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Harvesting, Storage and Yield Improvement in Oyster Mushroom (*Pleurotus ostreatus*)

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The Oyster mushroom (*Pleurotus ostreatus*) has emerged as one of the most commercially significant fungi globally. Its popularity stems from several unique biological advantages: a fast growth rate, the ability to thrive on a wide range of agricultural lignocellulosic wastes, and an exceptionally high biological efficiency. Oyster mushrooms are not only a culinary delight but also a nutritional powerhouse, rich in proteins, vitamins (B1, B2, C), and minerals, while remaining low in fat and calories. Despite its cultivation ease, the oyster mushroom faces a critical challenge: extreme perishability. With a moisture content ranging from 80% to 90%, the fruiting bodies begin to deteriorate almost immediately after harvest. This deterioration is driven by high respiration rates, enzymatic browning, and rapid moisture loss. Statistics suggest that without proper postharvest management, farmers can face losses between 30% and 35%. This guide aims to provide a deep dive into strategies for optimizing yield and preserving quality from the farm to the market.

Harvesting in Oyster Mushroom

Determining the Optimal Harvesting Stage

Timing is the most critical factor in harvesting. For Oyster mushrooms, the 'market stage' is reached when the cap margin is still slightly incurved (turned inward). If the cap becomes flat or turns upward, it signifies over-maturity. Over-mature mushrooms release billions of spores, which can cause respiratory allergies in workers and lead to a tough, fibrous texture that is less palatable for consumers. Typically, harvesting occurs 3 to 5 days after the first appearance of pinheads. In a standard cropping cycle, mushrooms are harvested in 2 to 3 distinct 'flushes' over a period of 20 to 25 days. The first flush usually provides the highest yield and best quality.

Harvesting Methods and Hygiene

Practical Method: The best way to harvest is to grasp the whole cluster at the base and gently twist and pull. This ensures the entire mushroom is removed without leaving organic debris behind. Common Mistakes: Farmers should avoid using knives to cut the mushrooms. Cutting leaves 'stumps' on the substrate. These dead tissues are highly susceptible to bacterial rot and green mold (*Trichoderma*), which can jeopardize subsequent flushes. Harvesting should ideally be done in the early morning when the ambient temperature is low, minimizing the 'field heat' of the mushroom.

Yield Measurement and Biological Efficiency (BE)

To evaluate the success of a crop, farmers use the concept of Biological Efficiency. This measures the ability of the fungus to convert the dry matter of the substrate into fresh mushroom weight.

BE (%) = (Fresh Weight of Mushroom / Dry Weight of Substrate) × 100

A healthy Oyster mushroom crop should yield a BE of 70% to 100%. This means for every 1 kg of dry straw, one can expect 700g to 1000g of fresh mushrooms.

Yield Improvement Strategies

Advanced Substrate Supplementation

While paddy straw and wheat straw are the standard 'base' materials, they often lack sufficient nitrogen and minerals for maximum output. Supplementing the substrate can dramatically improve performance.

- Organic Supplements: Adding 2% groundnut haulm, chickpea haulm, or wheat bran can reduce the incubation period by 3-5 days and increase yields significantly (up to 871 g/kg substrate).
- Growth Stimulants: Research indicates that using a 10% boiled yeast extract as a supplement can nearly double the yield, increasing it from ~507g to ~918g per kg of substrate. This is due to the rich amino acid and B-vitamin profile of the yeast.

Precise Environmental Controls

Oyster mushrooms are sensitive to their microclimate. The ideal range for fruiting is 20-30°C with a Relative Humidity (RH) of 85-95%. Heat waves are the biggest threat; at temperatures above 35°C, the developing pinheads (buds) undergo physiological wilting and die. In regions like Coimbatore, production has been seen to drop by 90% during peak summer months due to inadequate cooling.

Low-Cost Microclimate Optimization

For small-scale farmers, expensive HVAC systems are not feasible. Instead, biological solutions can be used:

- Intercropping: Growing mushrooms under the shade of a maize or banana canopy. The transpiration from the larger plants naturally cools the air and maintains a higher RH (8085%), creating a perfect 'forest floor' environment for the mushrooms.

Postharvest Physiology and Losses

Mushrooms are living organisms even after they are harvested. They continue to respire at a very high rate. The heat generated by respiration can cause the mushrooms to 'cook' themselves if they are packed too tightly without cooling.

Major causes of loss include:

- Transpiration: Loss of water vapor through the cap and gills. A weight loss of just 5% makes them appear wrinkled and unmarketable.
- Enzymatic Browning: The enzyme polyphenol oxidase (PPO) reacts with oxygen, turning the white/grey oyster mushroom into a brownish, unattractive color.
- Autolysis: Endogenous enzymes start breaking down the cell walls, leading to a slimy texture.

Storage and Shelf Life Extension

Temperature Management

Cold storage is the most effective way to slow down metabolism. Refrigeration at 4-6°C can extend the shelf life to 10-12 days. For longer-term preservation, deep freezing can be used. Pleurotus florida varieties have been successfully preserved at -15°C for up to 11 days with minimal changes in texture after thawing.

Packaging Innovations

The choice of plastic bag is vital. While most farmers use thin, perforated bags to prevent sweating, research shows that 250 µm non-perforated High-Density Polyethylene (HDPE) bags are superior. These create a Modified Atmosphere (MAP) where CO_2 levels rise slightly, and O2 levels drop, naturally slowing down the mushroom's aging process. This method can double the shelf life at ambient temperatures compared to standard bags.

Chemical and Pre-treatments

For commercial supply chains, chemical dips are often used:

- Short Term: A 5-minute dip in 0.05% Potassium Metabisulphite (KMS) before packing preserves the white color.
- Long Term (Steeping): Mushrooms can be preserved for up to 150 days in a brine solution consisting of 5% salt, 0.2% citric acid, and 0.1% KMS, provided they are blanched first.
- Organic Acids: 0.3% Ascorbic acid (Vitamin C) and 0.3% Citric acid are excellent natural antibrowning agents.

Value Addition and Drying

When fresh market prices are low, farmers should turn to drying. Dried mushrooms can be stored for 6-12 months. Methods include sun drying (cheapest), mud ovens, or microwavevacuum drying (best quality). Dried mushrooms can be ground into powder and used in functional foods like mushroom soup powder, biscuits, and papads. Incorporating 5-10% mushroom powder into wheat flour significantly boosts the protein and fiber content of bread and parathas.

Practical Summary for Farmers

Objective	Recommended Practice	Expected Outcome
Maximizing Yield	Paddy straw + 2% Groundnut/Wheat Bran	87% Biological Efficiency
Quality Harvest	Incurved cap stage, early morning harvest	Premium texture & lower field heat
Medium Storage	0.05% KMS dip + 250µm HDPE Bag (4°C)	12 days shelf life
Long-term Preservation	Blanching + Brine Steeping	4-5 months shelf life
Value Addition	Drying and Milling into powder	Stable income, zero waste

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