



4

CULTIVATION OF OYSTER MUSHROOM

In the previous lesson we learnt about the cultivation of button mushroom. In the first lesson we had seen that oyster mushroom is the second most important mushroom in terms of production in the world and also in India. Oyster mushroom is scientifically known as *Pleurotus*. It is very popular in China, Japan and various other East Asian countries including India. Its shape is like an oyster or big spoon with stalk on one side and gills on the lower side.

Number of species of *Pleurotus* have been cultivated as a result of which we get oyster mushrooms of all colours like white, grey, yellow, pink, etc. Some of the commonly cultivated species are *Pleurotus oesteratus*, *P. sapidus*, *P. florida*, *P. sajor-caju*, *P. djamor*, *P. eous*, *P. citrinopileatus*, *P. flabellatus*, *P. eryngii* etc.

Its cultivation is easy, but it has some critical steps to be taken care off like moisture content, proper sterilization and layered spawning to get proper mycelial growth and fruiting. There is no need to compost substrate (straw or other material used for growing mushroom) as was done for growing button mushroom. It can be grown on wide range of substrates and temperatures. Some species grow well below 20°C and others grow well above 20°C. In this lesson we will learn how to prepare the substrate and how to cultivate this mushroom.



OBJECTIVES

After reading this lesson you will be able to:

- prepare substrates by different methods for growing oyster;
- learn about cultural conditions required for cropping;
- harvest and dry mushroom as per market demand.



4.1 RAW MATERIALS AND PREPARATION OF SUBSTRATE

Oyster mushroom can be cultivated on wide variety of substrates like wheat straw, paddy straw, maize straw/cobs, cotton hulls, saw dust and so on. In fact it can be grown on any cellulosic waste. In India we normally grow it on wheat or paddy straw. It is more suitable for our country as:

- It can be grown on wide range of agricultural, horticultural and forest wastes
- There is no need of composting, its cultivation technique is easy and it can be grown on small scale in huts
- It can be grown in tropical part of our country as there are number of varieties that can grow between 20-30°C. Moreover, we also have varieties that can grow below 20 °C. These species also vary in colour (Fig 4.1)
- It has a short life cycle and mushrooms can be easily sun-dried
- It is a nutritious mushroom with medicinal benefits (like presence of cholesterol lowering compound -lovastatin)

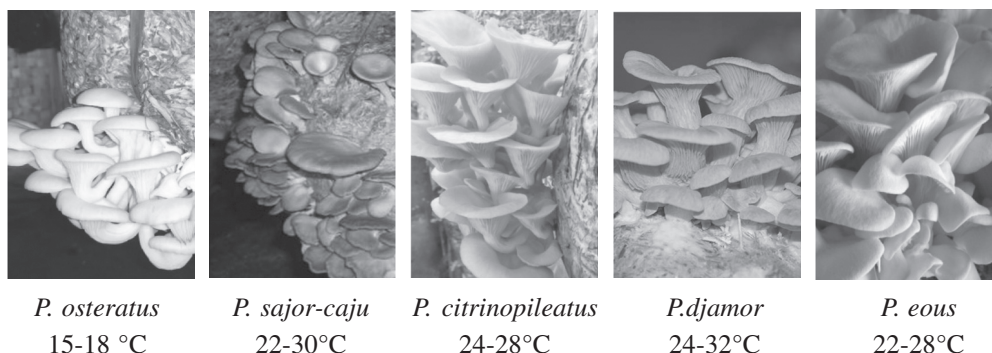


Fig. 4.1: Some oyster mushroom species varying in colour and temperature requirement

The first step is to prepare the substrate. Composting of the substrate is not required for cultivation of oyster mushroom species. As already mentioned, number of cellulosic waste like wheat straw, paddy straw, corn cobs, saw dust, cotton hulls, etc., can be used for cultivation depending upon the availability. Most commonly used substrate in our country is wheat straw followed by paddy straw. We should ensure that the substrate used is not exposed to rains after harvesting. We can pasteurize or sterilize the substrate or even use it as such. Let us learn different methods of preparation of substrate.



Notes

4.1.1 Use of Straw as such without any Treatment

We soak the straw in water as such overnight and used for cultivation. To make the pH slightly basic, you may add lime powder (1%) in the water. We soak the straw overnight, take it out and air dry before spawning. It must be ensured that the straw is fresh, that is, not exposed to rain. The spawning rate is kept more, i.e. 4%. Normally we add about 2.5% spawn on wet weight basis. It may be proper to keep moisture slightly less and also close the bags for higher carbon dioxide production. However, this is not recommended method, particularly at commercial level. It has been observed that farmers in Odisha follow this method with slight modifications. Majority of the farmers in coastal regions in Odisha keep the bags in single layer in simple huts made of coconut leaves (Fig. 4.2). Due to natural high humidity, it becomes possible to cultivate this mushroom in simple huts.



Fig. 4.2: Cultivation of Oyster mushroom in simple huts in Odisha

4.1.2 Pasteurisation using Chemicals

We may sterilize the straw using chemicals by soaking it in water containing formalin and carbendazim (Fig. 4.3). Both of these also inhibit the growth of mushroom. Hence it is important that chemicals should be pure and only recommended dose is used. For 10 kg straw about 100 litres of water is needed to which 7.5 g carbendazim (50WP) and 125 ml formalin is added. Soak the straw in this solution for 18 hours and then take out and air dry for 2-4 hours depending upon the season. In South India, farmers have innovated and developed machines for drying the straw (Fig. 4.4). These are like big washing machines used to dry clothes.



Fig. 4.3: Chemical sterilization of wheat straw using bavistin and formalin



Fig. 4.4: Indigenous arrangement for removing water from straw. Mechanism is like washing machine. Motor below, container for straw on top

4.1.3 Hot Water Treatment after Wetting the Straw

We wet the straw overnight. After taking out, soak it in hot boiling water. The straw is allowed to stay in this water for few hours and is cooled before spawning. The temperature of the hot water may be between 60-65°C. Over-boiling does not mean better treatment of the straw. Rather it will lead to partial sterilization of the straw which will attract more diseases. Secondly, soaking in hot water for prolonged period can lead to anaerobic conditions which are not required. However, many of us may find it difficult to heat large amounts of waters using wood, oil or electricity. An alternative method is use of solar energy.

4.1.4 Direct Hot Water Treatment and use of Solar Water Heater

Dry paddy and wheat straw can be directly soaked in hot water. It is important that a temperature of about $60 \pm 2^\circ\text{C}$ is maintained for about an hour and after that the straw can be spin dried and spawned. Actually direct treatment with hot water leads to immediate removal of waxy layer of straw and water absorption becomes easy. It has been observed that temperature above 65°C can be obtained in solar water heater. It may be possible to use electricity or integrate electricity and solar systems. Spin drying machine can be used to immediately remove excess water. We can develop a system of using many solar water heaters and drums and substrate can be filled in the drums at a regular interval of say 15 minutes. This way we can continuously use the spinning machine (Fig. 4.5).



Notes

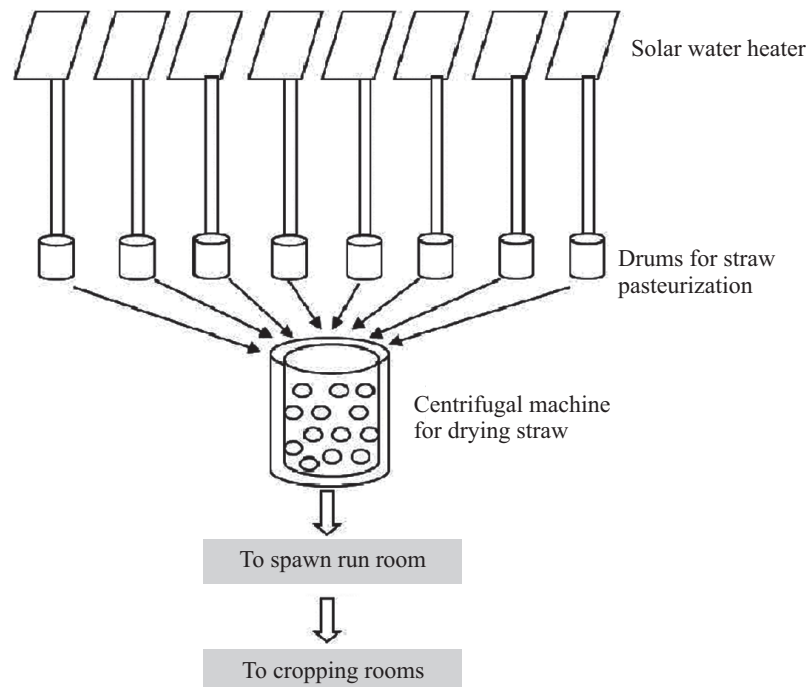


Fig. 4.5: Solar energy based model for cultivation of oyster mushroom

4.1.5 Pasteurization in the Tunnels

Even though pasteurization using hot water is a better method as the heat penetration is quick and uniform, but for commercial scale cultivation of oyster mushroom, it may not be possible to use this method. Here pasteurization in tunnel will be required. The method involves wetting straw, mixing 1% lime on dry weight basis, turning the pile of 4' width, 3-4' height (length of pile will depend upon the amount of substrate) every alternate day twice, filling in tunnel up to 4-5', raising the temperature to 60-62 °C using steam and maintaining it for 4-6 hours, followed by conditioning for 30-36 hours at 44-48 °C and cooling down. The material is then cooled and spawned.

4.1.6 Autoclaving

We may sterilize the straw by autoclaving. Straw is soaked, excess water is drained and after air drying, it is filled in polypropylene bags and sterilized just like spawn bags. For cultivation of some species of oyster mushroom like *P. eryngii* (King Oyster), autoclaving is must. After autoclaving, the bags are cooled and spawned under sterile conditions before laminar flow. This approach will ensure better results and very less contamination. It will be more useful where aim is to produce and sell spawn run bags at commercial scale or develop Ready To Fruit (RTF) packets for urban horticulture.



INTEXT QUESTIONS 4.1

State True or False

- (i) Some species of *Pleurotus* can grow well below 20° and others grow well above 20°C.
- (ii) Oyster can be grown on any cellulosic waste.
- (iii) Compositing of the substrate is required to grow oyster.
- (iv) We need to case the bags to get mushrooms.
- (v) Mushrooms appear on all sides of the bag.

4.2 CULTIVATION OF OYSTER

We spawn the pasteurized straw @ 2-3% spawn on wet weight basis. Two-five kg wet substrate can be filled in each bag. In other words, one kg dry straw will require about 100 g of spawn. Spawn can be mixed thoroughly or put in layers inside the bag. Bags are kept inside room or any hut and can be kept on ground or in tiers as in button mushroom or can be hung from the roof or rack with the help of nylon rope (Fig. 4.6). Small perforations are made in the bags. Bags are kept at temperature $24\pm 2^{\circ}\text{C}$. Spawn run takes about two weeks when whole bag becomes white. No light or fresh air is required for spawn run. Rather it is better to keep the rooms closed.



Fig. 4.6: Bags hung from the racks



Notes

For induction of fruiting, the bags require diffused light and fresh air for 3-4 hours daily for production of normal fruit bodies. Large holes can be made in the bag or whole of polythene can be removed. In 3-4 flushes, one kg of dry straw can yield 0.5 to 1.0 kg fresh mushrooms (Fig. 4.7). The temperature during cropping is kept around below 20°C or around 25°C (depending upon the species) and humidity is maintained above 85%. Temperature requirement will vary with the species. The development of colour will vary with temperature and duration of fruit-body on the bag.



Fig. 4.7: (L to R): Spawning, bag filling, spawn run and fruiting in oyster

4.2.1 Ready to Fruit (RTF) Bags

If you are staying in urban areas, it may not be possible for you to make or obtain small quantity of spawn, and also wet and heat straw and fill bags. Hence it is important that such growers are provided ready-to-fruit bags. For growing mushrooms for your own self, particularly in urban areas, ready to fruit bags are now available. The fully colonized substrate is already packed inside these bags and all you need to do is cut open the box on one or both sides and start watering. Within 10 days or so you will get the first crop.

RTF bags promote peri-urban horticulture. Even such bags can be used for science projects in schools to educate the children about mushrooms. Such kits are available in many countries and also in India (Fig. 4.8).



Fig. 4.8: Ready to Fruit bags

Cultivation of Oyster Mushroom

Substrate production requires special facilities. All growers cannot have such facilities. However, if spawned bags are available, almost everyone can cultivate mushrooms. Thus producing ready to fruit bags is a novel vocation. However, quality control will be very important as we cannot afford failure of bags especially if someone has purchased only one or two bags.

Another approach is that of having satellite growers. That is, fully spawn run bags are given to the farmers in the area and the produce is collected. By this approach we will be able to get mushrooms of the same variety and thus the next important vocation of packing and marketing can be undertaken.



INTEXT QUESTIONS 4.2

State True or False

- (i) Spawning rate on dry weight basis is 10%.
- (ii) Diffused light and fresh air is required for the formation of normal fruit bodies
- (iii) Temperature required for the spawn run is around 25°C.
- (iv) Temperature required for fruiting depends upon species and may be below or above 20°C.
- (v) Ready to fruit bags of oyster mushroom are now available in our country.

4.3 HARVESTING AND POST-HARVEST STORAGE

We harvest the mushrooms by twisting and we may cut any straw of substrate that may be there on the stalk. Do not water the bags before harvesting. We can easily sun dry oyster mushroom in open or in cabinets. The drying temperature should not be high (>60°C) as mushrooms dried at higher temperature do not rehydrate properly and also have poor smell. We can powder the dried mushrooms and powder can be added to biscuits, various other bakery products, health foods, etc. We can also make pickle of oyster mushroom after blanching just like button mushroom. As this mushroom produces lot of spores, workers should invariably wear masks inside the cropping room. A few people may be allergic to mushroom spores. The cultivation method of this mushroom is the easiest. Cost of cultivation is around Rs. 20-30 per kg under natural conditions.



Notes



Notes

**INTEXT QUESTIONS 4.3**

State True or False

- (i) Oyster mushroom can be easily sun dried.
- (ii) We should dry mushrooms below 60°C.
- (iii) Dried mushroom can be powdered and used for making various products.
- (iv) It is must to wear mask as this mushroom produces lot of spores and some people can be allergic to these spores.
- (v) Cost of cultivation is around Rs 20-30 per kg under natural conditions.

**WHAT YOU HAVE LEARNT**

Let us recapitulate the important points we have learnt in this lesson:

- Pasteurisation using chemicals has played important role in the spread of the technology but now there is going to be ban on the chemicals used for this purpose (bavistin). Hence it may be apt that hot water treatment is followed.
- Overheating is not required and is rather harmful. This can be exemplified using the analogy of pasteurisation of milk where we treat it at specific temperature for short time and do not boil and pack it.
- It may be important to develop solar based model by making modification in normal solar water heater to ensure that all the hot water comes out in one go without getting diluted with cold water.
- Fresh air and diffused light is necessary for the formation of fruit bodies
- All species require around 25°C for spawn run, but for fruiting some species require low whereas others require high temperature.

**TERMINAL EXERCISE**

1. What are the different methods of preparation of substrate?
2. Explain various steps from spawning to harvest and drying of mushrooms
3. Why diffused light and fresh air is necessary. What happens if these are not provided?
4. Describe some of the methods of using fresh and dry oyster mushrooms.



ANSWERS TO INTEXT QUESTIONS

4.1

- | | | |
|------------|-----------|-------------|
| (i) True | (ii) True | (iii) False |
| (iv) False | (v) True | |

4.2

- | | | |
|-----------|-----------|------------|
| (i) True | (ii) True | (iii) True |
| (iv) True | (v) True | |

4.3

- | | | |
|-----------|-----------|------------|
| (i) True | (ii) True | (iii) True |
| (iv) True | (v) True | |

SUGGESTED ACTIVITIES

- Considering that it is very easy to grow oyster at home, try to prepare or obtain one bag and attempt its cultivation.
- Search the literature and try to tabulate the temperature required for fruiting of different species of oyster mushroom.

Key Learning Outcomes

- Cultivate oyster mushroom crop as per recommended method.
- Pick, grade and pack the harvested oyster mushroom.