

# CULTIVATION OF MUSHROOMS ON OIL PALM FACTORY WASTES

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## Introduction

Mushrooms are preferred as an alternative source of food and valued for its flavour and nutritional value. Mushroom cultivation is mainly confined to indoors, is labour intensive and provides employment opportunities.

In palm oil factory, two types of sterile byproducts are available; one after the sterilization of fresh fruit bunches (FFB) at 3 kg/cm<sup>2</sup> pressure for one hour and stripping. This is known as bunch refuse. The second type of byproduct is called mesocarp waste and is obtained after the extraction of palm oil. During the processing of 1000 kg of FFB, about 350 kg bunch refuse and 150 kg of mesocarp waste are obtainable. At present these wastes are used either as fuel to the boiler or as mulch in plantations.

## MESOCARP WASTE

This has been found to be very ideal for the cultivation of oyster mushrooms (*Pleurotus flabellatus*) (Fig. 1), also called as wood fungus and as 'Dhingri' in Hindi and 'Chippikoon' in Malayalam.

About 40 species of oyster mushrooms suited to various temperate and tropical zones are available. Oil palm is a tropical crop having higher field adaptability and their cultivation is less expensive.

The species which give higher bio conversion efficiency are *Pleurotus florida*, *sajor-*

*caju*, *P. citrinopileatus* and *P. flabellatus* (Fig. 1). Growth and yield are better in ambient temperature of 20-30°C.

The cultivation technique is very simple involving less capital investment. Thatched sheds with sufficient ventilation and high relative humidity are ideal. Wooden frames are made at a height of about 2.5 meters from ground level so as to enable hanging of substrate beds for spawn run. A mud/brick parapet is to be provided on the side of the shed. The space between the parapet and the roof can be covered with a layer of plaited coconut leaf and the inside with a gunny screen to absorb moisture and provide humidity and coolness. River sand is spread over the floor to retain moisture and increase humidity in the shed.

## Preparation of substrate

Unlike the conventional paddy straw substrate, mesocarp waste does not require sterilization. The waste obtained fresh from factory is dipped in two changes of cold water for about 10 minutes primarily to remove oil remnants. Then excess moisture is drained by squeezing.

## Spawn preparation

Spawn is the vegetative seed material of mushrooms. Pure culture of the mushrooms are obtainable from agencies or can be isolated from sporocarps on potato dextrose agar medium. These need to be maintained on

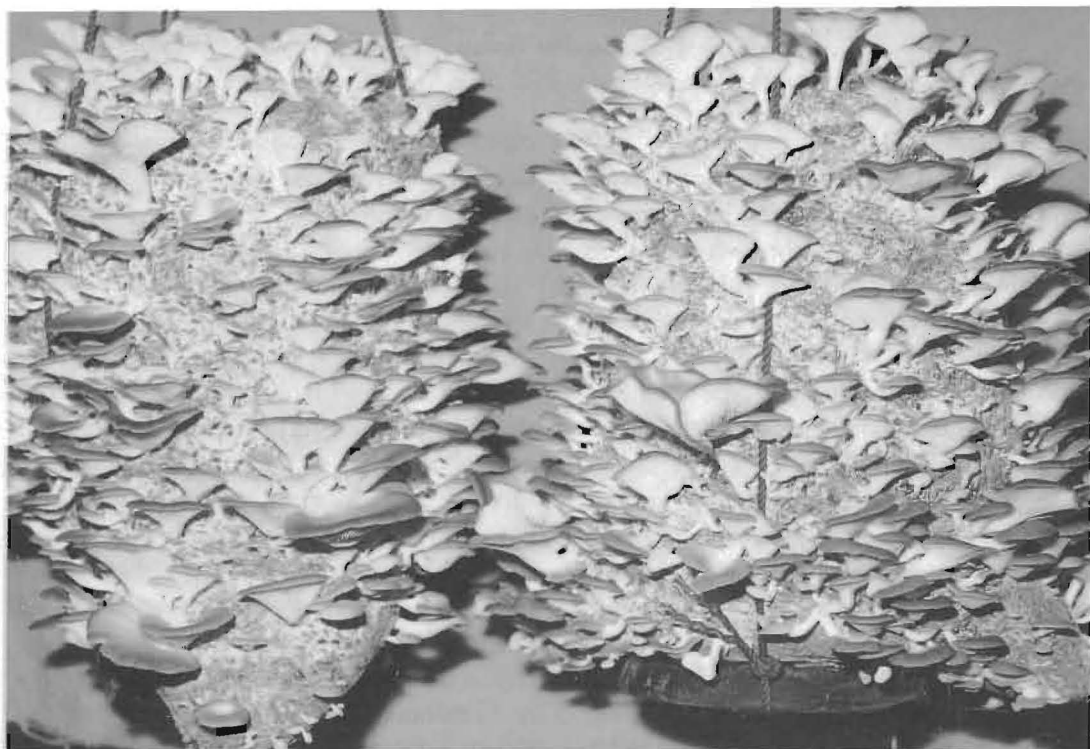


Fig. 1 : Oyster mushroom (*Pleurotus flabellatus*) on oil palm mesocarp waste.

media in test tube slants in refrigerator. Grains like paddy, wheat, sorghum etc are used as substrates for making spawn. Cleaned grains are half cooked in sufficient water and allowed to air dry on gunny bags for about an hour. Calcium carbonate @ 2 per cent of dry weight of grades is mixed with the grain and filled in empty glucose bottles to two third capacity. The filled in bottles are plugged with cotton preferably non absorbant and steam sterilized (autoclaved) at  $1.4 \text{ kg/cm}^2$  pressure for 2 hours.

After cooling, the bottles are inoculated with pure cultures of mushrooms under aseptic conditions and incubated for mycelial ramification preferably at  $24 \pm 3^\circ\text{C}$  for 15 days.

### Spawning

The spawn is removed from the bottles using a clean needle/rod. Multilayered spawning technique in polybags is adopted for cultivation. Polythene bags (150-200 guage) of  $45 \times 30 \text{ cm}$  punched with holes can accommodate 2 kg of the substrate. A 100 m layer of the substrate is filled in the polybag and spawn is applied preferably along the periphery along with rice bran (2%) as starter. The polybag is filled with the substrate spawn and rice bran, is multilayered, compacted, tied and kept as hangers or racks. Application of greeze on racks prevents access to ants. Keeping a bamboo pipe of 2-3 cm diameter in the centre of substrate is advantageous for

watering. About 100 gm of paddy grains spawn (5 per cent) is used per bag.

In 15 days, the mycelia ramifies (spawn run) on the substrate. At this stage the polybags are ripped open and kept on hangers and watered thrice daily using rose can.

### **Cropping**

Mushrooms buttons (pinheads) appear in 5-7 days which can be harvested in about three to four days. Mushrooms are to be harvested before the upcurving of the margins of pileus. Flushes continue to appear for a period of two months, but about 71 percent of the cropping is obtainable within a month after spawn run.

### **Harvesting and storage**

The mushrooms are picked up carefully without damaging the buttons. The debris from lower portions of sporocarp are removed and the mushrooms are packed in polythene bags with small holes. Marketing afresh is good or it can be stored in refrigerator for 2-3 days. An yield of 800-1200 gm of fresh mushrooms can be obtained from a bed of 2 kg.

### **BUNCH REFUSE**

Bunch refuse, another lignocellulosic waste is suitable for the cultivation of paddy straw mushrooms (*Volvariella volvacea* and *V. diplasia*) (Fig. 2). These mushrooms come up well in places where temperature ranges from 25 to 35°C.

### **Preparation of spawn**

Fresh paddy straw is chopped into small pieces of about 3 cm length and packed tight in long necked bottles. The filled in bottles are

soaked in water overnight and excess water drained off.

Coarsely powdered red gram powder is sprinkled in the bottle after making a hole in the centre of straw. The bottles are plugged with cotton and sterilized at 1.4 kg/cm<sup>2</sup> for one hour. After cooling, pure culture of *Volvariella volvacea* or *V. diplasia* is inoculated under aseptic condition and incubated for mycelial run.

Within 15 days mycelia ramifies and formation of chlamydo spores of the fungus on the peripheral side of straw indicating spawn maturity

Paddy straw spawn can be substituted by wheat grains spawn as described under oyster mushrooms.

### **Preparation of substrate and spawning**

Washed bunches are arranged to form a layer (75x45 cm) on a raised platform in a thatched mushroom shed. Since ants are a manace on bunches, the raised platform are to be kept ant free by retaining water around the pillars of the platform.

Bits of paddy straw spawn are inoculated on bunch refuse around the layer. Coarsely powdered red gram powder is applied over the spawn as a starter.

Subsequently 2 to 3 similar layers are made and spawned after placing the top layer and applying spawn over the layers are compacted and covered with polythene sheet.

Spawn is applied at the rate of one

bottle per bed of 75x45x30 cm size.

The beds are checked for moisture levels once in 4 days. After 10 days when the mycelial ramification is complete, the sheets are removed and the beds are to be watered thrice daily with rose can.

Bottoms of the mushrooms appear in about 2-3 days and can be harvested in another 2-3 days time when they are egg stage. If harvesting is delayed the mushroom opens resulting in higher crude fibre content (Fig 2).

The shelf life of paddy straw mushroom is less (24 hours in refrigerator) when com-

pared to oyster mushroom and hence need to be sold out immediately.

An yield of about 2 kg can be obtained from a bed of size 75x45x30 cm. Since it requires larger area for utilization of bulk quantity of bunch refuse, cultivation under shade in palm basin is advisable. Under field conditions about 50 per cent of the crop obtainable from indoor cultivation can be harvested. This enables the bulk utilization and production of mushrooms.

The cost of cultivation of one kg of mushrooms is less than Rs. 10/-. At the present selling price of Rs. 40/-, a net return of over Rs. 30/- is obtainable.



Fig. 2 : *Volvariella volvacea* on oil palm bunch waste