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Production technology of oyster mushroom

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Oyster mushroom (*Pleurotus* sp.) belonging to Class Basidiomycetes and Family Agaricaceae is popularly known as 'dhingri' in India and grows naturally in the temperate and tropical forests on dead and decaying wooden logs or sometimes on dying trunks of deciduous or coniferous woods. It may also grow on decaying organic matter. The fruit bodies of this mushroom are distinctly shell or spatula shaped with different shades of white, cream, grey, yellow, pink or light brown depending upon the species. It is one of the most suitable fungal organisms for producing protein rich food from various agro-wastes or forest wastes without composting. Cultivation of different varieties of oyster mushroom was initiated in India in the early sixties. Commercial cultivation began in mid-seventies.

The oyster mushrooms have three distinct parts- a fleshy shell or spatula shaped cap (*Pileus*) , a short or long lateral or central stalk called *Stipe* and long ridges and furrows underneath the pileus called gills or *Lamellae*. The gills stretch from the edge of the cap down to the stalk and bear the spores. The spores are smooth, cylindrical and germinate very easily on any kind of mycological media within 48-96 hrs. The mycelium of *Pleurotus* is pure white in colour. Oyster mushrooms are the third largest cultivated mushroom. China, the world leader in Oyster production, contributes nearly 85 per cent of the total world production of about a million tonnes. The other countries producing oyster mushrooms include Korea, Japan, Italy, Taiwan, Thailand and Phillipines. The present production of this crop in India is only around 1500 tonnes due to low domestic demand. Another inhibiting factor is that export demand orders are large and can be met only if a linkage is developed between producer, co-operatives and exporters.

The economic importance of the mushroom lies primarily in its use as food for human consumption. It is rich in Vitamin C and B complex and the protein content varies between 1.6 to 2.5 per cent. It has most of the mineral salts required by the human body. The niacin content is about ten times higher than any other vegetables. The folic acid present in oyster mushrooms helps to cure anemia. It is suitable for people with hyper-tension, obesity and diabetes due to its low sodium : potassium ratio, starch, fat and calorific value. Alkaline ash and high fibre content makes them suitable for consumption for those having hyperacidity and constipation. A polycyclic aromatic compound pleurotin has been isolated from *P. griseus* which possess antibiotic properties.The spent straw can be re-cycled for growing oyster mushroom after supplementing with wheat or rice bran @ 10-15 % and also for preparing compost of white button mushroom after suitable supplementation with nitrogen rich horse or chicken manure (sun-dried before use). The spent straw can be used as cattle feed and also for bio-gas production, The slurry can be used as manure.

Market analysis and strategy: This mushroom is not as popular as white button mushroom in the domestic market. A few units are cultivating it commercially for export market. Cultivation of this mushroom on commercial basis would be more profitable as compared to white button mushroom as capital costs are low. The cultivation of this variety of mushroom is very simple and economical in rural areas where raw materials and facilities required are easily available. Marketing of fresh oyster mushroom does not pose any problem at present due to very low production. However, as production increases linkage of producers with domestic markets and export oriented processing units will need to be developed to ensure remunerative prices to the producers. Generally, export orders are too big to be met by a single grower and as such co-operatives have to be encouraged to pool their produce for trading the crop in a dried powder form in international markets.

Analysis and future strategy: Species of *Pleurotus* are cheapest and easiest to grow among all the cultivated edible mushrooms. Cultivation does not require complicated

substrate preparation technique as in case of button mushroom. The former can be grown on non-fermented, almost fresh plant residues (agri-wastes containing lignin and cellulose). Substrate preparation does not require controlled environmental conditions as in case of button mushroom.The crop has got a number of varieties varying in shape, colour, texture and aroma which can be cultivated throughout the year under varied agro-climatic conditions. Faster growth rate and early cropping is observed. About 5 to 6 crops can be taken in a year as the total cropping period is 60 days.

Production technology:

Agro-climatic requirements: Oyster mushroom can grow at moderate temperature ranging from 20 to 30^{0}C and humidity 55-70 per cent for a period of 6 to 8 months in a year. It can also be cultivated in summer months by providing the extra humidity required for its growth. In hilly areas above 900m. (m.s.l.), the best growing season is during March/April to September/October and in the lower regions from September/October to March/April.

Growing and potential belts: The major states in India producing this mushroom are Orissa, Karnataka, Maharashtra, Andhra Pradesh, Madhya Pradesh, West Bengal and most of the North Eastern hill states.

Varieties cultivated: Among all the cultivated mushrooms *Pleurotus* has maximum number of commercially cultivated species suitable for round the year cultivation. All the varieties or species of oyster mushroom are edible except *P. olearius* and *P. nidiformis* which are poisonous. Species commercially cultivated all over the world during summer months includes *P. flabelltus, P. sajor cajo, P. sapidus, P. membranaceous, P.citrinopileatus, P.eous etc.* and those produced during winter are *P.ostreatus, P.florida, P.cornucopiae, P. fossulatus, P. eryngii etc.*

Cultivation technology: The procedure for oyster mushroom cultivation can be divide into following four steps preparation or procurement of spawn, substrate preparation, spawning of substrate and crop management.

Spawn preparation : A pure culture of *Pleurotus* sp. is needed for inoculation on sterilized substrate. It takes 10-15 days for mycelial growth on cereal grains. It has been reported that *Jowar* and *Bajra* grains are superior over wheat grains.

Substrate preparation: Oyster mushroom can be cultivated on a large number of agro-wastes having cellulose and lignin which helps in more enzyme production of cellulose that is correlated with more yield. These include straw of paddy, wheat and ragi, stalk and leaves of maize, millets and cotton, used citronella leaf, sugarcane bagasse, saw dust, jute and cotton waste, dehulled corncobs, pea nut shells, dried grasses, sunflower stalks, used tea leaf waste, discarded waste paper and synthetic compost of button mushrooms etc. It can also be cultivated by using industrial wastes like paper mill sludges, coffee by products, tobacco waste, apple pomace etc. The popular methods of substrate preparation are: Steam pasteurization; Hot water treatment; Sterile technique (Till method); Fermentation or composting and Chemical sterilization.

Spawning of substrate : Freshly prepared (20-30 days old) grain spawn is best for spawning. Old spawn (3-6 months) stored at room temperature (at 20-30^{0}C) forms a very thick mat like structure due to mycelium aggregation and sometimes young pinheads and fruit bodies start developing in the spawn bottle itself. The spawning should be done in a pre-fumigated room (48hrs.with 2% formaldehyde).

Crop management:

Incubation: Spawned bags, trays or boxes are arranged in a dark cropping room on raised platforms or shelves for mycelium colonization of the substrate. Although mycelium can grow from 10 to 33^{0}C, but the optimum temperature for spawn running lies between 22 to 26^{0}C.

Fruiting : When the mycelium has fully colonized the substrate, the fungus is ready for fruiting. Contaminated bags with moulds may be discarded while bags with patchy mycelial growth may be left for few more days to complete mycelial growth. While various species require different temperature regimes all require high humidity (70-85%) during fruiting. Frequent spraying of water is required in the cropping room depending upon the atmospheric humidity. Fruit body produced under humid conditions (85-90%) is bigger with less dry matter while those developed at 65-70 per cent relative humidity are small with high dry matter. CO_2 concentration during cropping should be less than 600 ppm. or 0.6 per cent. Sufficient ventilation has to be provided during fruiting.

Plant protection measures: The crop is suspect to attacks from flies (sciarid, cecid) spring tails and mites. Timely spraying with insect specific insecticides is needed. The crop is prone to fungal diseases. Several competitor moulds e.g. *Aspergillus* sp., *Cladosporium* sp. and *Fusarium* sp., *Rhizopus* sp. have been reported to occur in the substrate used for cultivation. Spraying with Bavistin or Benomyl is a recommended control measure.The crop is also subject to diseases like yellow blotch, brown spot and bacterial rot, control measures which are needed

include: Proper management of temperature and humidity during growing period. Regular application of chlorinated water containing 100-150 ppm of freely available chlorine at an interval of 3-5 days. Application of oxytetracycline and streptocycline.

Harvesting and yield: The right shape for picking can be judged by the shape and size of the fruit body.The fruit bodies should be harvested before spore release, by twisting so that the stubs are not left on the beds (straw). It is advisable to pick all the mushrooms at one time from a cube and the next flush will appear at one time. More than 500 kg of fresh mushrooms per ton of dry wheat or straw can be obtained in case of crop produced in 45-60 days.

Post harvest management:

Short-term storage: Fresh mushrooms are packed in perforated polythene bags which are directly sent to the local market situated nearby.Freshly harvested mushrooms can be stored at low temperature (0-5^0 C) for 1-2 weeks without loss in quality in case it is to be sent to the distant markets.

Long-term storage:Dried mushroom with 2-4 per cent moisture, can be stored for 3-4 months in sealed pouches without any change in taste. The dried produce can be rehydrated in luke warm water (40-50^0 C) within 20-30 mins. giving 80-90 per cent of original weight.

Packing and transportation: Fresh mushrooms are packed in perforated polythene bags. Poly pouches containing crushed ice and overwrapped in paper are put in trays/baskets which are then covered with thin polythene sheet with sufficient perforation for proper aeration. The pre-packed pouches (250 or 500 g.) can be transported by roadways in trucks, buses depending upon the quantity to be transported.

Marketing: Domestic marketing does not pose a problem at present because only small quantities are being traded. As production develops, marketing promotion measures will need to be undertaken to bolster the demand. Export potential exists and needs to be taken advantage of by organizing co-operatives of producers linked to commercial units for processing fresh mushroom into dehydrated powder for export.

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