

## Growth and yield performance of oyster mushroom (*Pleurotus florida*) on different agricultural waste

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A huge amount of agro based lignocellulosic crop residues and byproducts are generated annually. The production of these wastes can cause environmental and many health problems (Garg and Gupta, 2009). Mushrooms are saprophytic fungi growing on dead organic matters and can utilize almost all forest and agricultural residues as substrates (Adejoye *et al.*, 2006). Mushrooms can grow on dead organic matters which are rich in lignin, cellulose and other carbohydrates. *Pleurotus* spp. commonly known as oyster mushroom, are decomposer of wood and vegetable residues (Zadrazil & Kurtzman, 1981). *Pleurotus* spp. is one of the most widely studied white-rot fungi for its excellent ligninolytic properties (Philippoussis *et al.*, 2001; Olivieri *et al.*, 2006 and Li and Shah, 2016). *Pleurotus* species need a short growth time, as compared to other mushrooms. Its fruiting body is rarely attacked by pests and diseases, and it can be grown simply and inexpensively. It has a higher yield, utilizes a wide range of substrates, tolerates various chemicals and temperatures, and contributes to environmental bioremediation (Bellettini *et al.*, 2019). Therefore, the aim of the study is to evaluate the growth and yield of *P. osteratus* on locally available substrates with supplementation in ambient environmental conditions which can be easily applied by farmers from hinterlands.

To study on the effects of different substrate on the growth and yield of oyster mushroom

(*Pleurotus florida*) an experiment was conducted at ICAR-CRIJAF, SRS, Bamra, Odisha during the season August to September, 2019 and 2020. Different substrates like paddy (*Oryza sativa*) straw, wheat (*Triticum sativum*) straw, maize (*Zea mays* L.) straw, arhar (*Cajanus cajan*) straw, mung (*Vigna radiata*) straw, urd (*Vigna mungo*) straw, mustard (*Brassica juncea*) straw, sesamum (*Sesamum indicum*) straw, jute (*Corchorus olitorius*) straw, sunhemp (*Crotalaria juncea*) straw, mesta (*Hibiscus sabdariffa*) straw and sisal (*Agave sisalana*) toe fibre were taken. All the substrates after chopping into 3-4 cm length were stored under a covered shade. All the substrates were dipped separately into drum containing 100 ml formalin and 10 gram carbendazim per 100 liter of water. The mixture was stirred with the help of a wooden pole and allowed to soak for 18 hours in the solution. After sterilization, they were shade dried. The moisture content of about 65% was maintained before spawning. Then the substrates were packed in polypropylene bags and spawns were added correspondingly. Spawn of *P. florida* was added for each trial at the rate of 10 % on dry weight basis of substrate. Three bags per replication were kept in each treatment and all the treatments were replicated four times in Randomized Block Design. Spawned bags were placed in closed position with the temperature of about 25p - 28p C. The number of

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days required from inoculation to the formation of mycelium, and time required till the first harvesting was recorded. Yield parameters, such as total fresh weight (g) of mushroom recorded at harvest time. Matured fruiting bodies (white in color, with up curved pileus) were harvested. Three harvests of mushroom were made across all substrate types in the course of the experiment. Yield and biological efficiency were calculated to evaluate the growth performance of mushroom on different substrates (Nithyatharani and Kavitha, 2018).

Mycelial running is an extension and colonization of fungal hyphae throughout the substrate. It was observed that the overall cropping period for oyster mushroom, the time elapsed between spawn seeding and harvesting (maturity of fruiting bodies) varied for each of the different substrates used ranging from 24.1 days to 33.4 days. The time required for maturing the fruiting bodies was less on wheat straw (24.1 days) followed by paddy straw (26.4 days) which was significantly better than other substrates used in the experiments. Time required for maturing the fruiting bodies on jute straw, mung straw, mustard straw, urd straw, sisal toe fibre, sunhemp straw and maize straw were 27.5 days, 27.9 days, 28.3 days, 28.5 days, 28.7 days, 29.3 days, 29.3 days, respectively which were statistically at par with each other. Maximum time taken for maturing the fruiting bodies was on sesamum straw (33.4 days) followed by arhar straw (31.5 days) and mesta straw (30.8 days).

The variation in the number of days taken for a spawn to complete colonization of a given substrate is a function of the fungal strain, growth conditions and substrate type (Chang and Miles, 2004). This variation could, in turn, be attributed to the variations in chemical composition and carbon to nitrogen ratio (C: N) of the substrates used (Bhatti *et al.*, 1987). Pin-head formation (premordium initiation) was observed following the invasion of substrates by mycelia

growth. Ahmed (1998) reported pin-head formation of oyster mushroom cultivated in different substrates to be between 23 and 27 days from spawning, while Fan *et al.* (2000) reported it to be 20–23 days.

This implies that with regard to the cropping period, wheat straw and paddy are the preferred substrate for early harvesting of oyster mushroom. In this regard, other studies came-up with varying results of cropping periods. Khan and Ali (1981) reported a cropping period between 21 and 28 days using cotton seed, while Tan (1981) reported the harvesting time to be within a month using cotton waste. These variations in cropping periods may emanate from the variations in the growing environment (controlled versus semi-controlled conditions) and physiological requirements for mushroom cultivation, for instance, the constant temperature, humidity and light arrangements.

Results of the yield attributes of oyster mushroom grown in each substrate are presented in Table 1. It was observed that the weight of fruiting bodies was significantly higher in the substrate of mung straw (13.2 g/ fruit) followed by paddy straw (12.7 g/ fruit) and wheat straw (12.4 g/ fruit) which were significantly better than other straw used in experiments. The lowest weight of fruiting bodies was recorded in sisal toe fibre (6.8 g/ fruit) followed by sunhemp straw, mustard straw, sesamum straw, urd straw and mesta straw which were statistically at par with each other.

Matured fruit bodies of oyster mushroom were harvested and weighed to determine the yield of mushroom (Table 2). The highest yield of 767.5 g/kg dry substrate with 76.8 % BE was recorded in wheat straw followed by paddy straw (747.5 g/kg dry substrate, 74.8 % BE) which was significantly superior to other substrate used. Yield of 663.8g/kg dry substrate was recorded in mung straw followed

**Table 1.** Effect of different substrates on yield attributing characters of *Pleurotus florida*

Sl. No.		DFFH (Days for first harvest)			WOFB (Weight of fruit bodies) (g/ fruit)		
		Aug. to Sep. 2019	Aug. to Sep. 2020	Mean	Aug. to Sep. 2019	Aug. to Sep. 2020	Mean
1.	Jute ( <i>Corchorus olitorius</i> ) straw	27.5	27.5	27.5	9.5	9.0	9.3
2.	Sunhemp ( <i>Crotalaria juncea</i> ) straw	29.5	29.0	29.3	7.5	8.8	8.2
3.	Mesta ( <i>Hibiscus sabdariffa</i> ) straw	30.8	30.8	30.8	8.8	8.5	8.7
4.	Sisal ( <i>Agave sisalana</i> ) toe fibre	28.5	28.8	28.7	7.0	6.5	6.8
5.	Sesamum ( <i>Sesamum indicum</i> ) straw	34.0	32.8	33.4	8.5	8.5	8.5
6.	Mustard ( <i>Brassica juncea</i> ) straw	28.3	28.3	28.3	9.0	7.5	8.3
7.	Arhar ( <i>Cajanus cajan</i> ) straw	31.5	31.5	31.5	11.8	11.0	11.4
8.	Urd ( <i>Vigna mungo</i> ) straw	29.0	28.0	28.5	8.8	8.5	8.7
9.	Mung ( <i>Vigna radiata</i> ) straw	28.5	27.3	27.9	12.8	13.5	13.2
10.	Maize ( <i>Zea mays</i> L.) straw	28.8	29.8	29.3	11.5	11.5	11.5
11.	Wheat ( <i>Triticum sativum</i> ) straw	23.8	24.3	24.1	12.5	12.3	12.4
12.	Paddy ( <i>Oryza sativa</i> ) straw	26.3	26.5	26.4	11.8	13.5	12.7
	CD(0.05)	2.7	2.6	2.7	1.9	1.9	1.9

**Table 2.** Effect of different substrates on yield of *Pleurotus florida*

Sl. No.		Yield (g/kg dry substrate)			Biological efficiency (%)		
		Aug. to Sep. 2019	Aug. to Sep. 2020	Mean	Aug. to Sep. 2019	Aug. to Sep. 2020	Mean
1.	Jute ( <i>Corchorus olitorius</i> ) straw	410.0	435.0	422.5	41.0	43.5	42.3
2.	Sunhemp ( <i>Crotalaria juncea</i> ) straw	385.0	407.5	396.3	38.5	40.8	39.6
3.	Mesta ( <i>Hibiscus sabdariffa</i> ) straw	455.0	487.5	471.3	45.5	48.8	47.1
4.	Sisal ( <i>Agave sisalana</i> ) toe fibre	402.5	415.0	408.3	40.3	41.5	40.8
5.	Sesamum ( <i>Sesamum indicum</i> ) straw	430.0	482.5	456.3	43.0	48.3	45.6
6.	Mustard ( <i>Brassica juncea</i> ) straw	565.0	550.0	557.5	56.5	55.0	55.8
7.	Arhar ( <i>Cajanus cajan</i> ) straw	582.5	565.0	573.8	58.3	56.5	57.4
8.	Urd ( <i>Vigna mungo</i> ) straw	640.0	655.0	647.5	64.0	65.5	64.8
9.	Mung ( <i>Vigna radiata</i> ) straw	642.5	685.0	663.8	64.3	68.5	66.4
10.	Maize ( <i>Zea mays</i> L.) straw	610.0	637.5	623.8	61.0	63.8	62.4
11.	Wheat ( <i>Triticum sativum</i> ) straw	747.5	787.5	767.5	74.8	78.8	76.8
12.	Paddy ( <i>Oryza sativa</i> ) straw	742.5	752.5	747.5	74.3	75.3	74.8
	CD(0.05)	45.6	42.9	44.3	-	-	-

by urd straw (647.5g/kg dry substrate) and maize straw (623.8g/kg dry substrate) which were statistically at par with each other. While, the low yield was obtained from sunhemp straw (396.3g/kg dry

substrate, 39.6 % BE) followed by sisal toe fibre (408.3 g/kg dry substrate, 40.8 % BE) and jute straw (422.5g/kg dry substrate, 42.3 % BE) which were statistically at par with each other. Pokhrel (2016) also reported that corn cob substrate with rice bran supplement showed the superior mycelia growth, faster spawn run and better yield among all the treatments including check.

Maheswari *et al.* (2020) reported maximum biological efficiency (92.08 %) of *P. ostreatus* in substrate composed of paddy straw, ragi straw and wheat bran which could be due to the presence of favourable nutrients such as cellulose and hemicellulose in paddy and ragi straw. In another study, the bioconversion efficiency of milky mushroom on wood shavings was found to be 62.5 % (Maheswari *et al.*, 2018). Girmay *et.al.* (2016) reported that cotton seed produced a significantly higher yield and biological efficiency compared to the other substrates.

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