



Edible mushroom production technology using coconut residues

● Alka Gupta, Murali Gopal & George V. Thomas

Microbiology Section, ICAR-Central Plantation Crops Research Institute
Kudlu P.O., Kasaragod-671124, Kerala

Mushrooms have been used for culinary purpose from the time immemorial, not only because of its flavour and texture, but also because as it is good for health. Mushrooms are fleshy, macroscopic fruiting bodies of fungi and are technically called 'sporophores'. Though mushrooms grow on soil surface and are short-lived, their fungal mycelium grows below ground which massive and extensively spread but is also long-lived.

Thousands of species of mushrooms grow in wild, out of which some are edible, some poisonous and few are used in medicine. Some of the edible mushrooms are commercially grown and are available in markets. In India, three types of mushrooms viz. white button mushroom (*Agaricus bisporus*), paddy straw mushroom (*Volvarella volvacea*) and oyster mushroom (*Pleurotus* spp.) are commonly cultivated. Out of these, oyster mushroom is the ideal mushroom for tropical regions due to its ability to grow at a wide range of temperature from 15 to 31°C. Moreover, it has high productivity and the fruiting bodies have longer shelf life, which can be easily dried and stored.

Cultivation of oyster mushroom is being done mostly using paddy straw as substrate. But at CPCRI, a low cost technology has been developed for cultivation of oyster mushroom (*Pleurotus* sp.) utilizing recyclable coconut wastes such as leafstalk, bunch waste, leaflets, etc. obtained from coconut gardens. Cultivation of oyster mushroom on coconut wastes involves: preparation or procurement of spawn, substrate preparation, spawning of substrate and crop management.

1. Preparation or procurement of spawn

Spawn is a pure culture of mushroom and is used as



Oyster mushroom fruiting bodies (Pleurotus sp.) grown on coconut residues

seed material for mushroom cultivation. It can either be procured from ICAR-CPCRI, Agricultural Universities or reliable private agencies or prepared in polypropylene bags. If spawns are to be prepared, sorghum, paddy, maize or wheat grains are commonly used as substrates. The grains are cooked in water for 30 minutes; excess water drained and allowed to cool by spreading over a clean surface. Calcium carbonate @ 20-30 g/kg of grain is added and mixed well. These grains are filled in polypropylene bags up to 3/4th level and the mouth of the bags are plugged with cotton and sterilized in a pressure cooker or autoclave at 1.02 kg/cm² pressure for two hours. After cooling, they are inoculated with discs



Oyster mushroom spawn

(6-8 mm diameter) of fungal growth using a sterilized cork borer or inoculation needle. The inoculated bags are incubated at room temperature for 15 to 20 days. The spawn is ready for use when grains are completely covered with white mycelial growth. The first generation fungal culture is called mother spawn, from which further spawns can be produced up to third or fourth generation. Thirty spawn bags can be prepared from a single 250g mother spawn bag.

2. Substrate preparation

Partially dried leaves and bunch waste of coconut are chopped to 5-7 cm long pieces either manually or using chaff cutter and sun dried. The chopped substrates are soaked in water overnight. Excess water is drained off the next morning. Substrates are then sterilized either by steam pasteurization in an autoclave at 1.02 kg cm² pressure for 1½ hour or by immersing in boiling water for one hour (hot water treatment). After sterilization, excess water is drained off so that the substrate retains 70% moisture.

3. Spawning of substrate

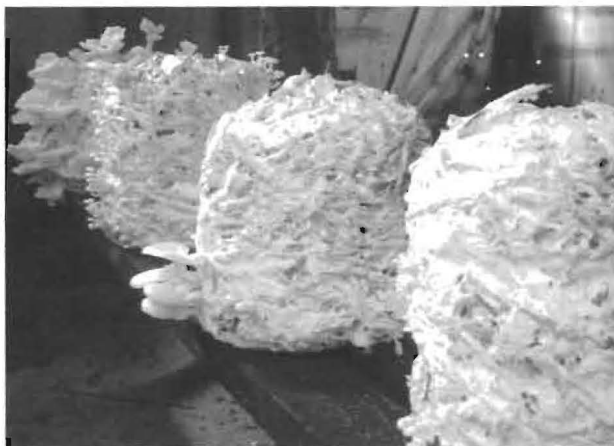
Polythene bags of 60x45 cm size (100-150 gauge) are used for bed preparation and about 10 holes (0.5 cm dia) are made on sides and bottom for aeration. Bottom of the bag is tied with jute thread to provide flat circular bottom. 20-30 days old spawn (300 g) is taken out in a plastic tray cleaned with 1% Dettol solution (1ml in 100 ml water) and divided into three equal parts and again one portion is apportioned to four equal parts for preparing bed. Multilayered spawning technique is followed to inoculate the substrate with spawn @ 100 g per bag containing 3- 3.5 kg substrate. Sterilized rice bran is added @ 5% (150g per bag) as an organic supplement to quicken mycelial ramification.

4. Crop management

After spawning, the bags are incubated for spawn run in a mushroom house. Low cost mushroom sheds can be built within coconut gardens using coconut stem and leaves. Multi-tier racks made of coconut reapers are fixed inside the shed to place the mushroom beds. The river sand is spread on the floor upto 8 cm height. Inside of the shed is lined with gunny bags. Ventilators with



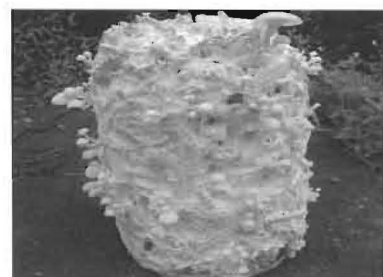
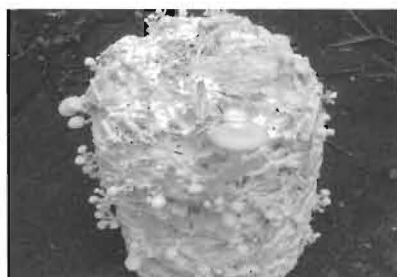
Mushroom beds after spawn run



Opened mushroom beds placed on racks in mushroom shed



Low cost mushroom shed



'Pin stage of mushroom cultivation' -- minute fruiting bodies appear on mushroom beds



Pleurotus mushroom fruiting bodies ready for harvest

insect proof plastic net should be provided on all sides of the shed for aeration. 80-85 % relative humidity is maintained inside the shed by periodical watering of the floor and gunny bags on the sides.

The filled up mushroom beds are kept on racks in the mushroom shed for 15-20 days period, during which spawn grows as white mycelium and covers the entire bed. Ideally, a temperature of 20-28°C and relative humidity of about 85% are maintained in the mushroom shed. After the spawn run, the polythene covers are ripped open and the compact cylindrical beds are placed on racks 20 cm apart.

After 24 hours of removal of polythene covering, water is sprayed on the mushroom beds two or three times daily with sprayer or rose can. The first flush will be ready in 5 to 10 days after opening of the bag.

The mushrooms are to be harvested just before the up-curving of the pileus and shedding of spores. The mushrooms should be plucked in the morning before spraying water. After each harvest, about one cm deep layer of substrate is scraped and removed from the entire surface of the bed to obtain the next flush within a short period.

Three to four crops can be harvested from each bed. The interval between flushes is normally 7-10 days. Spraying the beds with a solution of 1% urea and 1% superphosphate helps to reduce interval between harvests to some extent. Wastes generated from 1 ha area of coconut garden can yield about 1700 kg of fresh mushrooms.

The spent mushroom substrate obtained after

mushroom cultivation can be used to produce compost/vermicompost for use as soil organic amendment.

Mushrooms should be packed in pin holed polypropylene bags or polythene bags and sold on the same day or stored in refrigerator (maximum 3 days). Mushrooms dried in sunlight or in hot air oven at 40-50 °C can be stored for 3-4 months. Dried mushrooms can be rehydrated by soaking in lukewarm water for 20-30 minutes. Oyster mushrooms are used for preparing various dishes like thoran, kurma, soup, pickle, etc.

Mushrooms are rich in proteins (20-30 % on dry weight basis), essential amino acids, potassium, phosphorus, and fibre but have low starch content, sodium potassium ratio and calorific value. Mushrooms are known for their natural moisture content and antioxidant properties. They are good for our skin and higher amounts of folic acid and iron found in them takes care of haemoglobin deficiency in the body. Mushrooms also contain vitamins A, B and C which bolsters immune response in our body. This makes the mushrooms 'health food' and desirable dietary component of diabetics, obesity and hypertension patients.

The cost of oyster (*Pleurotus florida*) mushroom production on coconut residues works out to Rs. 90/- per kg where as the market rate is somewhere between Rs. 200/- to 250/- per kg, which shows its profitability.

Mushroom cultivation can be done by farm women, unemployed youth, etc. without any additional land requirement utilizing the waste materials available in their coconut gardens. This technology can be the source of income and provide nutritional security to the family. ■