

Fundamental Cultivation Technology Of Oyster Mushroom (*Pleurotus* spp.)

Suresh Kumar

Ph.D. Research Scholar

Department of Plant Pathology, Rajasthan College of Agriculture,
Maharana Pratap University of Agriculture and Technology, Udaipur-313001

ARTICLE ID: 062

Introduction

Pleurotus is commonly known as 'Oyster mushroom', the word over and as 'Dhingri' in India, has origin from the Greek word 'pleuro' that means formed laterally or in a side way position (lateral position) of the stipe in relation to pileus. *Pleurotus ostreatus* (Jacq: Fr.) Kummer is one of the best known species of Oyster mushrooms. The word Oyster actually refers to the Oyster shell like structure of mushroom. More than 1000 species of the oyster mushroom have been described throughout the world under more than 25 related genera and about 50 species are recognized as a genus *Pleurotus*. It is lignicolous mushroom causes white rot disease in the trees. It is one of the most second important edible mushrooms after *Agaricus bisporus* for production and consumption worldwide and has broad adaptability among the mushroom growers reasons being 1) to be grow it on various organic wastes of agricultural, forest and industrial origin under wide range of agro climatic conditions from 10-30°C with 60- 90 percent humidity; 2) easy to grow, easy to manage in crop room and easy to post harvest; 3) it is nutritionally and medicinally rich with good taste.



Oyster Mushrooms

Climatic condition

Oyster mushrooms can grow from cold to temperate but prefer humid climatic conditions. The various species as below sustain wide range of temperature. Summer species of oyster mushroom can grow from 25-30°C. However, winter species can better perform from 18-22°C with 85-90 per cent humidity. However, 20-25°C temperature is most optimum for cultivation of oyster mushroom.

Growing species

The following species of *Pleurotus* are growing world over during summer and winter months.

Summer growing species of *Pleurotus*

1. *Pleurotus flabellatus*
2. *Pleurotus sajorcaju*
3. *Pleurotus sapidus*
4. *Pleurotus membranaceus*
5. *Pleurotus citrinopileatus*
6. *Pleurotuseous*

Winter growing species of *Pleurotus*

1. *Pleurotus ostreatus*
2. *Pleurotus florida*
3. *Pleurotus cornucopiae*
4. *Pleurotus fossulatus*
5. *Pleurotus enyngii* (King mushroom)
6. *Hypsizygusul marius* (Blue oyster)

Cultivating system of oyster mushroom

The following cultivation systems are adopted in various locations India wide

1. **Cut wood log cultivation system:** Mostly used with hardwood species and generally practiced in Europe.
2. **Bed cultivation system:** In this system the spawn mixed substrate is placed in the bed frame and or on the ridges. This system is mostly used with cotton waste/ straw substrate.
3. **Plastic bag cultivation system:** Spawned mixed substrate is filled in plastic bags. This system is mostly with cereal crop straw and is common in India and other South East Asian Countries.
4. **Bottle or jar cultivation system:** The suitable substrate is filled in bottles/jars and inoculated with suitable strain. This system is mostly used with saw dust. It is used in Japan.

5. **Modified bed cultivation system:** This system is common in main land of China. In which trench are formed and covered by the plastic roof. The trench is about 2 meter deep, 2.5 meter wide and of variable length with 3 meter height from base to plastic roof.
6. **Vertical tray system:** The vertical tray system was described by Kurtzman in 1978 for growing oyster mushroom. This system is practiced in some places of Bihar and Eastern Uttar Pradesh.

Substrate Preparation

Pleurotus mushroom commonly cultivates on wheat straw worldwide. Although, it can grow on almost all kind of fresh, uncontaminated organic wastes like wood logs, saw dust, cereal straw sugarcane bagasse, cotton wastes, jute, coir pith, cocoa pods, mango seed kernels, different oil cakes, rubber seed cake, sunflower straw, ground nut pod shell, tapioca starch, water hyacinth, banana wastes etc. Various methods of substrate treatment are adopted for *Pleurotus* cultivation. The most commonly adopted substrate treatments are giving below.

Categories of substrate

1. **Highly suitable farm wastes :** Paddy straw and wheat straw (Productivity 80-150%)
2. **Moderately suitable farm wastes:** Sugarcane bagasse, maize earhead, cotton waste, oil palm fruit waste (productivity 50-80 %)
3. **Suitable farm waste;** Cotton stalk, sorghum stalk sugarcane trashes (productivity 40-50%)

Substrate sterilization:

1. **Unsterilized method:** In this method substrate after soaking in water is used for spawning. The chances of contamination are increased.
2. **Hot water dip method:** It consists mainly of dipping of substrate in hot water for variable duration depending upon the nature of substrate used. Pre soaked wheat straw is dip in hot water at 60oC for an hour followed by drying in sunlight. (Fig. 1)

- 3. Pasteurization method:** In this method the wet substrate is exposed to live steam for different duration (few minutes to few hours). This is most common and widely adopted method throughout the world especially with cereal straw.
- 4. Fermentation method:** It involves application of thermophilic microorganisms in the fermentation of substrate.
- 5. Chemical treatment method:** This method is commonly used in the North India to sterilize the wheat and paddy straw substrate for *Pleurotus* mushroom. Generally formalin and fungicide (bavistine) are used to treat the substrate.
- 6. Sterile method:** In this method the substrate is sterilized by live steam under pressure. This method is suitable under lab condition.

Spawn and Spawning

Spawn

Commercial spawn is used for spawning purpose. It is second generation spawn prepared by first generation master spawn. About 15-25 spawned grains of master spawn are transferred in thermostatic polypropylene bags that contained 300-500g sterilized wheat grain. Thus, one bottle of master spawn is sufficient to distribute in 30-40 polypropylene bags. Inoculated bags are incubated at $25\pm 1^{\circ}\text{C}$. Other grains like sorghum and pearl millet can also be used for spawn making. The boiling and sterilization process of commercial spawn is same as master spawn. The detail procedure of spawn preparation is described here under.

1. Preparation of mother Spawn

The mushroom cultures prepared above three methods are also known as master culture or pure culture. The next steps after securing the pure cultures is preparation of

mother spawn also known as master spawn. The method commonly followed in India is as follows: About 6 kilograms of wheat grains are boiled for 30 minutes in 10 litres of water and then allowed to soak for another 20 minutes without heating. Turn the grains several times with a spoon for quick cooling. After boiling, wheat grains are filtered to drain out excess water using sieve. The grains remain in sieve at least for overnight to remove rest moisture content present on their surfaces. The weight of wheat grains is increased by 10 kg. The collected grains are mixed with 120 g gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and 30g calcium carbonate. The gypsum prevents the grains from sticking together and calcium carbonate is necessary to correct the pH. The prepared grains are filled into half-litre milk / glucose bottles at the rate of 150-200 g per bottle (by three-fourth capacity) and autoclaved at 20-22 lb. psi (126°C) for 1 ½ to 2 hours. Sterilized bottles are taken out from the autoclave while still hot and are shaken to avoid clump formation. The bottles are immediately transferred to inoculating room or chamber and allowed to cool down overnight. Next day, bottles are inoculated with bits of agar medium colonized with the mycelium of pure cultures. These inoculated bottles then incubated at $21 \pm 2^\circ\text{C}$. Periodic shaking of bottles is doing for proper distribution and colonization of mushroom mycelium on to the wheat grains. Mycelium completely permeates the grains within 2-3 weeks. The master spawn becomes ready for further multiplication of second generation spawn.

2. Preparation of commercial spawn

It is second generation spawn prepared by first generation master spawn. About 15-25 spawned grains of master spawn are transferred in thermostatic polypropylene bags that contained 300-500g sterilized wheat grain. Thus one bottle of master spawn is sufficient to distribute in 30-40 polypropylene bags. Inoculated bags are incubated at $25 \pm 1^\circ\text{C}$. Other grains like sorghum and pearl millet can also be used for spawn making. The boiling and sterilization process of commercial spawn is same as master spawn.

Spawning

Generally thorough method of spawning is used by majority of mushroom growers. In this method commercial grade spawn is mixed in the sterilized substrate @ 2 per cent on wet weight basis of the substrate. However, spawning rate is varied with the method of substrate

treatment. In pasteurization treatment 1-1.5 per cent on wet weight basis of substrate is sufficient. In case of active mycelium spawning 8-10 per cent spawn is recommended.

Spawn Run

The growth of spawn in the substrate is affecting by relative humidity, temperature, CO₂, fresh air exchange, light and watering. The following parameters are important for successful spawn run in the substrate.

RH	:	85-95%
Temperature	:	20-25°C
CO ₂	:	20000 ppm
Light intensity	:	Total darkness
Watering	:	Regular (twice a day)

In the presence of above conditions about 8-12 days are taken for complete colonization of substrate by mushroom mycelium.

Crop management

Pin head formation and cropping of mushroom are regulated by adjusting O₂, CO₂, light, humidity and temperature manually or by electronic devices. Regular watering is essentially required to maintain 80-90% moisture in the crop room.

Harvesting and packing

The harvesting standard for oyster mushroom is different with different use of them. In general the right stage of picking of oyster mushroom is before the margins of sporocarp start curling inwards, this stage will come 3-4 days after pin head emergence. Sometimes small fruiting bodies of 2-25mm are harvested. For canning or preserved in brine, the mushroom of 30-35mm in diameter or even larger may harvest. The fruit bodies should be harvested by twisting them so that broken pieces are not left out on the bed surfaces, which may often cause bacterial infections and rotting of the beds. In general, 3-4 flushes of fruit bodies could be harvested from different *Pleurotus* species. Total cropping period is extended from 30 to 45 days. During this period maximum yield is obtained from first harvest and

thereafter reduce gradually in each flush. The fresh mushrooms are packed in the polythene bags of 100-200 g capacity (fig. 1)

Yield

The yield of *Pleurotus* varied extensively from 0.4-1.5 kg fresh weight of mushroom per kg of dry weight of substrate. However, an average commercial yield is about 0.8-1kg fresh mushroom/kg dry substrate (80-100% BE) is obtained from 30-45 days with special growing practices and care exercised during pin head formation and cropping.

Crop termination

The substrate left after mushroom harvest is used as a fodder, basal substrate for multiplying biocontrol agent *Trichoderma* or placed and buried in the dig for next two years to decompose it properly in form of organic fertilizers.

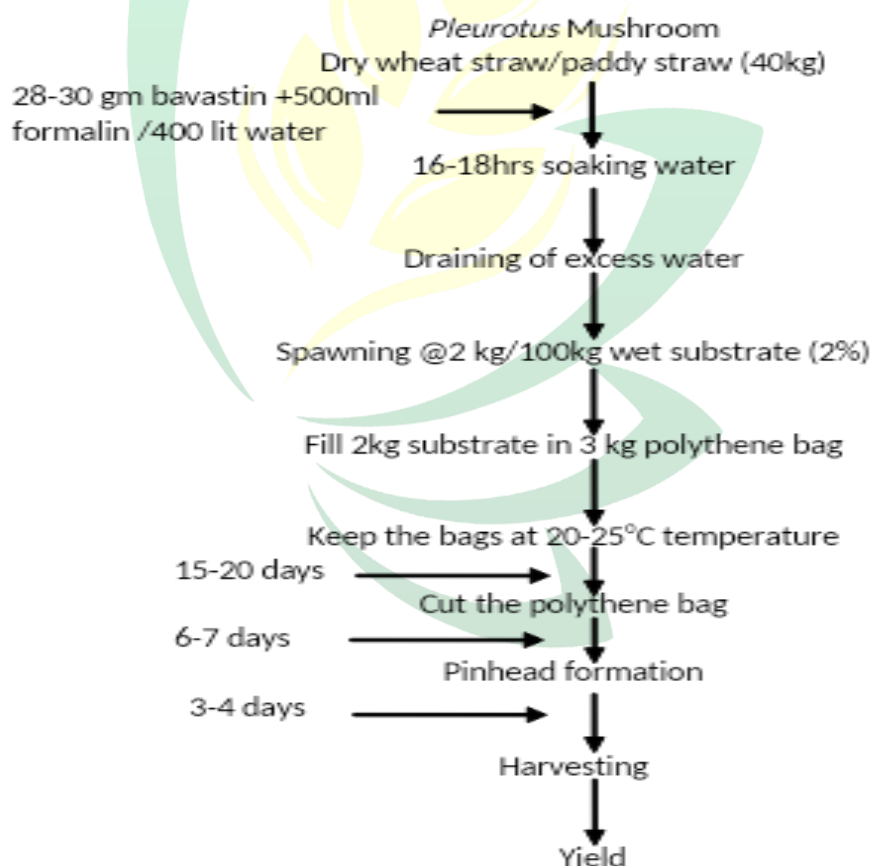


Fig 1. Schematic diagram of cultivation of oyster mushroom

