



## Cultivation potential of oyster mushroom (*Pleurotus ostreatus*) using agricultural wastes as substrates

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### ABSTRACT

This study aimed to assess the suitability of five different substrates-coir pith, finger millet straw, banana fibre, sawdust, and sugarcane trash-for oyster mushroom cultivation. Plastic bags were filled with 250 g of substrate and arranged in a completely randomized block design. Throughout the cultivation process, various parameters including spawn running, pinhead formation, fruiting body development, number of caps, yield per bed (g), and biological efficiency were monitored. Results revealed that spawn running occurred within 18 and 19 days in sawdust and sugarcane trash respectively, while pinhead formation took place at 21 and 22 days in the same substrates. Sawdust and sugarcane trash exhibited the highest biological efficiency, with mushroom yields of 826 and 780 g/bed, respectively. Based on these findings, sawdust was identified as the most suitable substrate for oyster mushroom production, followed by sugarcane trash.

**Key words:** Substrates, banana fibre, saw dust, sugarcane trash, yield.

### INTRODUCTION

Mushrooms have been utilized for food and medicine since ancient times. They are notable for their high protein content, surpassing many vegetables and fruits when measured on a fresh weight basis. Despite this, mushrooms are often considered inferior to traditional protein sources like meat and dairy products (Aremu *et al.*, 2). Mushrooms, particularly oyster mushroom (*Pleurotus ostreatus*), offer an attractive means to reduce body weight. In countries like India, where agriculture is a primary livelihood for around 70% of rural households (Prasad *et al.*, 15), oyster mushrooms stand out for their ability to utilize a wide range of agricultural waste products. Research has shown that substrates such as sterilized paddy straw (Al Amin, 1) and rice (Maniruzzaman, 10) are highly conducive to oyster mushroom growth. Oyster mushrooms thrive in tropical and subtropical climates, characterized by their rapid mycelial proliferation. The substrates mentioned, including wheat straw, soybean straw, paddy straw, and sugarcane bagasse, are particularly appealing due to their abundance in agricultural production and high cellulose and lignin content. These materials hold significant promise for bioconversion into value-added products (Philippoussis and Zervakis, 14). Unlike some other mushroom species, oyster mushrooms do not require substrate composting for production. In our study, we examined various conventional substrates-coir pith, finger millet straw,

banana fibre, sawdust, and sugarcane trash-for the cultivation of oyster mushrooms, *Pleurotus ostreatus*.

### MATERIALS AND METHODS

The methodology employed in these experiments followed standardized procedures outlined by Siddiqui (19). Half-cooked, high-quality sorghum grains were mixed with CaCO<sub>3</sub> or CaSO<sub>4</sub> at 20 g per kg and filled into high-density polypropylene bags sized 30 × 15 cm with a thickness of 150 gauges. One end of each bag was securely tied with a cotton thread to form a cylindrical container, while the open end was fitted with a PVC ring to create a rigid mouth, sealed with non-absorbent cotton. These bags were then autoclaved at 15 psi/cm<sup>2</sup> pressure for 90 min. After cooling, they were transferred to a culture room or laminar air-flow chamber for aseptic introduction of mushroom culture previously grown in petridishes. Using a sterile scalpel, the pure culture in the petri dish was divided into 10-12 triangular sectors. Each spawn bag was inoculated with one or two mycelial bits using a sterile inoculation needle or forceps, performed near a Bunsen burner. The grains in the bags were left to fully colonize with white mycelial growth over 10-15 days, depending on the species or strain used.

For oyster mushroom cultivation, the standard polythene bag method was employed to evaluate various agricultural wastes including coir pith, finger millet straw, banana fibre, sawdust, and sugarcane trash. Initially, the dry agricultural wastes were

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**Table 1.** Days for completion of spawn running, fruiting body formation and pinhead formation of Oyster mushroom on different substrate.

Agro-waste	No. of days required for			Yield/bed (g)	Biological efficiency (%)
	Spawn running	Pinhead formation	Fruiting body formation		
Coir pith	21 ± 0.35	25 ± 0.24	31 ± 0.26	720 ± 12.73	72 ± 1.27
Finger millet straw	23 ± 0.74	26 ± 0.71	33 ± 0.09	678 ± 12.46	68 ± 1.62
Banana fibre	21 ± 0.54	25 ± 0.78	32 ± 0.33	690 ± 13.62	69 ± 1.17
Saw dust	18 ± 0.60	21 ± 0.60	24 ± 0.54	826 ± 2.25	83 ± 2.60
Sugarcane trash	19 ± 0.49	22 ± 0.01	27 ± 0.90	780 ± 17.51	78 ± 0.37

chopped into small pieces (5-6 cm long), soaked in water for a day until achieving approximately 75% moisture content, and then drained. Three large polypropylene bags were filled with each substrate. Layers of prepared substrate and spawn were alternated inside each bag, with the final layer of spawn covered with a smaller amount of substrate. Bags were tightly secured and placed on a rack or hanging rope system.

Prior to use, all instruments, glassware, and culture media were sterilized by autoclaving at 15 psi and 121°C for 1-2 h. The culture room underwent regular cleaning with detergent and 70% ethyl alcohol. Data on spawn running, pinhead formation, fruiting body development, number of caps, yield per bed (g), and biological efficiency were recorded periodically throughout the growing season. Time measurements were recorded for the completion of mycelial growth and appearance of pinheads on each substrate within the bags. Harvesting was conducted at maturity, and the yield of fruiting bodies from each flush was noted. Biological efficiency was calculated using the relevant formulae.

$$\text{Biological efficiency (\%)} = \frac{\text{Weight of fresh mushroom fruiting bodies}}{\text{Weight of dry substrate}} \times 100$$

The data on spawn running, pinhead formation, fruiting body development, number of caps, yield per bed (g), and biological efficiency were subjected to statistical analysis using the Completely Randomized Design (CRD). Duncan's Multiple Range Test (DMRT) was employed to determine significant differences among treatments. IBM SPSS Statistics 22.0 software was utilized for the statistical analysis, with significance level set at  $p < 0.05$ .

## RESULTS AND DISCUSSION

The results of the present investigation, as summarized in Table 1, reveal significant insights across various parameters. Sawdust exhibited the shortest spawn running time of 18 days, followed

closely by sugarcane trash and coir pith at 19 and 21 days, respectively. Finger millet straw and banana fiber took longer, with spawn running times of 23 and 21 days, respectively. Similar discrepancies in pinhead formation time were observed across various substrate sterilization methods, as reported by Khan *et al.* (6), while successful cultivation of *Pleurotus* species on conventional substrates was noted in studies by Kumar *et al.* (8) and others. Sawdust emerged as the optimal substrate, demonstrating the shortest time for pinhead formation.

Fruiting body formation followed a similar trend, with sawdust exhibiting the shortest time at 24 days, followed by sugarcane trash at 27 days. Coir pith and banana fiber had longer fruiting body formation times of 31 and 32 days, respectively, while finger millet straw required 33 days. Sawdust also yielded the highest production per bed at 826 g, followed by sugarcane trash at 780 g. Coir pith, banana fiber, and finger millet straw yielded 720, 690, and 678 g, respectively.

Biological efficiency mirrored these trends, with sawdust demonstrating the highest efficiency at 83%, followed by sugarcane trash at 78%. Coir pith, banana fiber, and finger millet straw showed efficiencies of 72, 69 and 68%, respectively. These findings align with previous studies highlighting the cultivation potential of *Pleurotus* species on various agricultural wastes (Ingale and Ramteke, 4; Mane *et al.*, 9; Jain and Vyas, 5; Sangeetha and Theradimani, 17). *Pleurotus* species have shown adaptability to non-conventional substrates, utilizing vegetable waste through enzymatic degradation (Singh *et al.*, 20). Overall, our investigation underscores the suitability of sawdust as a substrate for optimal oyster mushroom (*P. ostreatus*) cultivation.

## AUTHORS' CONTRIBUTION

The study was conceptualized and designed by M. Sathiyaseelan. M. Sathiyaseelan conducted

the experiments and prepared the manuscript. V. Kannadhasan, S. Tamilpriyan, K. Balaji, and V. Saranya assisted with media preparation, data collection, and data analysis. The article was reviewed and approved by all authors.

## DECLARATION

The authors declare no conflict of interests.

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