[a]	2.33[abc]

Table 6. Mean total flush of *Pleurotus ostreatus*

	No of FB	LS	DP	WFFB	WDFB	BE
A	44.35^{c}	36.98^{c}	63.02^{bc}	98.83^{ab}	10.33^{c}	9.883^{b}
B	59.33^{b}	44.91^{c}	67.46^{b}	89.41^{b}	$9.oo^{d}$	8.941^{ab}
C	59.66^{b}	45.52^{c}	97.39^{a}	103.07^{a}	12.01^{b}	10.307^{b}
D	40.00^{c}	34.02^{d}	58.59^{c}	87.67^{b}	11.99^{b}	8.767^{ab}
X	68.65^{a}	74.82^{a}	101.05^{a}	125.33^{a}	14.01^{a}	12.533^{c}
Y	60.67^{b}	59.34^{b}	78.18^{b}	78.26^{c}	10.66^{c}	7.826^{a}
Z	38.33^{d}	31.33^{c}	50.39^{b}	75.13^{c}	9.67^{d}	7.513^{a}

Values are mean of three values on the same column with the same superscripts are not statistically different ($p>0.05$).

Table 7. Phytochemical composition of *Pleurotus ostreatus*

	Alkaloid	Flavonoid	HCN	Phenol	Steroid
A	$5.92^{e}\pm0.02$	$2.42^{b}\pm0.02$	$0.022^{c}\pm0.01$	$2.16^{f}\pm0.01$	$0.57^{e}\pm0.01$
B	$4.84^{g}\pm0.01$	$3.73^{a}\pm0.01$	$0.024^{abc}\pm0.01$	$2.08^{g}\pm0.01$	$0.44^{d}\pm0.01$
C	$5.36^{f}\pm0.07$	$1.27^{f}\pm0.02$	$0.024^{abc}\pm0.01$	$2.27^{c}\pm0.01$	$0.36^{e}\pm0.01$
D	$6.11^{d}\pm0.02$	$2.05^{d}\pm0.01$	$0.024^{a}\pm0.01$	$2.35^{b}\pm0.01$	$0.62^{b}\pm0.01$
X	$6.16^{c}\pm0.02$	$1.42^{e}\pm0.02$	$0.023^{abc}\pm0.01$	$2.20^{d}\pm0.02$	$0.62^{b}\pm0.01$
Y	$6.26^{b}\pm0.21$	$2.16^{c}\pm0.01$	$0.023^{bc}\pm0.01$	$2.19^{e}\pm0.01$	$0.58^{c}\pm0.01$
Z	$6.37^{a}\pm0.03$	$1.08^{g}\pm0.01$	$0.024^{ab}\pm0.00$	$2.39^{d}\pm0.01$	$0.68^{a}\pm0.01$

Values are mean± SD. Mean in the same column with different letters are statistically different ($p< 0.05$)

DISCUSSION

Generally the result obtained showed significant variability in the cultivation parameters .The investigation showed a significantly higher number of fruit-bodies (68.65^{a}) followed by Andropogon + Treculia (60.67^{b}) while the least was from Pennisetum + Treculia (38.33^{d}) Also total yield produced produced on Andropogon and + Pennisetum (X) (68.65^{a}) is higher than that produced in Andropogon (A) (44.35^{c})or Pennisetum (C) (59.66^{b}) . The fruit-bodies produced in (X) weighed more than those from the other substrates in most flushes .Similarly the other cultivation parameters followed the same trend asin the number of fruit –bodies .This result shows that for fruit-body yield Andropogon + Pennisetum is recommended.

The results of the myco-chemical revealed that *Pennisetum + Treculia* had the highest content of alkaloid (6.37 ± 0.03^{a}). Followed by *Andropogon + Treculia* (6.26 ± 0.01^{b}) and the least from rice straw

(4.84±0.01^{g}). The flavonoid content ranged from rice (3.73 ±0.01^{a}) followed by *Andropogon* (2.42±0.02^{b}) and the least is *Pennisetum + Treculia* (1.08±0.01g). HCN content was low generally but highest in Rice,*Pennisetum* and *Treculia* (0.024 ±0.01^{abc}) (0.024±0.01^{abc}) (0.024±0.01^{b}) respectively. Phenol content was highest in *Pennisetum + Treculia* (2.39±0.02^{a}) followed by *Treculia*(2.35± 0.01^{b}) the least (2.08±0.01^{g}) in rice straw.Steroidhas(0.68±0.01^{a}) contents in *Pennisetum +Treculia* , followed by (0.62 ±0.01^{b}) in both *Treculia* and *Andropogon+Pennisetum* and the least (0.36±0.01^{e}) in *Pennisetum*. This investigation shows that there is significant variability in the chemical content of the substrates hence with appreciable quantities in all .However this analysis showed that the highest percentage of most of the various chemicals was observed I *Pennisetum + Treculia* bark and can be implored to seek for this chemicals in high quantities.

CONCLUSION

Production of oyster mushroom on biological substrate can be a highly efficient method for producing protein-rich food. The organic ingredient in the various plant substrate is suitable in the production of *Pleurotus ostreatus* in high mass and better quality however Andropogon straw supplemented with Pennisetum straw is recommended for higher yield and *Treculia Africana* bark supplemented with *Pennisetum* straw is recommended for the beneficial results of its chemical build up. This will thus contribute a quota to the economic development of Nigeria as well as minimize waste disposal problem in the country.

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