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RESEARCH ARTICLE

Can Oyster Mushroom Be Cultivated on Seagrass?

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Abstract

Oyster mushroom *(Pleurotus sp)* is being cultivated almost in all parts of Tamil Nadu by using paddy straw and other agricultural wastes. Therefore, in this present investigation attempts were made to grow mushroom on seagrass. Experiments were conducted on seagrass which was collected from the sea shore of Kannirajapuram, Ramnad district. Dried seagrass was partially cooked before inoculating mushroom seeds. The partially-cooked seagrass with optimum moist condition was filled in polybag fermentors along with *Pleurotus florida* spawn. Then these bags were kept in mushroom house for solid state fermentation. The temperature and humidity of the hut was managed in optimum level for spawn running and fruit body formation of *Pleurotus* fungus. The result revealed that mushroom was produced from polybag fermentors filled with seagrass in 18^{th} day. Among the four fermentors tested, fungal fruit formation was noticed in three bags. The results gave an idea that mushroom cultivation in coastal area of Tamil Nadu.

INTRODUCTION

Mushrooms are very nutritious food that can be cultivated from lignocellulosic waste materials; and are in rich in crude fibre and protein. In fact, mushrooms also contain low fat, low calories and good vitamins. In addition, many mushrooms possess multi-functional medicinal properties. Mushroom cultivation is eco-friendly. *Pleurotus sp* was known to decompose and utilize various agriculture wastes. Their cultivation on cereal straw has been suggested for recycling of agriculture wastes as food (fruit bodies) and feed as the straw substrate left after the cultivation (spent straw) has better rumen digestibility and is enriched in minerals. A lot of biological waste is generated in rural areas and this waste could be utilized directly through mushroom cultivation converting them into protein rich palatable food. Agricultural activity generates large amount of biomass which are rich in cellulose, lignin and hemicelluloses. One of the simplest ways to recycle it for human consumption is through mushroom cultivation.

Generally lignocellulosic materials like paddy straw, wheat straw, maize stalks, etc., are used as substrates for the commercial production of oyster mushroom in our country (Jain and Vyas, 2002). In India, only paddy straw is widely used for cultivation of oyster mushroom. Though a huge quantity of paddy straw is available in the rice growing areas of eastern India, its availability for mushroom cultivation is gradually becoming restricted because of its use for several other purposes like cattle feed, thatching, roofing, mud plastering, fuel, etc,. in rural areas.

Though cereal straws are popular substrates for cultivation of oyster mushroom (Bano and Srivastava, 1962; bano et al., 1978) yet several studies have been carried out to utilize wild grasses as a suitable and alternative substrate for the cultivation of oyster mushroom (Das et al., 2000) are being replaced rapidly by high yielding varieties. According to (Das et al., 2002) sabai grass is a potential substrate for cultivation of oyster mushroom *Pleurotus sajor caju*. Lemon grass, another species belonging to grass family is widely cultivated in the less fertile lands for the purpose of extracting essential oils from the leaves. Since this grass contains sufficient lignocellulosic material and is available in plenty in this area, there is a possibility of using it as a substrate for growing mushroom.

Common Substrate used:

A number of organic substrate materials are available for mushroom production. The production of edible and medicinal mushroom utilizing, for example paddy straw, wheat straw, bagasses, tea waste, de-oiled cake, oilseed rape straw, soya bean straw, mustard residue, sesame residue with capsule shell, pea haulms, black gram/ green gram pod shell, hulled maize cob, saw dust of saw mill, banana leaves, waterhyancinth, cotton waste, cocoyam peels, rice bran, wheat bran, gram flour, pine sawdust, Goose grass (*Eleucine coracana*), kikiyu grass (*Pennisetum typhoides*), Kash grass (*Saccharum spontaneum*), Sabai grass (*Eulaiopsis binata*), Lemon grass (*Cympogon citrates*), Thatch grass (*Hyparrhenia filipendula*).

This particular study aims to investigate the possibility of using seagrass as a substrate for oyster mushroom cultivation.

Seagrass:

Seagrasses are plants that grow underwater but they are not the same as seaweeds (Algae). Some species of seagrass look very much like terrestrial (Land) grass, with strap like leaves or paired oval leaves. Places where many seagrass plants grow together are often called seagrass meadows or seagrass beds (Nguyen, 1998).

Seagrasses are commonly found in shallow coastal marine locations, salt-marshes and estuaries; in the tropic they are often found associated with mangroves. Like any plant seagrasses to grow and are usually restricted to the upper two meters of water where there is sufficient light. Seagrasses often grow on soft sand or mud. To anchor themselves firmly to the bottom seagrasses have an extensive root systems. This stops the plants from being washed away in stormy seas. (ICMAM-PDa, 2001) was recorded 726.15 ha of dense and 601.00 ha of sparse seagrass beds in this part of the Gulf during the year 2004, accounting for a total of 1327.15 ha of seagrass beds, which figure is very low when compared to the estimate of 22.71 km 2 of seagrass beds reported earlier**.**

Seagrass comprises a group of 49 species widely distributed throughout the shallow waters of every coastal sea except the most polar (Den Hartog, 1977). Of the 12 recognized genera, only 4 are found in the Caribbean and Puerto Rico. The local species are; *Thalassia testudunum, Syringodium filliforme (Cymodocea manatorum), Halodule wrightii (Diplanthere), Halophilla baillonis* and *Halophilla englemani*. Large amount of *Thalasia* and *Syringodium* were washed ashore on South-western Puerto Rico during the passage of hurricane (David, 1979). The another estimates that damage was considerable, although no quantitative measurements have been made yet. *Thalassia* and *Syringodium* commonly known as turtle grass and manatee grass respectively, are the most abundant and ecologically important seagrasses in Puerto Rico.

Solid State Fermentation:

Solid State Fermentation is defined as the cultivation of microorganisms on moist solid supports, either on inert carrier or on insoluble substrate that can, in addition , the used as carbon and energy source. The fermentation takes place in the option or near option of free water, thus being close to the natural environment to which microorganisms are adopted (Pandy et al., 2000). More generally, solid state fermentation can be understood at any process in which substrates in a solid particulate state are utilized (Mitchell et al., 2000).

Material and Method:

Collection of Substrate:

The paddy straw was collected from rural areas of Madurai. The Seagrass was collected from the sea shore of Kannirjapuran, Ramnad District.

Preparation of substrate for Solid state fermentation:

Known quantity (3kg) of absolutely dry substrates were soaked in water overnight. The soaked substrate was collected in the morning and boiled for about 30 minutes in a metal boiler. The excess water was decanted and the sample was spread uniformly on cement floor previously disinfected with 2% $KMNO_4$ solution. The sample was allowed to air dry until reaches about 50% moisture. The properly air dried sample was inoculated with fungal spores.

Polybag fermentor:

Polybags of 16X26cm size were used as a fermentor. A knot was made at bottom end of the bag. Then the bag was turned in such a way that the knot got inside the bag. Substrate was placed inside the bag as layer of few inch thickness and pressed tightly with help of palm. Fungal spawn was sprinkled randomly over the layer. It was followed by another layer of substrates. In the same manner samples were tied in the bag along with the spawn. After completion of spawning upper end of the bag was filled with threat. Perforation was seen on the surface of the fermentor to facilitate humidity of the chamber was maintained at 24±2^{o}C and 70-80% RH level throughout the study period.

Yield and biological efficiency:

Total weight of all the fruiting bodies harvested from all the three pickings were measured as total yield of mushroom. The biological efficiency (yield of mushroom per kg substrate on dry wt. basis) was calculated by the following formula (Chang et al., 1981).

$$\text{B.E. (\%)} = \frac{\text{Fresh weight of mushroom}}{\text{Dry weight of substrate}} \times 100$$

Results and Discussion:

The **Table:1** reveals that the cultivation of oyster mushroom on paddy straw and seagrass. The moisture retention capacity of the substrate in paddy straw was higher over grass. The results indicate the fungal fruit body appeared in 357g of paddy straw and 325g of seagrass. However no significant difference was found the dry biomass of fruit body in paddy straw 35.93g and 35.75g of seagrass. The variation was between 0.18mg of dry biomass. (Moorthy and Mohanan, 1991) recorded 332 to 474 g/bag yield from polyethylene bags containing 1.2 kg dry substrate/bag when inoculated with 150 g spawn/bag using a multi-layered spawning technique.

The Maximum biological efficiency value of 84.39% was obtained paddy straw, which was followed by the grass in 70.65%. The rate of decomposition in very fast to the paddy straw and then the seagrass. Reports on cultivation of the oyster mushroom on similar by-products have manifested variable levels of B.E. These variations are mainly related to spawn rate, fungal species used and supplement added to the substrate (Mane et al., 2007). Some of the elevated B.E. of *Pleurotus sp.* on commonly used substrates rice straw 85.5% (Mehta et al., 1990). (Shyamal Rajak et al., 2011) reported Lemon grass or Sabai grass or Kash grass alone resulted to a biological efficiency 54.6, 52.0 &39.1 and total cropping duration 51, 51 &56 days. This values were less than the BE of sea grass substrate. The probable reason may be that the nutrients for the mushroom particularly for its spawn run and pinhead development were supplied from paddy straw, which decomposed a little quicker than the grasses as reported by (Das et al., 2000).

Table:1 Yield Parameters of Substrate

S.No.	Substrates	Total fresh weight of substrate (g)		Total dry weight of substrate (g)		Total amount of fruit body production (g)	Dry biomass of fruit body (g)	BE (%)
		Before harvest	After harvest	Before harvest	After harvest			
1	Paddy Straw	1150	573.50	423.30	229.40	357.00	35.93	84.39
2	Seagrass	1150	653.00	460.00	348.20	325.00	35.75	70.65

Fig:1 Mushroom Growing from Paddy straw Fig:2 Mushroom Growing from Seagrass

The **Table:2** the present study reveals that total cropping duration of *Pleurotus florida* was higher for paddy straw substrate in 43 days as compared to the seagrass in 38 days. The sporophore initiation in paddy straw 19-23 days and seagrass took place in 16-18 days. (Fan et al., 2000) observed that first fructification occurred after 20-23 days of inoculation. The mushrooms were harvested at 10 days interval between 4-7 flushes. whereas (Jiskani et al., 1999) reported 7.5 days, but (Bughio, 2001) recorded 8.53 to 14.33 days between flushes.

Table:2 Days of harvesting and sporophore initiation

S.No.	Substrates	Days of Harvested				Total no. of days harvested
		Sporophore initiation	First Harvest	Second harvest	Third Harvest	
1	Paddy Straw	19-23	23	33	43	43
2	Seagrass	16-18	18	28	38	38

Conclusion:

Oyster mushroom *(Pleurotus sp)* is being cultivated by using paddy straw and other agricultural wastes. Seagrass is useful in oyster mushroom cultivation to substitute paddy straw, wheat straw and other agricultural wastes. The results gave an idea that mushroom cultivation in coastal area.

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