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GROWTH AND PRODUCTIVITY OF (*PLEUROTUS FLORIDANUS*) ON SAWDUST SUBSTRATE

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ABSTRACT
Study was conducted to investigate growth and biological efficiency of oyster mushroom (Pleurotus floridanus) cultivated on different proportions of sawdust substrate supplemented with wheat bran. The experiment was a complete randomized design with three treatments (A-500g , B-1000g and C-1500g) 10 replicates each. The yield and biological efficiency of the 500g substrate was highest (with 265.5g) and B.E of (26.5%). Result of this study revealed no significant different (P>0.05) between yield and B.E of treatments 1000g and 1500g. Biological efficiency decreased with an increase in substrate quantity. Maximum moisture content (86.4%) was recorded in treatment 1500g followed by 85.8% for treatment 500g and 85.5% for 1000g. Number of fruit bodies recorded was 233, 201 and 91 for treatments 1500g, 1000g and 500g respectively. Means of pileus diameter and stipe length obtained were higher for mushrooms grown in 1500g substrate while lower values were obtained from those grown in the 500g substrate. Yield, B.E, moisture content, number of fruit, pileus diameter, stipe length of the mushrooms grown in different proportion of sawdust substrate were dependent on the quantities of the substrate. The use of less quantities of sawdust substrate in mushroom production is encouraged.

Keywords: *Pleurotus floridanus*, yield, Biological Efficiency, Mushroom Production.

INTRODUCTION

Agricultural output often referred to as yield is an essential component in every agricultural venture. It assists farmers to assess crop productivity as well as the effectiveness and efficiency of the production process. In crop production, crop yield refers both to the measure of yield of crop per unit area of land cultivated and seed generation of plants. In mushroom industry, yield is measured in terms of biological efficiency because productivity depends on the ability of different mushroom strain to convert substrate into mushrooms (Stamets, 2000). Mushroom cultivation and domestication had long been neglected, because most of the mushrooms consumed locally are picked from the wild. However, awareness in mushroom cultivation has increased significantly and is now popular. Domestication of mushroom is on the increase (Adedokun& Akuna 2013). Biological efficiency is a tool used in measuring yield of mushroom production (Quimio 1976). It is a term frequently used in the mushroom industry to describe yield potentials of mushrooms from various agricultural bye products. It is the most important and the most basic of all measurements in mushroom cultivation. It is the comparison of the dry weight substrate to the fresh harvested mushrooms. The formula was originally developed by the white button mushroom industry and expressed as " 25% conversion of wet substrate mass to fresh mushrooms or 10% conversion of dry substrate mass into dry mushroom" (Stamets, 2000).
Often times, in the mushroom industry, mushroom farmers produced mushrooms without knowing the quantity of fruit bodies they could obtain per certain quantity of substrate. A

mushroom grower should be able to ascertain the productivity of substrate used in cultivation. It is also of utmost interest to him to know the yield of every production. This makes it imperative for growers to understand biological efficiency to be able to assess the efficiency and effectiveness of the substrate for cultivation. The objectives of this study are to assess the yield of oyster mushroom on sawdust substrate as well as to compare the yield and biological efficiency of different quantities of bulk substrate used.

MATERIALS AND METHODS

Project Site

This experiment was conducted at the mushroom unit, Faculty of Agriculture Demonstration farm, University of Port Harcourt, Choba campus, Rivers State with a geographical co-ordinates of latitude 4° 47' 21" North and longitude 6° 59' 55" East.

Experimental Design

The experiment was set up as a complete randomized design with three treatments (500g, 1000g and 1500g) and 10 replicates each. Substrate preparation: The sawdust used was obtained from the Rumuosi Timber market and saw mill along East-West road Rumuosi, in Obio/Akpor Local Government Area of Rivers State. Sawdust, 93kg, wheat bran 7kg, calcium carbonate, 400g and 30-40 L of waters were mixed thoroughly to maintain homogeneity and the water was added to serve as a binder. The squeeze method was used to determine the moisture content of about 65%. The mixed substrate was them bagged tight and weighed for treatment A (500g), treatment B (1000g) and treatment C (1500g). 10 replicates of each treatment was prepared, well labeled, and corked with plastic rings held with rubber bands. A hole was made at the tip through the cork for easy of inoculation and covered with cotton wool; the bags were then transferred to the sterilization drum for sterilization. Sterilization was achieved using heat in a fabricated sterilizing unit.

Inoculation of Substrate

Each substrate bag was inoculated with 10% of spawn w/w weighed with electronic weighing scale **(capacity: 5000g×1g/2000g×0.1oz)**

Incubation, Fruiting and Harvesting

The bags were arranged in a dark incubation room for mycelia ramification. After one month, they were transferred to the fruiting room, where the capped cotton wool was carefully cut off using a razor blade to allow for sprouting. Harvesting of the mushrooms was done by hand twisting. Each bag was harvested separately and the mass of the mushroom from each bag was recorded in grams using a manual scale.

Drying

The harvested mushrooms were dried in a solar drier and used to determine the moisture content until constant weight recorded.

Data Collection

The following parameters of growth/yield were measured:

Number of Days to Full Ramification

The date at which bags were put into the incubation room was recorded as well as the date each bag attained full ramification for each treatment (500g (A) 1000g (B) and 1500g (C). Fresh weight of harvested mushrooms was recorded using a manual weighting balance.

Number of Days to Full Ramification
This was recorded prior to the time of harvesting of fruits.
Numbers of Fruits from each Bag
This was done by directly counting the number of fruit bodies on each substrate bag.
Pileus Diameter
The pileus diameter was taken from one end of the pileus to the other passing through the center of the pileus and was measured in centimeters (cm) using a transparent plastic rule.
Stipe Length
To effectively get the right stipe length the readings were taking before trimming the stipe to get the length, the length was measured by placing the string or thread from one end where it was attached to the substrate to the point where the gills on the pileus started on the stipe. The string or thread was placed along a rule to get the length in centimeters (cm).
Dry Weight
This was done using an electronic weighing balance.

DATA ANALYSIS

Yield and biological efficiency
Total weight of all the fruit bodies gotten form the three flushes were measured as total yield of mushroom. The biological efficiency was determined as the percentage ratio of the fresh weight of the harvested mushrooms per grams substrate over dry weight of substrate and calculated by the above formula (Chang et.al., 1981).

$$\text{B.E (\%)} = \frac{\text{fresh weight of harvest}}{\text{dry weight of substrate}} x\ 100$$

Moisture content
The moisture content of mushroom was also expressed in percentage (%) and calculated by the formula (Madan et al. 1987).

$$\text{Moisture content (\%)} = \frac{\text{weight of fresh sample - weight of dry sample}}{\text{weight of } \textit{fresh sample}} x100$$

Data were analyzed using the analysis of variance (ANOVA) procedure by SAS and means were separated using LSD at $p>0.05$

RESULTS

Number of Days to Full Ramification
Table 1 shows result for complete ramification of substrate by mycelia of mushroom. Minimal number of days to full ramification of substrate was recorded in the 500g substrate (A), followed by the 1000g (B) and 1500g (C) which took longer days to fully ramify. There is significant difference in full ramification day between treatments at P=0.05 (Table 1)

Table 1: Days to full ramification

Treatment	Days to full mycelia ramification
A	17.5±1.17
B	24.9±1.37
C	28.8±0.42

Mushroom yield

The oyster mushroom was harvested in three flushes. There was a steady increase in yield from first to third flush for treatment A. Yield of treatment B and C however, decreased by the third flush. The highest yield of *P. floridanus* was obtained in Treatment A with 265.5g followed by Treatment B with 187.8g while the least yield was obtained in Treatment C with 178g.

Table2: Mushroom yield and biological efficiency

Treatment	Total yield in 3 flushes (g)	Biological Efficiency
A	265.5	**25.55 ± 1.04[a]**
B	187.8	**18.78 ± 1.77[b]**
C	178	**17.8 ± 0.99[b]**
LSD 3.93		

Biological efficiency

Treatment A gave the highest biological efficiency with 26.5% followed by Treatment B with B.E of (18.7%) and the lowest was Treatment C with B.E of (17.8%).

Number of fruit bodies

The 1500g substrate produced the highest number of fruit bodies with a mean value of 77.6. The next was 67.0 produced by 1000g followed by 500g with 30.3

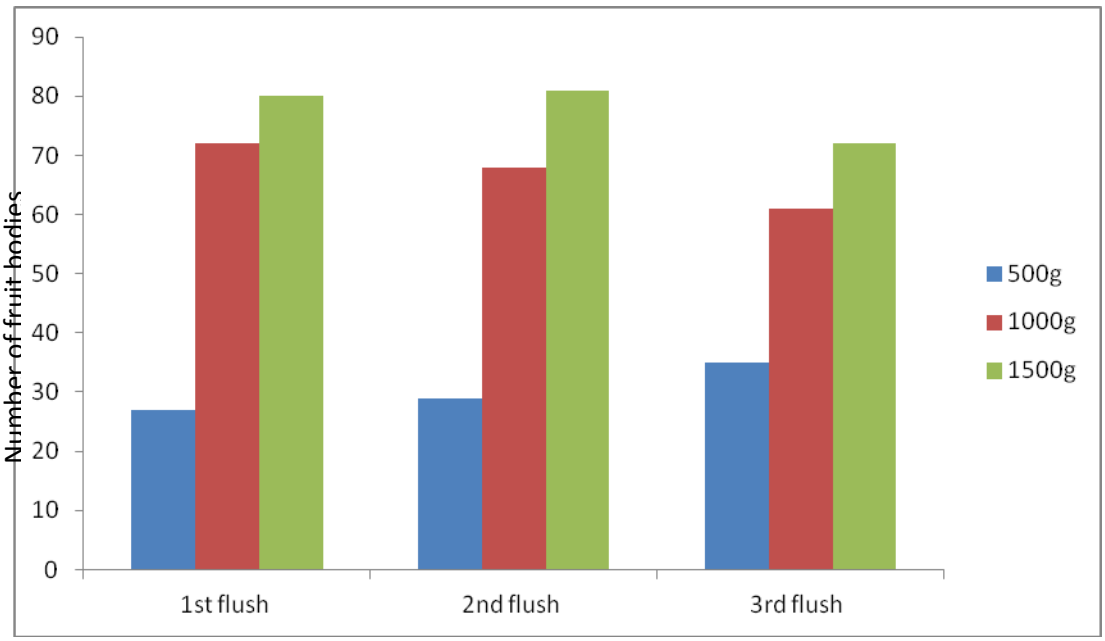

Fig 3: Total Number of Fruit Bodies

Table 3: Interaction Between Number of Flush, Pileus and Stipe

Treatment	Flush	Cap Diameter	Stipe Length
500g	**1**	**3.66** ± 0.47	**2.084** ± 0.34
	2	**5.09** ± 0.37	**2.46** ± 0.17
	3	**5.43** ± 0.38	**2.61** ± 0.17
1000g	**1**	**5.71** ± 0.27	**3.27** ± 0.14
	2	**5.18** ± 0.23	**3.10** ± 0.15
	3	**5.61** ± 0.25	**3.37** ± 0.14
1500g	**1**	**6.97** ± 0.46	**3.56** ± 0.15
	2	**5.96** ± 0.28	**3.39** ± 0.14
	3	**5.54** ± 0.19	**3.26** ± 0.34

MOISTURE CONTENT

The moisture content was maximum on 1500g (86.4%) followed by 500g (85.5%) there was slight variation with 1000g substrate (85.5%).

Table 4: Average (%) of moisture content

Treatment	1st flush (%)	2nd flush (%)	3rd flush (%)	Average (%)
500g	84.8	84.8	87.8	85.8
1000g	82.4	83.3	90.8	85.5
1500g	78.3	89.1	91.9	86.4

DISCUSSION

Ramification of substrate by mycelia of mushrooms differed according to the quantity of substrate used. It was observed that treatment with lowest quantity of substrate attained full mycelia ramification first compared to other substrate with higher quantities thus, the lower the substrate quantity, the faster the full ramification of substrate by mushroom mycelia. This corresponds with observation of Quimio (1999) who reported that the spawn running took 3-4 weeks. Mushrooms were harvested in three flushes. The increase in yield for treatment A and decrease for treatment B and C by the third flush could be as a result of the quantity of substrate used. In a similar research, Shar et.al (2004) reported maximum yield in the first flush, the same trend as observed in treatment B and C. The quantity of substrate could also be responsible for yield and biological efficiency. Increase in moisture content of fruiting bodies in all treatment with increased number of flushes is expected as watering of substrate continued as harvesting of mushrooms continued.

Furthermore, as observed in this study, low quantities of substrate resulted in higher yield and B.E. This could have a cumulative effect on reducing production cost and enhancing profitability because, the use of low quantity of substrates saves both the amount of substrate used and the amount of spawns needed for inoculation. Less substrate also indicates less time and labour needed for the preparation of the substrate. Observation of Shah et al (2004), corroborates this findings. The changes in the stipe length and pileus diameter of oyster mushroom in the different treatment could be explained by the quantity as well as compartment of substrate and supplement available for use by the mushroom. This is in agreement with observation by Onyango et al (2011).

CONCLUSION

Biological efficiency and its understanding have a vital role to play in increasing mushroom yield. Different proportions of substrate used in this study supported growth of mushroom however; both mycelia growth and yield were optimal in substrate with least substrate. This could have a cumulative effect in reducing production cost and profit. The use of low quantities of sawdust substrate is recommended to mushroom farmers since it has shown minimal days to full substrate ramification by mushroom mycelia, maximum yield and biological efficiency there by leading to short cultivation period.

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