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Performance of oyster mushroom (*Pleurotus ostreatus*) on different substrates

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Abstract

The present study was undertaken to find the suitable substrates for cultivation of oyster mushroom (*Pleurotus ostreatus*) using different agro wastes such as paddy straw, coconut coir, ragi straw, newspapers, paddy straw + newspapers (1:1), paddy straw + ragi straw (1:1) and paddy straw + coconut coir (1:1). Highest yield and biological efficiency was obtained from paddy straw followed by paddy + ragi straw substrates (1:1), paddy+ coconut coir substrates (1:1), paddy+ newspapers substrates (1:1), respectively. Minimum yield was obtained from newspapers.

Keywords: Oyster mushroom, *Pleurotus ostreatus*, substrates, yield

Introduction

Oyster mushroom (*Pleurotus ostreatus*) is an important edible mushroom cultivated commercially in India as well as Odisha. It is important for its taste, flavor, higher yield potential and longer shelf life. It is also known as "Dhingri" which grows on dead and decaying wooden logs. Oyster mushroom (*Pleurotus* species) is cultivated in temperate and sub-tropical regions of the world. In Odisha, it is mainly grown during winter season in the month of November to February at a temperature range of 20°- 30 °C. Many species of oyster mushroom are cultivated in this state. Dominant species of this mushroom which are grown in the state are grey oyster mushroom (*Pleurotus sajorcaju*), white oyster mushroom (*P. florida*), pink oyster mushroom (*P. eous*) and blue oyster mushroom (*Hypsizygus ulmarius*). Oyster mushrooms are rich sources of Vitamin C, Vitamin D, B-complex, minerals and proteins (Caglarirmak, 2007) [1]. They are also considered as ideal diet for patients suffering from heart diseases and diabetes (Randive, 2012) [7].

Oyster mushrooms are efficient lignin degraders which can be grown on different agricultural wastes such as banana leaves, wheat bran, sugarcane baggage, wheat, rice straw, maize stalks and leaves, waste papers, saw dust, various grasses, cotton wastes etc. (Shah *et al*, 2004; Hasan *et al*, 2010; Sharma *et al*, 2013; Hossain, 2018) [8, 2, 9, 3]. As substrates play an important role in determining yield of mushroom, the present investigation was carried out to find out the best substrate for cultivation of oyster mushroom (*P. ostreatus*)

Materials and Methods

Isolation and maintenance of pure culture of *P. ostreatus*

Pure culture of *P. ostreatus* was obtained from fresh fruiting body by tissue culture method (Jonathan *et al*, 2009) [4]. Pure culture of this mushroom was maintained in potato dextrose agar medium. Sub culturing was done in every 15 days. One week old pure culture of the fungus was used for mother spawn preparation.

Spawn preparation

Initially wheat seeds were washed thoroughly in tap water for 3-4 times and soaked overnight in water. Then soaked grains were boiled in a container till they become soft, excess water was drained off and subsequently grains were mixed with calcium carbonate at the rate of 2% by the grain weight. Then grains were filled into milk bottles, plugged with non -absorbent cotton and sterilized in autoclave at 15 lb psi for 1 hour at 121 °C. Bottles were then kept in the room temperature for cooling. Bottles containing grains were inoculated in the laminar air flow chamber with pure culture of *P. ostreatus* maintained on PDA and incubated at 25 °C until the mycelium fully covered the grains (Modified method of Michael *et al.*, 2011) [5].

Preparation of different substrates for cultivation

The experiment was conducted during winter season in the year 2023 at Department of Plant Pathology, College of Agriculture, Chiplima, Sambalpur. Seven different treatments such as paddy straw, coconut coir, ragi straw, newspapers, paddy + ragi straw (1:1), paddy + coconut coir (1:1), paddy + newspapers (1:1) were used for this experiment. Different agro wastes such as paddy straw, ragi straw were collected from students' plot, College of Agriculture, Chiplima and used as cultivation substrate. The substrates were chopped into 2-3 cm pieces. Coconut coir were collected from market and newspapers were collected from house and shredded into pieces. Ragi straw, coconut coir and newspapers were combined with paddy straw in the ratio of 1:1. The substrates except newspapers were soaked in a solution containing 10 g of carbendazim in 100 liters of water for six hours. Newspapers were soaked in water for half an hour. After soaking, different substrates were removed from water tank and spread as thin layer on polythene sheet to maintain 60% moisture in the substrate.

To prepare the beds, the sterilized substrates were filled in polythene bag of the size of 35 x 45 cm. and multi layered technique was used for spawning. Each bag was filled up with 1 kg of substrate and spawn was mixed at the rate of 2% of wet substrate. Three replications were done for each treatment. The inoculated bags were kept in the spawn running room in dark at room temperature (20 to 28 °C). When bags were fully impregnated with white mycelium, the bags were transferred to cropping room. Then polythene covers were removed fully and water was sprinkled on the bed from second day of opening. Time required for completion of spawn run, pin head and fruiting body formation was recorded. Total yield of mushroom fruiting body from each bed was recorded immediately after harvest. Biological efficiency was calculated by dividing average yield of mushroom per bed by dry weight of substrate.

$$\text{Biological efficiency} = \frac{\text{Fresh weight (g) of mushrooms harvested}}{\text{Dry weight (g) of substrate}} \times 100$$

Results and Discussions

Effect of substrates on spawn running, pin head and fruiting body formation

In order to find out the best substrate and other alternatives, different agro- wastes were used to study the growth and yield of *P. ostreatus.* Data on time required for completion of spawn run, pin head emergence and fruiting body formation are presented in Table 1. The data reveals that spawn run period varied on different substrates ranged between 22 to 27.8 days. Minimum time required for completion of spawn run was recorded in paddy straw (22 days) followed by coconut coir (23.2 days), paddy + coconut coir (1:1) (23.9 days), paddy + ragi straw (1:1) (24.7 days), paddy + newspapers (1:1) (25.8 days), respectively. Longest spawn run period was observed in newspapers (27.8 days). Similar trend was observed with respect to days required for pinhead emergence and fruiting body formation by *P. ostreatus* on different substrates. Almost similar results were reported by Sharma *et al*, 2013 [9] who observed that time required for completion of spawn run period and pin head emergence by this oyster mushroom on different substrates ranged from 22.4 days to 26 days and 26.4 to 31.6 days, respectively.

Table 1: Days for completion of spawn run, pin head emergence and fruiting body formation by *P. ostreatus* on different substrates

Substrate	Spawn running (days)	Pinhead emergence (days)	Fruiting body formation (days)
Coconut coir	23.2	27.0	30.3
Paddy straw	22.0	26.1	29.2
Newspapers	27.8	31.7	36.2
Ragi straw	26.9	30.8	34.9
Paddy straw + coconut coir (1:1)	23.9	27.8	31.3
Paddy straw + newspapers (1:1)	25.8	29.9	33.8
Paddy straw+ ragi straw (1:1)	24.7	28.8	32.5
SEm±	0.20	0.22	0.30
CD at 5% level	0.60	0.66	0.90

All the observations are average of three replications

Effect of various substrates on yield

Different agro-wastes such as paddy straw, coconut coir, ragi straw, newspapers, paddy straw in combination with other substrates such as paddy + ragi straw (1:1), paddy + coconut coir (1:1), paddy + newspapers (1:1) were used to test the yield and biological efficiency of *P. ostreatus* and data are presented in Table 2. The results showed that highest yield (902.0 g) was recorded in paddy straw followed by paddy + ragi substrates (1:1) (801.0 g), paddy+ coconut coir substrates (1:1) (704.0 g), paddy + newspapers (1:1) (649.0 g), respectively. Lowest yield (385.0 g) was recorded in newspapers. Highest biological efficiency was recorded in paddy straw (90.20%) followed by paddy+ ragi substrates (1:1) (80.10%), paddy+ coconut coir (1:1) (70.40%), respectively. Lowest biological efficiency was recorded in newspapers (38.50%). In our experiment, paddy straw was found to be the best substrate for cultivation of *P. ostreatus*. Our results are in agreement with the findings of Sharma *et al*, 2013 [9] who reported that rice straw was the best substrate followed by rice straw plus wheat straw, rice straw plus waste paper, respectively for the production of *P. ostreatus*. Our results are in consistent with the findings of Prajapati *et al*, 2022 [6] who obtained maximum yield from paddy straw in *P. ostreatus* among nine different substrates tested. Somashekhar *et al*, 2020 [10] reported that ragi straw was better than paddy straw in producing yield of oyster mushroom which is contradictory to our results.

Table 2: Yield and biological efficiency of *P. ostreatus* on different substrates

Substrates	Yield* (g) per kg of dry substrate	Biological efficiency%
Coconut coir	454.00	45.40
Paddy straw	902.00	90.20
Newspapers	385.00	38.50
Ragi straw	552.00	55.20
Paddy straw + coconut coir (1:1)	704.00	70.40
Paddy straw + newspapers (1:1)	649.00	64.90
Paddy straw+ ragi straw (1:1)	801.00	80.10
SEm±	8.06	
CD at 5% level	24.45	

*Average of three replications

Conclusion

In this study, it was observed that paddy straw was the best substrate followed by paddy straw + ragi straw (1:1) among seven different substrates tested to enhance the yield of oyster mushroom (*P. ostreatus*). So, paddy straw can be used for cultivation of oyster mushroom (*P. ostreatus*). Paddy straw in combination with ragi straw (1:1) can also be used as an alternative substrate to cultivate *P. ostreatus.*

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