

## Effect of Different Sawdust substrates on the Growth, Yield, and Proximate composition of Oyster Mushroom (*Pleurotus florida*)

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**Abstract:** Five different saw dust vzi. Mango tree (*Mangifera indica*, T<sub>2</sub>), Mahogany tree (*Swietenia mahagoni*, T<sub>3</sub>), Rain tree (*Albiia saman*, T<sub>4</sub>), Teak tree (*Tectona grandis*, T<sub>5</sub>), Jack fruit tree (*Artocarpus heterophylla*, T<sub>6</sub>) and all mixture of all five sawdust tree ( T<sub>1</sub>) supplemented with 30% wheat bran and 1 % lime as basal substrate were investigated in cultivation *Pleurotus florida*. The highest time from stimulation to primordial initiation (8.00 days), Time from primordial initiation to harvest (4.29 days) and highest cost benefit ratio (5.30) were obtain in T<sub>1</sub>. The highest average no. of primordial/packet (216.3), highest average no. of fruiting body/packet (116.7), the highest average no. of effective fruiting body (28.00), the highest average weight of individual fruiting body (4.58 g), the highest Dry yield (36.17) found in were observed in T<sub>3</sub>. The mycelium running rate in spawn packet (0.69 cm/day), the highest carbohydrate (42.36%) observed in T<sub>4</sub>. The highest amount of dry matter (11.20%) and the highest protein (27.83%) observed in T<sub>5</sub>. The highest amount of crude fiber found in T<sub>6</sub>. Therefore, it can be concluded that Mahogany sawdust supplemented with 30% wheat bran can be further used as a better substrate for *Pleurotus florida* production.

**Keywords:** Growth, Sawdust, Spawn, Substrate, Oyster Mushroom, *Pleurotus florida*, Wheat bran

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### I. Introduction

Oyster mushrooms are a diverse group of saprotrophic fungi belonging to the genus *Pleurotus*. Oyster mushroom contains 19-35% protein on dry weight basis as compared to 7.3% in rice 13.2% in wheat and 25.2% in milk [1]. It contains 4.0% fat having good quantity of unsaturated fatty acids which are essential in our diet [2]. It is rich in essential minerals and trace elements [3]. Mushrooms are source of Niacin (0.3 g) and Riboflavin (0.4 mg). Mushroom is a good source of trypsin enzyme. It is also rich in iron, copper, calcium, potassium, vitamin D and folic acid. Mushrooms are valuable health food, which are low in calories, high in vegetable proteins, zinc, chitin, fiber, vitamins and minerals [4]. Mushroom reduces serum cholesterol and high blood pressure [5]. These mushrooms are a good source of non-starchy carbohydrates, with high content of dietary fiber and moderate quantity of proteins, including most amino acids, minerals, and vitamins. The protein content varies from 1.6 to 2.5%, and the niacin content is about ten times higher than that of any other vegetable. Moreover reported that oyster mushrooms are rich in Vitamin C, B complex, and mineral salts required by the human body. Florida oyster mushroom good cultivation results at temperatures above 20°C and produce numerous carpophores. This summer strain forms numerous groups of primordia, distributed over the entire substrate. They develop into medium size (average 5 cm diam.), funnel-shaped fruit bodies with elongated stems. Their color varies, with increasing light intensity and temperature, from light-beige to greyish blue. The shelf life of the mushrooms is inversely proportional to the cultivation temperature. Recommended substrate is hardwood / (wheat) straw, rice bun. Flushes number 2-3 at 8-10 days interval at 90-95 percent relative humidity. Average yield 200 to 250 g saleable mushrooms per kg fresh substrate. Mushrooms are having a long history of use in traditional Chinese Medicine to promote good health and vitality and increasing body's adaptive abilities. Specifically, selected strains of dried mushrooms are used to produce mushrooms capsules and extracts. Mushroom reduces serum cholesterol and high blood pressure [5]. Edible mushrooms have been treated as important tool in modern medicine for their medicinal values [6]. Anti-cancer medicine (Leutinan) is produced recently by some chemical companies from the extract (Polysaccharides) of Shitake mushroom [5]. The present experiment was undertaken to evaluate influence of locally available substrates containing sawdust of different trees with wheat ban and 1% lime on growth and yield of *Pleurotus florida* mushroom. Those experiences were also to find the best sawdust among others as substrate for effective cultivation.

## II. Materials And Methods

### 2.1. Materials and Measurement:

The experiment was carried out at the Biochemistry laboratory and Mushroom Culture House (MCH) of the Department of Biochemistry, Sher-e-Bangla Agricultural University, Dhaka, during the period from January 2014 to June 2014. Fruiting body of oyster mushroom was collected from NAMDEC, Savar, Dhaka, Bangladesh. Details of the meteorological data during the period of the experiment were collected from Bangladesh Metrological Department, Agargone, Dhaka. Thi mushroom is characterized by the rapidity of the mycelia growth and high saprophytic colonization activity on cellulosic substrate. The sample was weighted by electric balance (KEY: JY-2003; China) and heated in muffle furnace (Nebetherm; Mod-L9/11/c6; Germany).

### 2.2. Treatment of the Experiments

Two different experiments with six treatments with five replications were conducted to achieve the desire objectives the experiments were as follows:

Experiment 1: Effect of different sawdust substrate on yield and yield contributing character of oyster (*Pleurotus florida*) mushroom.

Treatment used:

- T<sub>1</sub>: Controlled (Mixer of sawdust) supplemented with 30% wheat bran and 1% lime
- T<sub>2</sub>: Mango tree (*Mangifera indica*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>3</sub>: Mahogany tree (*Swietenia mahagoni*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>4</sub>: Rain tree (*Albiias aman*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>5</sub>: Teak tree (*Tectona grandis*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>6</sub>: Jack fruit tree (*Artocarpus heterophylla*) sawdust supplemented with 30% wheat bran

Experiment 2: Effect of different sawdust substrate on proximate composition analysis of oyster (*Pleurotus florida*) mushroom.

Treatment used:

- T<sub>1</sub>: Controlled (Mixer of sawdust) supplemented with 30% wheat bran and 1% lime
- T<sub>2</sub>: Mango tree (*Mangifera indica*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>3</sub>: Mahogany tree (*Swietenia mahagoni*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>4</sub>: Rain tree (*Albiia saman*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>5</sub>: Teak tree (*Tectona grandis*) sawdust supplemented with 30% wheat bran and 1% lime
- T<sub>6</sub>: Jack fruit tree (*Artocarpus heterophylla*) sawdust supplemented with 30% wheat bran

### 2.3. Preparation of packets

Spawn packets using different saw dust were prepared separately. With spawn preparing substrate; different supplements (at the different rate on dry weight basis) and CaCO<sub>3</sub> (1%) was added. The measured materials were taken in a plastic bowl and mixed thoroughly by hand and moisture was increased by adding water. Moisture was measured by using the moisture meter and adjusted the moisture content at 50%. The mixed substrates were filled into 9×12 inch polypropylene bag @ 200 g. The filled polypropylene bags were prepared by using bamboo neck and plugged the neck with cotton and covered with brown paper placing rubber band to hold it tightly in place.

### 2.4. Sterilization, inoculation and mycelium running in spawn packets

Therefore the packets were sterilized about 1hr and then these were kept for cooling. After cooling, 5g mother spawn were inoculated into the packets in the laminar airflow cabinet and were kept at 20-22°C temperature until the packets become white with the mushroom mycelium. After completion of the mycelium running the rubber band, brown paper, cotton plug and bamboo neck of the mouth of spawn packet were removed and the mouth was wrapped tightly with rubber band. Than this spawn packets were transferred to the culture house.

### 2.5. Cultivation of spawn packet

Two ends, opposite to each other of the upper position of plastic bag were cut in "D" shape with a blade and opened by removing the plastic sheet after which the opened surface of substrate was scraped slightly with a tea spoon for removing the thin whitish mycelial layer. Then the spawn packets were soaked in water for 15 minutes and invested to remove excess water for another 15 minutes. The packets of each type were placed separately on the floor of culture room and covered with newspaper. The moisture of the culture room was maintained 80-85% relative humidity by spraying water 3 times a day. The light around 300-500 lux and ventilation of culture house was maintained uniformly. The temperature of culture house was maintained 22°C

to 25°C. The first primordia appeared 2-4 days after scribing depending upon the type of substrate. The harvesting time also varied depending upon the type of substrate.

## 2.6. Collection of produced mushrooms

Oyster mushrooms matured within 2-3 days after primordia initiation. The matured fruiting body was identified by curial margin of the cap [7]. Mushrooms were harvested by twisting to uproot from the base.

## 2.7. Data collection

Data were collected on the according to the parameters mentioned below:

**Mycelial growth (%)**: Mycelial growth was counted by taking the full packet as a full unit and generally the data was taken at every two days intervals.

**Mycelium running rate in spawn packet (cm)**: Mycelium running rate (MRR) for each type of substrate was measured after the mycelium colony cross the shoulder of the packet. The linear length was measured at different places of packet using the following formula:

$$\text{MRR} = \frac{L}{N} \text{ cm/day [8]}$$

Where, L= Average length of mycelium running for different places (cm)

N= Number of days

**Days required for completing mycelium running**: Days required from inoculation to completion of mycelium running were recorded.

**Time from stimulation to primodia initiation (days)**: Time from stimulation to primodia initiation (days) were recorded.

**Time from primodia initiation to harvest (days)**: Time required form primodia initiations to harvest were recorded.

**Average no. of primodia /packet**: Number of primodia/packet was recorded.

**Average no. of fruiting body/packet**: Number of well-developed fruiting body / packet was recorded. Dry and pinheaded fruiting bodies were discarded but tiny fruiting bodies were included in counting.

**Average number of effective fruiting body per packet**: Number of well-developed fruiting body was recorded. Tiny fruiting bodies were discarded in counting.

**Average weight of individual fruiting body per packet**: Average weight of individual fruiting body was calculated by dividing the total weight of fruiting body per packet by the total number of fruiting body per packet.

**Biological yield (g)**: Biological yield per 500 g packet was measured by weighing the whole cluster of fruiting body without removing the lower hard and dirty portion.

**Economic yield**: Economic yield per 500 g packet was recorded by weighing all the fruiting bodies in a packet after removing the lower hard and dirty portion.

**Drying of mushrooms**: The collected fruiting bodies of the mushroom were transferred to the laboratory. Therefore data were collected on different parameter. After collection of the data the fruiting bodies were dried in the sun separately as per treatment. In the time of drying the stipe and the pileus were separated for better drying.

**Dry yield**: About 50 g of randomly selected mushroom sample was taken in a paper envelopes and was weighed correctly. The mushroom was oven dried at 72°C temperature for 24 hours and weighed again. The weight of blank envelop was subtracted from both the initial weight. The dry yield was calculated using the following formula [25]

$$\text{Dry yield (g/500g packet)} = \text{Economic yield} \times \frac{\text{Oven Dry Weight of sample (g)}}{\text{Fresh weight of sample (g)}}$$

**Biological efficiency**: Biological efficiency was determined by the following formula:

$$\text{Biological efficiency} = 100 \times \frac{\text{Total biological weight (g)}}{\text{Total weight substitute used (g)}}$$

**Benefit cost ratio**: The benefit cost ratio for different low cost substrates were computed based on present market price of mushroom and cost of different inputs in the markets [8]

**Cultural operations for subsequent flushes**: After completing the first harvest again the packets were scraped at the place where the 'D' shaped cut had been done and were soaked in a bucket for five minutes and then placed in the culture house and water was sprayed regularly. The primordia appeared 9-10 days after first harvest and 7-8 days after second harvest. Water spraying was continued until the mushrooms were ready to be harvested.

## 2.8. Proximate analysis of the mushrooms

**2.8.1 Collection of the samples**: Mushrooms grown from the spawn were collected packet wise and all the wastes and dusts were removed from the fruiting body. Therefore they were ready to be analyzed.

**2.8.2 Determination of Moisture:** About 10-20 g of the material of each sample were weighed into separated and weighed petridishes and dried in an oven at 100°C to 105°C till the weight of the petridishes with their contents was constant. The moisture content was expressed as percent of the fresh fruiting bodies or mushrooms.

$$\text{Moisture (\%)} = 100 \times \frac{\text{Initial weight} - \text{Final weight}}{\text{Weight of the sample}}$$

**2.8.3 Determination of Dry matter:** The dry matter content of sample was calculated by subtracting of the percent moisture of each sample from 100. The process was repeat 3-4 time for achieving constant weight of the sample used, The constant weight of the dry sample was termed as dry matter.

$$\text{Dry matter (\%)} = 100 - (\%) \text{ moisture content}$$

**2.8.4 Determination of crude fiber:** Ten gram of moisture and fat-free sample was taken in a beaker and 200 ml of boiling 0.255 N H<sub>2</sub>SO<sub>4</sub> was added. The mixture was boiled for 30 minutes keeping the volume constant by the addition of water at frequent intervals. The mixture was then filtered through a muslin cloth and the residue washed with hot water till free from acid. The material was then transferred to the same beaker and 200 ml of boiling 0.313 N NaOH added. After boiling for 30 minutes (keeping the volume constant as before) the mixture was filtered through a muslin cloth and the residue washed with hot water till free from alkali, followed by washing with some alcohol and ether. It was then transferred to a crucible, dried overnight at 80-100°C and weighed (We) in an electric balance (KEY: JY-2003; China). The crucible was heated in a muffle furnace (Nebertherm: Mod-L9/11/c6; Germany) at 600°C for 5-6 hours, cooled and weighed again (Wa). The difference in the weights (We-Wa) represents the weight of crude fiber.

$$\text{Crude fiber (g/100g sample)} = \frac{\{100 - (\text{moisture} + \text{fat})\} \times (We - Wa)}{\text{Weight of sample}} [9]$$

**2.8.5 Determination of protein:** The Protein contents of the fruiting bodies of the mushrooms were determined by the standard Micro-kjeldhal procedure of AOAC (1975). According to this method total nitrogen contents of the samples were estimated and proteins contents were find out by multiplying by 6.25 to the total nitrogen values.

$$\text{N (\%)} \text{ in the supplied fiber sample} = \frac{(a \times MHCL - b \times MNaoH) \times 1.401}{c}$$

**2.8.6 Total fat estimation:** Fat was estimated as crude ether extraction of the dry materials. The dried sample (about 5.0 g) was weighted into a conical flask and plugged with fat free cotton. The flask was then placed in an electric shaker and extracted with anhydrous ether for about 16 hours. The ether extract was filtered into another weighed conical flask. The flask containing the original ether extract was washed 4 to 5 times with small quantities of ether and the washings were also transferred to the filter paper. The ether in the conical flask was then removed by evaporation, and the flask with the residual was dried in an oven at 80°C to 100°C, cooled in desiccators and weighted. The result was expressed as follows:

$$\text{Fat contents (g/100g of dried sample)} = \frac{\text{Weight of ether extract} \times \text{Percentage of dried sample}}{\text{weight of dried sample taken}}$$

**2.8.7 Determination of total ash:** One gram of the sample was weighed accurately into a crucible. The crucible was placed on a clay pipe triangle and heated first over a low flame till all the material was completely charred, followed by heating in a muffle furnace for about 5-6 hours at 600°C. It was then cooled in a desecrator and weighed. To ensure completion of ashing, the crucible was then heated in the muffle furnace for 1hr, cooled and weighed. This was repeated till two consecutive weights were the same and the ash was almost white or grayish white in color. Then total ash was calculated as following equation

$$\text{Ash content (g/100 g sample)} = \frac{\text{Weight of ash} \times \text{Percentage of dried sample}}{\text{weight of dried sample taken}} [10]$$

### 2.8.8 Total carbohydrate estimation

The content of the available carbohydrate was determined by the following equation

$$\text{Carbohydrate (g/100 g sample)} = 100 - [(\text{Moisture} + \text{Fat} + \text{Protein} + \text{Ash} + \text{Crude Fiber}) \text{ g/100 g}] [10]$$

## 2.9. Elementary composition analysis

**2.9.1. Determination of total Nitrogen:** Total nitrogen was determined by a micro kjaldhal apparatus in the traditional method and calculated using the following formula.

$$\text{N (\%)} \text{ in the supplied fiber sample} = \frac{(a \times MHCL - b \times MNaoH) \times 1.401}{c}$$

**2.9.2. Determination of Ca, Mg, Fe, Zn and P:** The sample was digested with nitric acid to release of Ca, Mg, Fe, Zn and P, Ca, Mg, Fe and Zn were determined by atomic absorption spectrophotometer, P was determined by spectrophotometer and K was determined by flame photometry.

#### **Calculations**

For Ca, Mg, K, P

$$\text{mg per kg sample} = \frac{a \times 2500}{b \times c}$$

Where,

a= mg/L Ca, Mg, P measured on atomic absorption spectrometer, flame photometer or spectrophotometer

b= ml diluted filtrate transferred into the 50 ml volumetric flask for determination of Ca, Mg, K or P

c = g sample weighed into the digestion tube

If an additional dilution is made before the transfer to the 50 ml volumetric flask, the result is multiplied with the dilution factor. But the above elements were in trace. So addition of dilution was not to be performed.

For Fe, Zn and Co

$$\text{mg per kg sample} = \frac{d \times 100}{c}$$

Where,

d = mg/L Zn and Fe measured on atomic absorption spectrophotometer

c = g sample weighed into the digestion tub

### **III. Results And Discussion**

#### **3.1 Effect of different sawdust substrate on the growth and yield**

##### **3.1.1 Effect on mycelium growth**

###### ***Effect of different sawdust substrate on mycelium running rate in spawn (cm)***

Mycelium running rate per day (MRR) for each type of substrates was measured after the mycelium colony crossed the shoulder of the packet. The linear length was measured at different places of packet. Mycelium running rate in spawn packet was found to be differed due to different levels of supplements used. The highest running rate was observed in T<sub>4</sub> (0.69 cm) followed by T<sub>3</sub> (0.60 cm). The other treatments were statistically similar (Table 1). The present findings corroborated with the findings of previous workers [11, 12, 13 and 14]. Khan *et al.* (1991) [14] reported that time taken for completion of spawn running may require to 17 days from 22 days by use of different substrates. Sarker (2004) [11] found that the mycelium running rate of oyster mushroom greatly influenced with the supplement of wheat brans in different levels. Bhuyan (2008) [12] also found similar result as found in the present experiment.

###### ***Effect of different sawdust substrate on Time from stimulation to primordia initiation (Days)***

The time from stimulation to primordia initiation ranged from 6.0 days to 8.0 days. The highest time from stimulation to primordia initiation was observed in T<sub>1</sub> (8.0 days). Statistically similar lowest stimulation primordia initiation was shown in the treatment T<sub>2</sub> and T<sub>3</sub> (6.0) days. The other treatments were statistically varied to T<sub>6</sub> (7.33 days) and T<sub>5</sub> (6.66 days) of time from stimulation to primordia initiation (Table 1). The result of the present findings keeps in with the findings of previous scientists [11, 12].

###### ***Effect of different sawdust substrate on Time from primordia initiation to harvest (days):***

The lowest time from primordia initiation to harvest was in the treatment T<sub>4</sub> (3.06 days) and the highest time from primordia initiation to harvest was observed in the treatment T<sub>3</sub> (4.29 days) followed by T<sub>1</sub> (4.16 days). The other treatments were statistically similar but numerically different (Table 1). The result of the present findings keeps in with the findings of previous scientists Khan *et al.* (2001), Royse (2002) [14, 15] found, as the spawn rate increased the number of days to production decreased.

**Table 1.** Effect of sawdust substrate on mycelia growth of oyster mushroom (*Pleurotus florida*)

Treatment	Mycelium running rate in spawn packet (cm)	Time from stimulation to primordial initiation (days)	Time from primordia Initiation to harvest (days)
T <sub>1</sub>	0.54 <sup>c</sup>	8.00 <sup>a</sup>	4.29 <sup>a</sup>
T <sub>2</sub>	0.54 <sup>c</sup>	6.00 <sup>c</sup>	3.73 <sup>ab</sup>
T <sub>3</sub>	0.60 <sup>b</sup>	6.00 <sup>c</sup>	4.16 <sup>a</sup>
T <sub>4</sub>	0.69 <sup>a</sup>	7.66 <sup>a</sup>	3.06 <sup>c</sup>
T <sub>5</sub>	0.53 <sup>c</sup>	6.66 <sup>bc</sup>	3.37 <sup>bc</sup>
T <sub>6</sub>	0.54 <sup>c</sup>	7.33 <sup>ab</sup>	3.19 <sup>bc</sup>
CV(%)	6.30	6.90	8.96
LSD(0.05)	0.057	0.878	0.592

Mean followed by same letter significantly different at 1% or 5% level of significance

### 3.1.2. Effect on yield contributing character and yield

#### Effect of different sawdust substrate on average no. of Primordia/packe

The highest average number of primordia/packet was observed in the treatment T<sub>3</sub> (216.3) followed by T<sub>4</sub> (206.7) and T<sub>1</sub> (204.3) treatment and the lowest average number of primordia/packet was in the treatment T<sub>2</sub> (190.7) followed by T<sub>5</sub> (191.3). The result of the present findings keeps in with the findings of previous scientists [16]. Ahmed (1998) [17] reported significantly different number of primordia on different substrates. Bhuyan (2008) [12] found similar findings growing oyster mushroom on saw dust supplemented with different levels of cow dung.

#### Effect of different sawdust substrate on average Number of fruiting body/packet

The highest average number of fruiting body/packet was observed in the treatment T<sub>3</sub> (116.7) followed by T<sub>1</sub> (101.7) and the lowest average number of fruiting body /packet was in the treatment T<sub>2</sub> (71.00). The other treatments were statistically similar in terms of average number of primordia/packet (Table 2). The result of the present findings keeps in with the findings of previous scientists [18] reported that the number of fruiting bodies was lower, but increased when the substrates was mixed with different supplements. Sarker, (2004) [8] found that the number of primordia increased with the levels of supplement and continued up to a certain range and decline thereafter. Bhuyan (2008) [12] in a same type of experiment found similar results.

#### Effect of different sawdust substrate on average Number of effective fruting body/packet

The highest average number of fruiting body/packet was observed in the treatment T<sub>3</sub> (28.00) followed by T<sub>1</sub>(23.00) and the lowest average number of fruiting body /packet was in the treatment T<sub>5</sub> (16.00). The other treatments were statistically similar to T<sub>6</sub> (18.67) followed by T<sub>2</sub> (19.67) in terms of average number of primordia/packet (Table 2). The result of the present findings keeps in with the findings of previous scientists [18] reported that the no. of fruiting body was low but increase when the substrate was mixed with different substrate.

#### Effect of different sawdust substrate on average weight of individual fruiting body (g)

The average weight of individual fruiting body in different treatment ranged from 4.58 g to 3.02 g. The highest average weight of individual fruiting body was observed in the treatment T<sub>3</sub> (4.58 g) followed by T<sub>3</sub> (4.36 g) and the lowest average weight of individual fruiting body was in the treatment T<sub>2</sub> (3.02 g). The other treatments varied significantly over control in terms of average weight of individual fruiting body (Table 2). The present study matches with the study of the previous scientists [8, 19, 12].

**Table 2.** Effect of sawdust substrate on mushroom on the yield attributes of Oyster mushroom (*Pleurotus florida*)

Treatments	Avg. no of primordia/packet	Avg. no of fruiting body/packet	Avg. no of effective fruiting body/packet	Avg. wt of individual fruiting body (g)
T <sub>1</sub>	204.3 <sup>c</sup>	101.7 <sup>b</sup>	23.00 <sup>b</sup>	4.36 <sup>b</sup>
T <sub>2</sub>	190.7 <sup>e</sup>	71.00 <sup>c</sup>	19.67 <sup>c</sup>	3.02 <sup>f</sup>
T <sub>3</sub>	216.3 <sup>a</sup>	116.7 <sup>a</sup>	28.00 <sup>a</sup>	4.58 <sup>a</sup>
T <sub>4</sub>	206.7 <sup>b</sup>	99.33 <sup>b</sup>	19.3 <sup>c</sup>	3.92 <sup>e</sup>
T <sub>5</sub>	191.3 <sup>e</sup>	80.67 <sup>d</sup>	16.00 <sup>d</sup>	3.37 <sup>e</sup>
T <sub>6</sub>	201.0 <sup>d</sup>	90.67 <sup>c</sup>	18.67 <sup>c</sup>	3.79 <sup>d</sup>
CV (%)	0.60	1.79	5.17	1.60
LSD (0.05)	2.195	3.038	1.956	0.115

Mean followed by same letter significantly different at 1% or 5% level of significance

Sarker *et al.* (2007) [19] reported the individual weigh of fruiting body ranged from 1.33-1.59g, which was more or less similar to this study. Bhuyan (2008) [12] found significant effect of supplementation on the weight of fruiting body but he found comparatively higher weigh of individual fruiting body ranged from (5.02g to 7.01g), which may be due to environmental conditions or growing season.

**Effect of different sawdust substrate on biological Yield (g)**

The highest biological yield was counted under treatment T<sub>3</sub> (369.2 g) and the lowest biological yield was counted under T<sub>2</sub> (371.3 g). The other treatments varied significantly as compared with control in terms of biological yield (Table 3). Baysal *et al.* (2003) [20] found the highest yield of Oyster mushroom (*Pleurotus ostreatus*) with the substrate composed of 20% rice husk in weigh. Amin *et al.* (2007) [21] found the highest biological yield 247.3g/packet. He also found that the trend of economic yield corresponded with different supplements at different level.

**Effect of different sawdust substrate on economic yield (g)**

The highest economic yield was recorded under treatment T<sub>3</sub> (361.7 g) and the lowest economic yield was counted under T<sub>2</sub> (311.0 g). The other treatments varied significantly over control (Table 3). Amin *et al.* (2007) [21] mentioned that suitable amount of supplements added to sawdust medium maximized economic yield of oyster mushroom at optimum production cost. Bhuyan (2008) [12] observed that the yield of *Pleurotus ostreatus* responded with the levels of supplements used with sawdust and increased with the level of supplementation and declined thereafter.

**Effect of different sawdust substrate on dry yield**

The dry yield of mushroom was maximum under the treatment T<sub>3</sub> (36.17 g) and the lowest dry yield was counted under T<sub>2</sub> (31.10 g). The other treatments were varied significantly over control (Table 3). Sarker *et al.* (2007) [19] found the range of dry yield from 4.28 g to 29.98 g, which was more or less similar to this study.

**Effect of different sawdust substrate on biological efficiency**

The highest biological efficiency of 201.5% was calculated in treatment T<sub>3</sub> and the lowest biological efficiency of 175.4% was calculated from T<sub>2</sub> (Table 3). The other treatments varied significantly over control. Obodai *et al.* (2003) [20] found biological efficiency (BE) followed a pattern and ranged from 61.0% to 80.0%. The present findings keep in with the findings of previous workers Biswas *et al.* (1997) [20] found supplementation of substrate promoted biological Efficiency (125.75%).

**Table 3.** Effect of different sawdust substrate on the yield of oyster mushroom (*Pleurotus florida*)

Treatment	Biological yield (g)	Economic yield (g)	Dry yield (g)	Biological efficiency (%)	Cost benefit ratio
T <sub>1</sub>	349.6 <sup>b</sup>	343.3 <sup>b</sup>	34.33 <sup>b</sup>	196.9 <sup>b</sup>	5.30 <sup>a</sup>
T <sub>2</sub>	317.3 <sup>e</sup>	311.0 <sup>e</sup>	31.10 <sup>e</sup>	175.4 <sup>d</sup>	4.70 <sup>c</sup>
T <sub>3</sub>	369.2 <sup>a</sup>	361.7 <sup>a</sup>	36.17 <sup>a</sup>	201.5 <sup>a</sup>	5.26 <sup>a</sup>
T <sub>4</sub>	345.7 <sup>b</sup>	339.3 <sup>bc</sup>	33.93 <sup>bc</sup>	195.1 <sup>b</sup>	5.11 <sup>ab</sup>
T <sub>5</sub>	330.1 <sup>d</sup>	324.0 <sup>d</sup>	32.40 <sup>d</sup>	186.2 <sup>c</sup>	4.89 <sup>bc</sup>
T <sub>6</sub>	341.6 <sup>c</sup>	335.7 <sup>c</sup>	33.57 <sup>c</sup>	195.9 <sup>b</sup>	5.02 <sup>b</sup>
CV (%)	1.13	1.18	1.18	0.73	2.59
LSD (0.05)	7.009	7.193	0.718	2.554	0.237

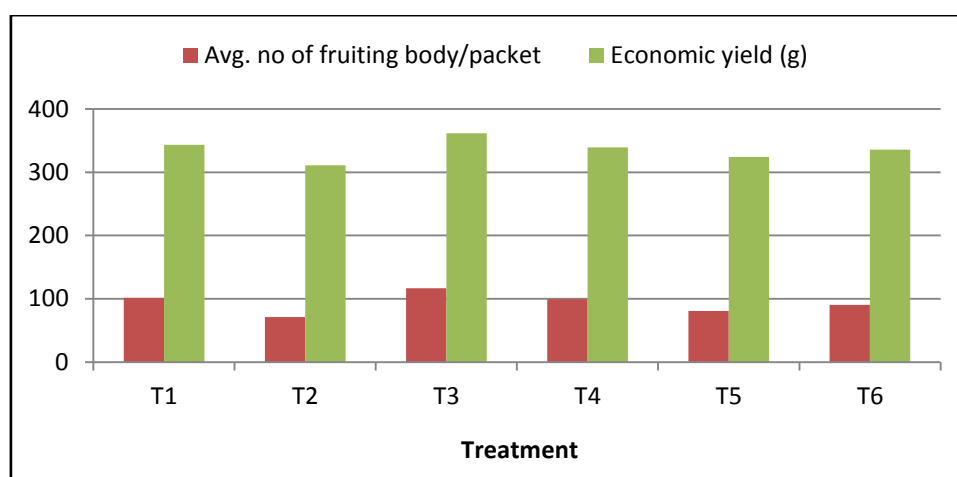
Mean followed by same latter significantly different at 1% or 5% level of significance

**Effect of different sawdust substrate on benefit Cost ratio**

The highest cost benefit ratio was calculated in treatment T<sub>1</sub> (5.30) and the lowest cost benefit ratio 4.70 was calculated from T<sub>2</sub>. The other treatments differed significantly in terms of cost benefit ratio (Table 3). The present findings keep in with the findings of previous workers [23, 17, 24]. Lim *et al.* (1997) [23] analyzed the cost and return of *Volvariella* and *Pleurotus* mushroom production and found the ROI of 8.9 and 5.1, respectively. Ahmed (1998) [17] also observed the benefit cost ratio of 73.2, 23.78 and 16.23 in case of *Pleurotus sajor-caj*.

**Relation between average number of fruiting body and economic yield (g)**

The highest average number of fruiting body was recorded under treatment T<sub>3</sub> and that was 116.7 and highest economic yield was recorded under treatment T<sub>3</sub> respectively and the lowest average number of fruiting body was recorded under treatment T<sub>2</sub> and that was 71 followed by T<sub>5</sub> (80.67) lowest economic yield was under T<sub>2</sub>(311).



**Fig: 1.** Effect of different sawdust on relation between average number of fruiting body and economic yield (g)

### 3.2. Effect of different sawdust substrate on proximate analysis oyster mushroom (*Pleurotus florida*)

#### 3.2.1. Effect on proximate composition of oyster mushroom (*Pleurotus florida*)

##### *Effect of different sawdust substrate on moisture*

The moisture content of the fruiting body shows significant difference. The moisture percent ranged from 88.80 % to 90.33 %. The highest moisture percent was observed in treatment T<sub>4</sub> (90.33 %) followed by T<sub>3</sub> (90.18 %). The lowest moisture percent was observed in T<sub>5</sub> (88.80 %) (Table 4). The result of the present study keep in with the findings of previous workers [25, 26]. Rahman (1994) [25] observed more or less 90% moisture in the mushroom *Pleurotus ostreatus*. Moni *et al.* (2004) [26] found 88.15 to 91.64% moisture. Bhuyan (2008) [12] found no significant differences among the mushrooms produced in sawdust supplemented with wheat bran.

##### *Effect of different sawdust substrate and dry matter*

The dry matter percentage of the fruiting body shows significant difference. The dry matter percent of fruiting body ranged from 11.03% to 9.66 %. The highest dry matter percentage was observed in treatment T<sub>5</sub> (11.03 %) and the lowest dry matter percentage was observed in T<sub>4</sub> (9.66%) (Table 4). The result of the present study matches with the findings of previous scientists. Bhuyan (2008) [12] found no significant differences among the treatments when cow dung used as supplement. But in this study there was significant differences found among the treatments. This may be due to different levels of cultural practices.

##### *Effect of different sawdust substrate on protein*

All the treatments contain a considerable amount of protein. The content of protein varied from 26.24-27.30% (w/w) in the mushroom grown on different sawdust substrate. The highest content of protein was found in treatment T<sub>5</sub> (27.30%) and the lowest protein was found in T<sub>2</sub> (25.35%). The other treatments varied significantly over control in respect to protein content (Table 4). The result of the present study corroborates with the study of Chang *et al.* (1981) [27] who reported that the fruit bodies of oyster mushrooms contained 26.6-34.1% protein.

##### *Effect of different sawdust substrate on lipid*

The lowest lipid percentage was counted under treatment T<sub>6</sub> (3.43 %) followed by T<sub>1</sub> (3.47 %). The highest lipid percentage was counted under T<sub>2</sub> (4.46 %). The rest of the treatments were statistically similar (Table 4). The result of the present study showed that the lipid content of the mushroom decreased as the supplements added with the substrates. The result of the present study keep in with the findings of Chang *et al.* (1981) [27], who found 1.1-8.0 lipid in oyster mushroom varieties. Alam *et al.* (2007) [28] reported 4.30 to 4.41% lipids in oyster mushroom grown on different substrates.

##### *Effect of different sawdust substrate on ash*

The highest percentage of ash was observed in the treatment T<sub>1</sub> (13 %) and the lowest percentage of ash was in the treatment T<sub>5</sub> (8.5%). The other treatments were statistically different but differed significantly in terms of percentage ash content (Table 4). The findings of the present study are supported by the study of Rahman (1994) [25] who reported ash contents were moderate in the fruiting bodies. Alam *et al.* (2007) [28]



reported 8.28 to 9.02% of ash in *Pleurotus spp.* In the present study the ash content is as high as 12.80 may be due to the newly introduced varieties.

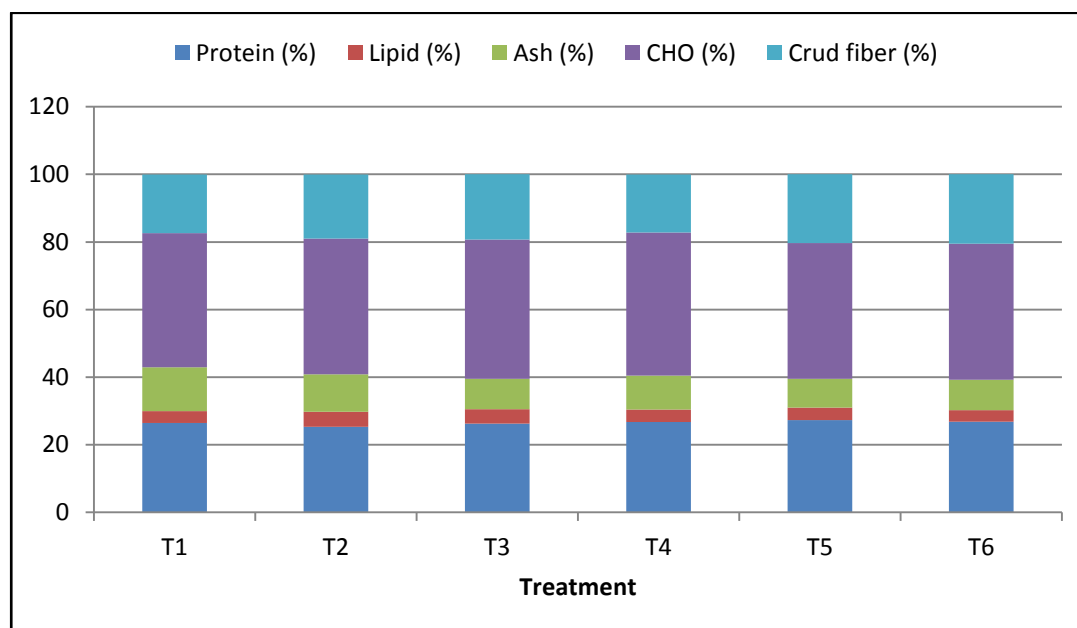
**Table 4.** Effect of sawdust substrate on proximate composition of oyster mushroom (*Pleurotus florida*)

Treatment	Moisture (%)	Dry matter (%)	Protein (%)	Lipid (%)	Ash (%)	CHO (%)	Crud fiber (%)
T <sub>1</sub>	90.02 <sup>c</sup>	9.98 <sup>c</sup>	26.46 <sup>ab</sup>	3.47 <sup>cd</sup>	13.0 <sup>a</sup>	39.67 <sup>c</sup>	17.37 <sup>d</sup>
T <sub>2</sub>	88.97 <sup>d</sup>	11.03 <sup>b</sup>	25.35 <sup>b</sup>	4.46 <sup>a</sup>	11.0 <sup>a</sup>	40.19 <sup>bc</sup>	18.96 <sup>c</sup>
T <sub>3</sub>	90.18 <sup>b</sup>	9.82 <sup>d</sup>	26.24 <sup>ab</sup>	4.25 <sup>ab</sup>	9.0 <sup>bc</sup>	41.26 <sup>b</sup>	19.25 <sup>b</sup>
T <sub>4</sub>	90.3 <sup>a</sup>	9.66 <sup>c</sup>	26.73 <sup>ab</sup>	3.75 <sup>b</sup>	10.0 <sup>b</sup>	42.36 <sup>a</sup>	17.13 <sup>d</sup>
T <sub>5</sub>	88.80 <sup>e</sup>	11.20 <sup>a</sup>	27.30 <sup>a</sup>	3.68 <sup>bc</sup>	8.5 <sup>c</sup>	40.23 <sup>bc</sup>	20.30 <sup>b</sup>
T <sub>6</sub>	90.14 <sup>b</sup>	9.86 <sup>d</sup>	26.83 <sup>ab</sup>	3.43 <sup>d</sup>	9.0 <sup>bc</sup>	40.21 <sup>bc</sup>	20.53 <sup>a</sup>
CV (%)	0.06	0.55	10.02	3.39	5.22	1.79	1.155
LSD (0.05)	0.09	0.09	4.91	0.23	1.02	1.32	0.39

Mean followed by same letter significantly different at 1% or 5% level of significance

**Effect of different sawdust substrate on carbohydrate**

The lowest percentage of carbohydrate was counted under treatment T<sub>1</sub> (39.67 %) and the highest carbohydrate percentage was counted under T<sub>4</sub> (42.36 %). The rest of the treatments were statistically different but differed significantly over control in respect to percent carbohydrate content (Table 7). The findings of the present study do not match with the study of Chang *et al.* (1981) [27] reported that the fruit bodies mushrooms contained 40.30-50.7% of carbohydrates. But it was supported by Alam *et al.* (2007) [28] who found 39.82 to 42.83% of carbohydrates in *Pleurotus spp.*



**Fig 2.** Effect of sawdust substrate on proximate composition of oyster mushroom (*Pleurotus florida*)

**Effect of different sawdust substrate on crud fiber**

The highest percentage of crud fiber was counted under treatment T<sub>6</sub> (20.53 %) and the lowest crud fiber percentage was counted under T<sub>4</sub> (17.13). The rest of the treatments were statistically different but varied significantly over control in respect to percent crud fiber content (Table 4). The findings of the present study corroborate with the study Alam *et al.* (2007) [28] reported 22.87g/100g to 23.29g/100g of fiber in *Pleurotus spp.*

**3.2.2. Effect of different sawdust substrate on elemental content**

**Effect of different sawdust substrate on nitrogen**

The highest percentage of nitrogen content (g/100gm) was counted under treatment T<sub>2</sub> (4.52 %) and the lowest nitrogen percentage was counted under T<sub>3</sub> (4.03 %). The rest of the treatments were statistically and significantly varied over control in terms of percent nitrogen content (Table 5). The rest of the treatments were statistically similar in respect to percent nitrogen content (Table 5). The findings of the present study matches

with the study of Moni *et al.* (2004) [26] who analyzed for various nutritional parameters and found 4.22 to 5.59 % of nitrogen on dry matter basis in fruiting bodies of oyster mushroom.

**Effect of different sawdust substrate on phosphorus**

The highest percentage of phosphorus content under treatment T<sub>1</sub> (0.94) was followed by T<sub>4</sub> and T<sub>6</sub> (0.83). The rest of the treatments were statistically similar (Table 5) but the lowest phosphorus percentage was counted under T<sub>5</sub> (0.77). Sarker *et al.* (2007) [27] found 0.97% phosphorus, in oyster mushroom grown on sugarcane bagasse based substrates.

**Effect of different sawdust substrate on calcium**

The highest percentage of calcium content (g/100g) was counted under treatment T<sub>5</sub> (31.63%) and the lowest calcium percentage was counted under T<sub>1</sub> (25.06). The rest of the treatments were statistically similar but differed significantly over control in respect to percent calcium content (Table 5). The findings of the present study matches with the study of Alam *et al.* (2007) [28] who found 22.15 to 33.7 mg/100g of calcium in different oyster mushroom varieties. Sarker *et al.* (2007) [19] found 2400ppm calcium, in oyster mushroom grown on sawdust based substrates.

**Effect of different sawdust substrate on magnesium**

The highest percentage of magnesium content was counted under treatment T<sub>4</sub> (21.46) and the lowest magnesium percentage was counted under T<sub>2</sub> (13.58) which were followed by T<sub>2</sub> (15.22). The rest of the treatments were statistically similar but differed significantly over control in respect to percent magnesium content (Table 5). The findings of the present study corroborates with the study of Alam *et al.* (2007) [28] found 13.4 to 20.22 mg/100g of magnesium in different oyster mushroom varieties.

**Effect of different sawdust substrate on zinc**

The highest amount (mg) of zinc was observed under treatment T<sub>2</sub> (28.31) followed by T<sub>3</sub> (27.59).The lowest amount was observed under T<sub>5</sub> (13.58) followed by T<sub>4</sub> (23.57). The rest of the treatments were statistically similar in respect to zinc content (Table 5). The result of the present study matches with the study of Alam *et al.* (2007) [28] who found that zinc content of different oyster mushroom varieties ranged from 16 to 20.9 mg/100g. Sarker *et al.* (2007) [19] found 30.92ppm zinc in oyster mushroom grown on sawdust based substrates.

**Effect of different sawdust substrate on cobalt**

The highest percentage of cobalt content (mg/100g) was counted under treatment T<sub>3</sub> (21.73) and the lowest cobalt percentage was counted under T<sub>1</sub> (12.53) followed by T<sub>5</sub> (12.87). The rest of the treatments were statistically different in respect to percent cobalt content (Table 5).

**Effect of different sawdust substrate on iron**

The highest percentage of iron content (mg/100g) was counted under treatment T<sub>2</sub> (42.40) and the lowest iron percentage was counted under T<sub>1</sub> (40.75). The rest of the treatments were statistically similar in respect to percent iron content (Table 5). The findings of the present study matches with the findings of Alam *et al.* (2007) [28] found 33.45 to 43.2 mg/100g of iron in different oyster mushroom varieties. Sarker *et al.* (2007) [19] found 92.09 ppm to 118.40 ppm iron, in oyster mushroom grown on sawdust based substrates.

**Table 5.** Effect of sawdust substrate on elemental contents of oyster mushroom (*Pleurotus florida*)

Treatment	N (%)	P (%)	Ca (%)	Mg (%)	Zn (mg %)	Co (mg %)	Fe (mg %)
T <sub>1</sub>	4.36 <sup>ab</sup>	0.94 <sup>a</sup>	25.06 <sup>b</sup>	18.04 <sup>ab</sup>	24.97 <sup>b</sup>	12.53 <sup>d</sup>	39.63 <sup>d</sup>
T <sub>2</sub>	4.52 <sup>a</sup>	0.81 <sup>b</sup>	29.84 <sup>ab</sup>	15.22 <sup>bc</sup>	28.31 <sup>a</sup>	14.10 <sup>c</sup>	42.40 <sup>a</sup>
T <sub>3</sub>	4.03 <sup>b</sup>	0.79 <sup>b</sup>	26.20 <sup>ab</sup>	19.17 <sup>ab</sup>	27.59 <sup>a</sup>	21.73 <sup>a</sup>	40.33 <sup>c</sup>
T <sub>4</sub>	4.39 <sup>ab</sup>	0.83 <sup>ab</sup>	26.83 <sup>ab</sup>	21.46 <sup>a</sup>	23.57 <sup>b</sup>	16.78 <sup>b</sup>	36.83 <sup>e</sup>
T <sub>5</sub>	4.16 <sup>ab</sup>	0.77 <sup>b</sup>	31.63 <sup>a</sup>	13.58 <sup>c</sup>	21.50 <sup>c</sup>	12.87 <sup>cb</sup>	40.41 <sup>ca</sup>
T <sub>6</sub>	4.12 <sup>b</sup>	0.83 <sup>ab</sup>	27.73 <sup>ab</sup>	16.38 <sup>bc</sup>	21.18 <sup>c</sup>	18.20 <sup>b</sup>	41.38 <sup>b</sup>
CV (%)	4.98	7.32	12.24	13.80	3.46	5.09	0.81
LSD (0.05)	0.39	0.11	6.20	4.34	1.54	1.48	0.58

Mean followed by same latter significantly different at 1% or 5% level of significance

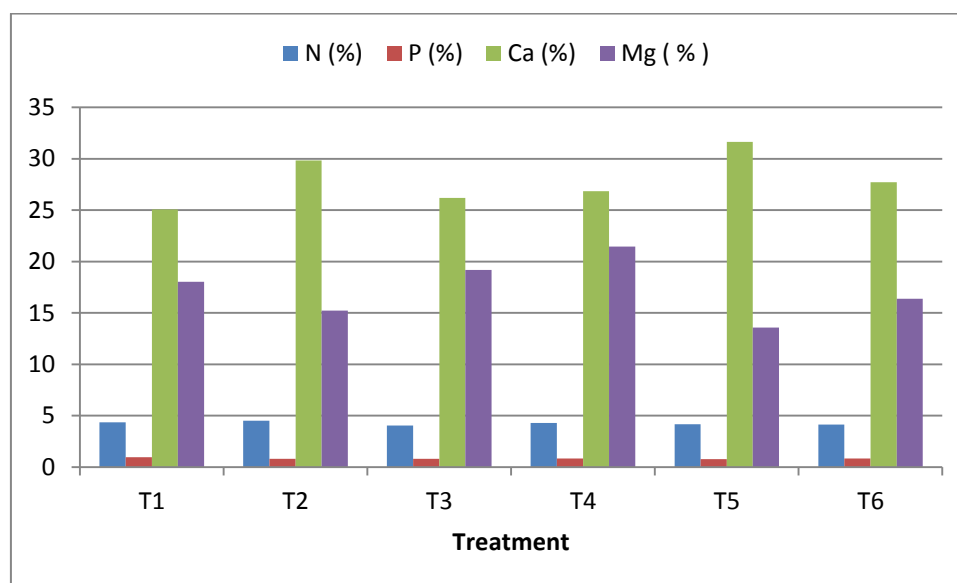


Fig 3. Effect of sawdust substrate on elemental contents of oyster mushroom (*Pleurotus florida*)

#### IV. Conclusion

*Pleurotus florida* cultivation on different sawdust waste those generated in the saw mill present a promising potential *pleurotus florida* cultivation on 5 different saw dust substrates such as mango tree (*Mangifera indica*, T<sub>2</sub>), Mahogany tree (*Swietenia mahagoni*, T<sub>3</sub>), Rain tree (*Albizia saman*, T<sub>4</sub>), Teak tree (*Tectona grandis*, T<sub>5</sub>) jackfruit tree (*Artocarpus heterphyllus*, T<sub>6</sub>) and mixture of all five tree sawdust (T<sub>1</sub>) supplemented with 30% wheat bran and 1% lime as basal substrate give better substrate compare to the previous research work. It makes a new opportunity for rural people and offer economic incentives for agribusiness. Therefore, the mushroom cultivation may become one of the most profitable agribusiness that could produce mushroom that are easily available and cheap in cost. Among all aspect T<sub>3</sub> was found as a best substrate with biological yield (369.2) followed by T<sub>1</sub>, T<sub>4</sub>, T<sub>6</sub>, T<sub>5</sub>, and T<sub>2</sub> for the production of mushroom.

#### V. Recommendation

In this experiment more than one treatment performed better in compared with benefit cost ratio therefore, different sawdust substrate supplemented with wheat bran can be recommended as an economically effective due to height yield. Among the treatment, mahogany tree sawdust supplement with 30% wheat bran can be recommended as an economically effective due to the highest yield. On the other hand rain tree sawdust supplemented with 30% wheat bran treatment may be fair option.

#### References

- [1] Chang, and Miles, P.G. (1988). *Edible Mushroom and their cultivation*. CRC Press, Inc. Boca Raton, Florida U.S.A. pp. 27, 83, 88.
- [2] Dey, R.C. (2006). *Mycelial Growth and Oyster Mushroom Production with Different Hormone and Media Composition*. M. S. Thesis, Department of Biotechnology, BAU, Mymensingh.
- [3] Chandha, K.L. and Sharma, S.R. (1995). *Advances in Horticulture. Mushroom*, Malhotra Publication house, New Delhi. 13: 649
- [4] Alam, S.M. and Saboo, R. (2001). Importance of mushroom. <http://www.mushroomworld.com>.
- [5] Mori, K. (1986). *Cultivated mushrooms in Japan*. Proc. Int'l. Sym. Sci. Tech. Aspects of Cult. Edible Fungi. Penna. State Univ. USA. pp. 21-24.
- [6] Kalita, M.K., Rathaiah, Y. and Bhagabati, K.N. (1997). Effects of some agro-wastes as substrate for Oyster mushroom (*Pleurotus sajor-caju*) cultivation in Assam. *Indian J. Hill Farming*. 10(1-2): 109-110.
- [7] Amin, S.M.R. (2002). *Performance of different Oyster mushroom (Pleurotus spp.) varieties*. M.S. Thesis. Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur.
- [8] Sarker, N.C. (2004). *Oyster mushroom (Pleurotus ostreatus) Production Technology Suitable for Bangladesh and its Nutritional and Postharvest Behavior*. PhD Thesis. Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur.
- [9] Payapanon A., Butranu, P. and Ayuthaya, P.S.N. (1994). *Optimum amount of the rice bran for Oyster mushroom (Pleurotus florida) cultivation*. Kasetsart University, Bangkok (Thailand). Proceedings of the 24th National Conference: Poster Session. Bangkok. pp. 259-264.
- [10] Raghuramulu, N., Madhavan, N.K. and Kalyanasundaram, S. (2003). *A Manual of Laboratory Techniques*. National Institute of Nutrition. Indian Council of Medical Research, Hyderabad-500007, India. pp. 56-58.
- [11] Sarker, N.C. (2004). *Oyster mushroom (Pleurotus ostreatus) Production Technology Suitable for Bangladesh and its Nutritional and Postharvest Behavior*. PhD Thesis. Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur.
- [12] Bhuyan, M. H. M. B. U. (2008). *Study on Preparation of Low Cost Spawn Packets for the Production of Oyster Mushroom (Pleurotus ostreatus) and its Proximate Analysis*. M.S. Thesis, Department of Biochemistry, SAU, Dhaka-1207.

- [13] Kalita, M.K., Rathaiah, Y. and Bhagabati, K.N. (1997). Effects of some agro-wastes as substrate for Oyster mushroom (*Pleurotus sajor-caju*) cultivation in Assam. *Indian J. Hill Farming*. 10(1-2): 109-110.
- [14] Khan, S.M., Mirza, J.H. and Khan, M.A. (1991). Studies on Shiitake mushroom (*Lentinula edodes*). Proc. 13<sup>th</sup> Int'l. Con. Sci. Culti. Edible Fungi. Dublin, Irish Republic. pp. 503-508.
- [15] Royse, D.J. (2002). Influence of spawn rate and commercial delayed release nutrient levels on *Pleurotus cornucopiae* (oyster mushroom) yield, size and time to production, *Appl. Microbiol. Biotechnol.* 58(4): 527-531.
- [16] Dey, R.C. (2006). *Mycelial Growth and Oyster Mushroom Production with Different Hormone and Media Composition*. M. S. Thesis, Department of Biotechnology, BAU, Mymensingh.
- [17] Ahmed, S. (1998). *Performance of different substrates on the growth and yield of Oyster mushroom (Pleurotus sajor-caju)*. M.S. thesis, Institute of Postgraduate Studies in Agriculture, Salna. Gazipur.
- [18] Yoshida, N., Takahashi, T., Nagao, T. and Chen, J. (1993). Effect of edible mushroom (*Pleurotus ostreatus*) cultivation on *in vitro* digestibility of wheat straw and sawdust substrate. *J. Japanese Soc. Grassland Sci.* 39(2): 177-182.
- [19] Sarker, N.C., Hossain, M.M., Sultana, N., Mian, I.H., Karim, A.J.M.S. and Amin, S.M.R. (2007a). Performance of Different Substrates on the growth and Yield of *Pleurotus ostreatus* (Jacquin ex Fr.) Kummer. *Bangladesh J. Mushroom.* 1(2): 44-49.
- [20] Baysal, E., Peker, H., Yalinkilic, M.K. and Temiz, A. (2003). Cultivation of Oyster mushroom on waste paper with some added supplementary materials. *Bio. Tech.* 89(1): 95-97.
- [21] Amin, S.M.R., Sarker, N. C., Khair, A. and Alam, N. (2007). Detection of Novel Supplements on Paddy Straw Substrates on Oyster Mushroom Cultivation. *Bangladesh J. Mushroom.* 1(2): 18-22.
- [22] Obodai, M., Okine, C. and Vowotor, K.A. (2003). Comparative study on the growth and yield of *Pleurotus ostreatus* mushroom on different lignocellulosic by-products. Food Res. Inst. Accra, Ghana. *J. Industrial Microbio. and Biotech.* 30(3): 146-149.
- [23] Lim, J., Mangaoang, Y. and Ranchev, C. (1997). Mushroom cultivation under the closed canopy high-diversity forest farming system. PCARRD highlights 1996. Philippine Council for Agriculture, forestry and Natural Resources, Research and Development. Los Banos, Laguna (Philippines). pp. 91.
- [24] Sarker, N.C., Hossain, M.M., Sultana, N., Mian, I.H., Karim, A.J.M.S. and Amin, S.M.R. (2007b). Performance of Different Substrates on the growth and Yield of *Pleurotus ostreatus* (Jacquin ex Fr.) Kummer. *Bangladesh J. Mushroom.* 1(2): 44-49.
- [25] Rahman, S.M. (1994). Nutritional and Biochemical Analysis of edible mushrooms in three developmental stages. M. Sc. Thesis. Department of Biochemistry. University of Dhaka.
- [26] Moni, K. H., Ramabardan, R. and Eswaran, A. (2004). Studies on some physiological, cultural and post-harvest aspects of Oyster mushroom *Pleurotus ostreatus* (Berk). *Trop. Agril. Res.* 12: 360-374.
- [27] Chang, S. T., Lau, O. W. and Chowdhury, K. Y. (1981). The cultivation and nutritional value of *Pleurotus sajor-cuju*. *Eur. J. Appl. Microbiol. Biotechnol.* 12(1): 58-62.
- [28] Alam, N., Khan, A., Hossain, M.S., Amin S.M.R. and Khan, L.A. (2007). Nutritional Analysis of dietary Mushroom *Pleurotus florida* Eger and *Pleurotus sajorcaj* (Fr.) Singer. *Bangladesh J. Mushroom.* 1(2): 1-7.

Topoti Roy Supta. "Effect of Different Sawdust substrates on the Growth, Yield, and Proximate composition of Oyster Mushroom (*Pleurotus florida*).” IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS), vol. 10, no. 9, 2017, pp. 47–58.