
**E-ISSN:** 2618-0618
**P-ISSN:** 2618-060X

www.agronomyjournals.com
2024; 7(3): 87-90
Received: 01-01-2023
Accepted: 06-02-2024

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# A study on cultivation and yield performance of oyster mushroom (*Pleurotus florida*) on paddy straw mixed with bamboo waste in different ratios and their nutrient evaluation

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**DOI:** https://doi.org/10.33545/2618060X.2024.v7.i3b.389

**Abstract**
The study conducted, on cultivating oyster mushrooms (*Pleurotus florida*) using paddy (*Oryza sativa*) straw with bamboo (*Bambusa vulgaris*) leaves as substrate at different combinations is an effective bioconversion method of agroforestry residues or waste. During the process of cultivation *(Pleurotus florida*), simultaneously the yield performance of harvesting mushrooms, and nutrient (*Protein alone*) analysis were done on mushrooms harvested from bags of different combinations of the substrate. Also, every combination's mushroom pileus's length and breadth were measured continuously for every harvest.
The manurial value of spent mushroom waste at the end of cultivation was also measured. Bamboo (*Bambusa vulgaris*) leaves were used as they were easily available for the tribal people the sole moto was to generate additional income by materials that could be used by them without cost. We had gone by different combinations of paddy straw with bamboo leaves (i.e 100:0, 75:25, 50:50, 25:75, 0:100) for the cultivation of *Pleurotus florida* (*Oyster mushroom*) the effect of the paddy straw and bamboo leaves on biological yield as well as days of the first harvest, size, and weight of individual mushrooms, biological efficiency, nutritional value and manurial value of spent mushroom waste were determined. The combinations are Paddy straw alone, bamboo alone, and paddy straw plus bamboo leaves in the ratio of 75:25, 50:50, and 25:75. So, finally we considered different combinations as 5 Treatments and 4 Replication each.
As a result, we got that 100% bamboo can give a 50 percent yield of 100% paddy straw. Tribal people can utilize this and additional income can be generated which may increase their lifestyle.

**Keywords:** *Pleurotus florida*, nutritional values, manurial value, biological yield, biological efficiency, paddy straw and bamboo leaves

## 1. Introduction
Mushroom, prominent umbrella-shaped fruiting body (sporophore) of certain fungi, typically arranged Agaricales within the phylum Basidiomycota but too of a few groups. A mushroom may be a spore-bearing fruiting body of an organism's fungi. A few are eatable and lack the visual green matter (chlorophyll). Mushrooms have been considered a delicacy since ancient times and were favoured both for taste and flavour. A few mushrooms taste scrumptious, whereas others have mind-altering impacts that have made them a portion of spiritual ceremonies. Early people as of now experienced that; different delineations of mushrooms have been found in cave paintings. For the Egyptians, mushrooms were the “Food of the God”. They accepted that eating them may offer assistance to them to live longer or indeed make them undying.
Mushrooms are rich in protein having 60-70 percent digestibility, and containing all essential amino acids, especially lysine. In addition, these have a small amount of carbohydrates, fat, vitamins like B, C, D, and K minerals like calcium, phosphorus, potassium, iron, copper, and high fiber content are also present. The vitamins are well retained after both cooking and processing. These can, therefore, serve as good nutrition in a balanced diet.

Oyster mushrooms are shell, fan, or spatula-shaped. It forms clusters of caps one above the other. They are shades of white, cream, grey, pink, or light brown depending upon the species. The stipe is strongly eccentric to lateral. Oyster mushrooms are edible and can be cultivated throughout the year in Tamil Nadu, Karnataka, Kerala, Andhra Pradesh, parts of Orissa etc. Oyster mushroom species are subtropical and grow well in the temperature range of 20-32 °C.

### 1.1 Objectives

- To analyze the yield performance of *Pleurotus florida* using different combinations of paddy straw and bamboo leaves as a substrate.
- To analyze the size (length and breadth) of pileus.
- To analyze the bio efficiency of different combinations.
- To analyze the manurial value of the spent mushroom substrate.
- To analyze the nutritional value of mushrooms.

## 2. Materials and Methods

An experiment was conducted at the Kumaraguru Institute of Agriculture in 2023. To access the yield and nutritional value of oyster mushrooms and the manurial value of spent mushroom waste by using different combinations of paddy straw and bamboo leaves.

Oyster mushroom belonging to class Basidiomycetes and Family Agaricaceae is popularly known as Dhingri in India and grow naturally in temperate and tropical forests on dead and decaying wooden lags or sometimes on drying trunks of deciduous coniferous woods. It may also grow on decaying organic matter it produces protein-rich food.

The Oyster Mushroom is the third largest cultivated mushroom. The economic importance of the mushroom lies primarily in its use as food for human consumption. It is rich in vitamin C and complex and the protein content varies between 1.6 to 2.5 percent and mineral salts required for the human body. The niacin content is about ten times higher than any other vegetable.

### 2.1 Collection and preparation of substrate

#### 2.1.1 Collection of Bamboo Leaves:

Bamboo leaves were collected from the North farm, Kumaraguru Institute of Agriculture on 8th April 2023. We collected diseased-free bamboo leaves as a substrate as it coincided with our motto which is making improvements in the lifestyle of tribal people by increasing income.

#### 2.1.2 Chopping of paddy straw

Paddy straw was chopped using a chaff cutter into small pieces of 3-4 inches, for easy penetration of fungal mycelium, we didn't chop the bamboo leaves as it was very thin and small.

#### 2.1.2.1 Soaking

The dried bamboo leaves collected from the farm and the chopped paddy straw were soaked in water overnight.

#### 2.1.3 Treatment details

The treatments are fixed in a way to evaluate the efficiency of Bamboo leaves alone and Bamboo leaves + Paddy straw combination and Paddy straw alone as a control.

**$T_1$**: Paddy straw alone (control)
**$T_2$**: Paddy straw + Bamboo leaves (75:25)
**$T_3$**: Paddy straw + Bamboo leaves (50:50)
**$T_4$**: Paddy straw + Bamboo leaves (25:75)
**$T_5$**: Bamboo leaves alone (100)

### 2.2 Bed preparation and mushroom cultivation.

#### 2.2.1 Bed preparation

The cultivation of Oyster mushrooms is carried out in transparent polythene covers of 60 x 30 cm, with a thickness of 80 gauges.

#### 2.2.1.1 Procedure followed

- Wash hands thoroughly with antiseptic lotion.
- Collect the substrate and boil it by using hot water pawn.
- And dry it in the shade until it reaches 60% moisture in the substrate.
- The substrates both paddy straw and bamboo leaves should be sterilized.
- Take the polythene cover, tie it at the bottom end with a rubber band, and turn it inwards. Mix the dried paddy straw and bamboo leaves according to the combination percentage thoroughly to get a uniform moisture level in all areas and each bag should contain 3kg of substrate at different combinations.
- Take out well-grown bed spawn, squeeze thoroughly, and divide into two halves (Two beds are prepared from the single spawn bags).
- Fill the straw to a height of 5 cm in the bottom of the polythene bag, take a handful of spawn, and sprinkle over the straw layer concentrating more on the edges. Repeat this process to get five straw layers with four layers of spawns.
- Gently press the bed and tie it tightly with a thread.
- Put 5 to 9 holes per bed for ventilation as well as to remove the excess moisture present inside the bed.
- Arrange the beds inside the thatched shed, (Spawn running room 15 days) following rack system or hanging system.
- Followed by tagging the bags as per treatment and replication. Take observation regularly.

#### 2.2.2 Cropping room

After 1st flush of harvest, the 0.5 to 1cm outer layer of the block should be scrapped. This helps to initiate 2nd flush which appears after about 10 days.

Mushrooms grow in a temperature range of 20-33°C. Relative humidity is maintained by spraying water twice a day on the walls and floor of the room. Spraying of blocks should be avoided for the first 2-3 days. A light mist spray of water is given on blocks as soon as the small pinheads appear. Once pin heads are 2-3 cm big a little heavier watering is to be done on blocks and further watering of blocks is to be stopped to allow them to grow and should be harvested before spore production.

#### 2.2.3 Disease and Pest Management

Observe regularly for the infestation of insect pests *viz*., flies, beetles, mites, etc, and also diseases like green and black mold. If noticed use 0.2% of neem oil per 100ml of water to control the pest and disease attack.

### 2.3 Manurial analysis

#### 2.3.1 Potassium analysis procedure: (Emission flame photometry)

- Collect the sample and dry it.
- Add 1g sample in different 100 ml conical flask as per different treatment
- Add 10-15 ml diacid in each of the conical flashes.
- Digest till a clear solution appears
- Filter and make 250 ml in a volumetric flask.
- Pipette out 5ml extract in 25 ml volumetric flask.
- Add 5ml of NH4OH.

- Read the solution by using a flame photometer.
- Note the flame photometer reading.

**Fig 1:** Preparing for digestion for potassium analysis

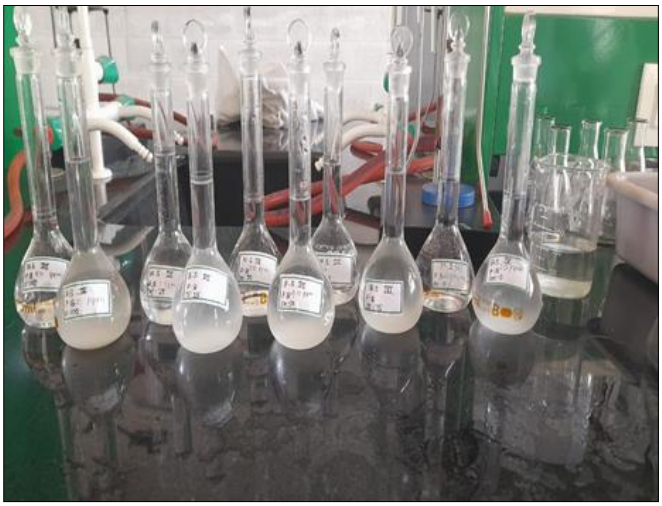

**Fig 2:** Extract after digested make up for 250ml

### 2.4. Nutritional analysis

**Protein analysis procedure: (Biuret test)**

- Add 0.5 ml of sample extracted solution as per different treatments into a series of tubes.
- Make up the volume to 1 ml in all the tubes with distilled water (add 0.5 ml of distilled water)
- 1 ml of distilled water serves as blank.
- Add 4 ml of biuret reagent to each tube and mix thoroughly.
- After 30 minutes, at room temperature read the absorbance of the solution at 520 nm against the reagent blank.
- Construct the standard graph and calculate the amount of protein present in 100 ml of the given mushroom substrate solution.

### 2.5 Biological efficiency

The total weight of the fruiting bodies harvested from all the two pickings was measured as the total yield of mushrooms. The biological efficiency (yield of mushroom per kg substrate on a dry wet basis) was calculated by the following formula Chang *et al.* (1981).

**Biological efficiency = Fresh weight of the mushroom/Dry weight of Substrate x 100**

### 2.6. Statistical analysis

We have worked out an ANOVA table for the yield, length, and breadth of mushrooms from different substrate combinations. As a result, the yield and length of mushrooms have a significant level of difference at the level of 5% between treatments. But in the case of mushroom breadth, there is no level of significance between the treatments.

## 3. Results and Discussion

These reports are in pair with our result, that the yield is high in 100% paddy straw substrate and followed by 75:25 of paddy straw: bamboo, 50:50 of paddy straw: bamboo, 25:75 of paddy straw: bamboo, and 100% bamboo. At this point for commercial production paddy is the best substrate. But our objective motto (i.e. to increase the income status of tribal people which leads to improving their lifestyle as a part) is satisfied.

Next to that of yield, we analyzed the size (length and breadth) of pileus. We have collected the length and breadth of every replication at every harvest. A graph has been drawn with the average value of length and breadth. From the graph, we observed that the length of the pileus in 100% paddy straw is high followed by 75:25 of paddy straw: Bamboo, 50:50 of paddy straw: bamboo, 25:75 of paddy straw: Bamboo, and 100% bamboo.

From our study, the length of the pileus differs among the treatments as that of the yield while the breadth remains significantly the same. Then the manurial (potassium) value estimation gives the result that the 100% paddy straw has a high level of potassium that is 1.40% followed by 75:25 of paddy straw: Bamboo, 50:50 of paddy straw: bamboo, 25:75 of paddy straw: Bamboo and 100% bamboo. Which can be used as manure for the field when we make it as a compost or we can use it with raw material for vermicompost production.

On analyzing the nutritional (protein) value of mushrooms harvested from different substrate combinations, we observed that the protein content is high in mushrooms of 100% paddy straw followed by Paddy straw+bamboo leaves (75:25) combination, paddy straw+bamboo (25:75) combination, paddy straw+bamboo leaves (50:50) combination and least at 100% bamboo.


**Fig 3:** Different treatment and replications

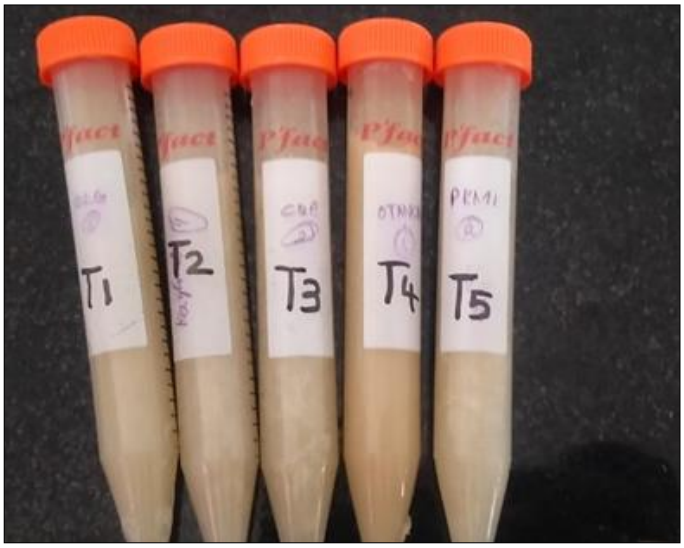


**Fig 4:** Protein analysis of mushroom by biuret method

## 4. Summary and Conclusion

The key to success in mushroom cultivation is the careful regulations of the enterprise. To enhance the production of fruiting bodies of oyster mushrooms, the adjustment of environmental conditions should be very important like favorable temperature, relative humidity, and moisture content. This study indicated the yield performance by using different combinations of paddy straw and bamboo leaves as a substrate in *Pleurotus florida*. The maximum production of fruiting bodies was recorded on 100 percent of paddy straw followed by other combinations of substrate. Based on the measurement of length and breadth, the size of pileus is large in 100 percent of paddy straw followed by other combinations. So, we conclude here that the length may vary from substrate to substrate but the breath of pileus is more or less equal. Based on the nutritional (protein) analysis in mushroom samples obtained from beds of different combinations of paddy straw and bamboo, the protein content is high in 100 percent paddy straw followed by paddy straw + bamboo (75:25), paddy straw + bamboo (25:75), paddy straw + bamboo (50:50), bamboo alone (100 percentage). Based on the estimation of the manorial (potassium) value in spent mushroom waste, the potassium content is higher in 100 percent of paddy straw followed by other combinations. At last biological efficiency of different substrate combinations, showed that biological efficiency is higher in 100% paddy straw alone followed by other combinations. Although paddy straw is commercially used as a substrate for mushroom cultivation. In hilly areas, as availability of paddy straw is less compared to bamboo leaves. So, bamboo leaves can be used as an alternate substrate. The bamboo leaves give a yield status of 50% of paddy straw. Thus, bamboo can be included as a part of the Agro-forestry integrated farming system. Thus it proves to be the most efficient method of biological conversion of Agro-forestry residues. So, the prime motto of the research (i.e. to increase the income status of tribal people which leads to improving their lifestyle as a part) is satisfied which means compared to 0% income better to have the 50% income of paddy straw is obtained from the bamboo leaves waste as substrate for growing mushroom.

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