

Oyster Mushroom (*Pleurotus ostreatus*) Cultivation and Spawn Preparation: A Sustainable Approach for Nutritional Security and Agricultural Waste Management

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Abstract

Mushroom cultivation has emerged as an important agro-based biotechnology industry due to its nutritional, medicinal, environmental, and economic benefits. Oyster mushroom (*Pleurotus ostreatus*) is one of the most extensively cultivated edible mushrooms worldwide because of its ability to grow on a wide range of agricultural wastes and its simple cultivation requirements. Spawn serves as the seed material in mushroom cultivation and plays a crucial role in determining crop productivity. The present review focuses on oyster mushroom cultivation and spawn preparation techniques, including pure culture development, grain spawn production, substrate preparation, environmental requirements, nutritional composition, medicinal importance, and economic significance. Oyster mushroom cultivation not only provides a protein-rich food source but also contributes to the recycling of agricultural residues and sustainable rural development. The review highlights the importance of quality spawn and proper cultivation practices for obtaining maximum yield and profitability.

Keywords: Oyster mushroom, *Pleurotus ostreatus*, Spawn preparation, Agricultural waste, Biotechnology, Mushroom cultivation.

1. Introduction

Mushrooms are macrofungi characterized by visible fruiting bodies and have been utilized as food and medicine for centuries. They belong mainly to the phylum Basidiomycota and possess the unique ability to convert lignocellulosic agricultural wastes into highly nutritious food. Among the cultivated edible mushrooms, oyster mushroom (*Pleurotus ostreatus*) occupies an important position because of its adaptability, high yield potential, and simple cultivation techniques.

The increasing global demand for nutritious food, coupled with environmental concerns regarding agricultural waste disposal, has promoted mushroom cultivation as an eco-friendly solution. Oyster mushrooms can be cultivated on various substrates including paddy straw, wheat straw, maize stalks, sugarcane bagasse, sawdust, cotton waste, and other lignocellulosic residues. Their cultivation requires minimal land area and comparatively low investment, making them suitable for small-scale and commercial production.

Spawn preparation is one of the most critical stages in mushroom cultivation. Quality spawn ensures rapid substrate colonization, reduced contamination, and improved yield. Therefore, understanding spawn production and cultivation techniques is essential for successful mushroom farming.

2. Taxonomy and Morphology of Oyster Mushroom

The oyster mushroom belongs to the genus *Pleurotus* and family *Pleurotaceae*.

Taxonomic Classification

Kingdom: Fungi
Phylum: Basidiomycota
Class: Agaricomycetes
Order: Agaricales
Family: Pleurotaceae
Genus: <i>Pleurotus</i>
Species: <i>Pleurotus ostreatus</i>

The fruiting body of oyster mushroom consists of a cap, gills, stem, and mycelial network. The cap is oyster-shaped, smooth, and may vary in color from white to gray or brown depending on environmental conditions and strain characteristics. The gills are white and decurrent, extending down the stem. The vegetative body consists of thread-like hyphae that collectively form the mycelium responsible for nutrient absorption.

3. Nutritional Importance of Oyster Mushroom

Oyster mushrooms are considered a highly nutritious food source due to their rich composition of proteins, vitamins, minerals, and dietary fibers.

The protein content ranges from 20–30% on a dry weight basis and contains essential amino acids such as lysine, leucine, valine, and methionine. Oyster mushrooms are also rich in B-complex vitamins, vitamin D, potassium, phosphorus, calcium, magnesium, iron, and zinc.

The low fat content and absence of cholesterol make them suitable for individuals seeking healthy dietary alternatives. Furthermore, mushrooms possess antioxidant compounds that contribute to disease prevention and overall health maintenance.

Oyster mushrooms contain approximately:

Protein: 20–30%
Carbohydrates: 50–60%
Fiber: 7–10%
Fat: 2–4%

4. Spawn Preparation

Spawn refers to mushroom mycelium grown on a suitable carrier material that serves as planting material for cultivation. Grain spawn is widely used because grains provide nutrients and a large surface area for mycelial growth.



4.1 Pure Culture Preparation

The preparation of spawn begins with obtaining a pure culture. Healthy fruiting bodies are selected and cleaned thoroughly. Small tissue sections from the inner portion of the mushroom are aseptically transferred to Potato Dextrose Agar (PDA) medium.

PDA Medium Composition
Potato extract – 200 g
Dextrose – 20 g
Agar – 20 g
Distilled water – 1000 ml

The inoculated Petri plates are incubated at 25°C for 7–10 days until white mycelial growth develops.

4.2 Grain Spawn Preparation

Wheat grains are commonly used for spawn preparation due to their favorable nutritional composition.

The grains are cleaned, soaked overnight, and boiled until soft. Excess moisture is removed, and gypsum (2%) and calcium carbonate (0.5%) are added. The grains are then filled into glass bottles or polypropylene bags and sterilized in an autoclave at 121°C and 15 psi pressure for approximately two hours.

Following sterilization, the grains are inoculated with actively growing mycelium under aseptic conditions and incubated at 25°C. Complete colonization usually occurs within 15–20 days, resulting in ready-to-use spawn.



5. Oyster Mushroom Cultivation Technology

5.1 Substrate Selection

Agricultural residues serve as suitable substrates for oyster mushroom cultivation. Paddy straw is the most commonly used substrate because of its availability and high biological efficiency.

5.2 Substrate Preparation

The straw is chopped into small pieces and soaked in water for several hours. Pasteurization is carried out using hot water treatment to eliminate undesirable microorganisms.

After pasteurization, extra water is removed to maintain the moisture content between 65 and 70 percent

5.3 Spawning

Spawn is mixed with the prepared substrate at a rate of 3–5% of substrate weight. The substrate and spawn are arranged in alternate layers inside cultivation bags.



5.4 Incubation

The bags are incubated under dark conditions at temperatures ranging from 24–28°C and humidity levels of 80–85%.

Within 15–20 days, complete substrate colonization occurs through extensive mycelial growth.

5.5 Fruiting

After complete colonization, fresh air exchange, diffused light, and high humidity are provided. Small pinheads appear and develop into mature fruiting bodies within a few days.

6. Environmental Factors Affecting Growth

Environmental conditions significantly influence mushroom growth and yield.

Temperature

The optimum temperature for oyster mushroom cultivation ranges between 20–28°C.

Relative Humidity

Humidity levels of 85–95% are necessary during fruiting body formation.

Light

Diffused light promotes proper fruiting and cap development.

Ventilation

Adequate air circulation prevents carbon dioxide accumulation and ensures healthy mushroom development.

Moisture

The substrate should maintain sufficient moisture throughout the cultivation period.

7.RESULTS AND OBSERVATIONS

The prepared grain spawn showed healthy white mycelial growth

within 15–20 days. Complete substrate colonization occurred within 18–25 days. Fruiting bodies appeared after 5–10 days of environmental modification. Healthy mushrooms were

obtained with high biological efficiency. The cultivation process demonstrated efficient utilization of agricultural waste materials.

Observation Table

Crop Duration

Stage	Duration
Spawn preparation	15–20 days
Spawn running	15–20 days
Pinhead formation	4–7 days
Fruiting body development	3–5 days
First harvest	25–30 days



8. Medicinal and Therapeutic Importance

Oyster mushrooms contain numerous bioactive compounds including polysaccharides, β -glucans, terpenoids, and phenolic compounds. These substances exhibit antioxidant, antimicrobial, anti-inflammatory, antitumor, and cholesterol-lowering properties.

Scientific studies have reported that regular consumption of oyster mushrooms may contribute to improved immune response, reduced blood cholesterol levels, and protection against oxidative stress-related diseases.

Their medicinal significance has increased their popularity among consumers seeking functional foods with health-promoting properties.

9.. Economic and Environmental Significance

Mushroom cultivation provides an efficient method for converting agricultural waste into value-added products. The process contributes to environmental sustainability by reducing waste accumulation and open-field burning of crop residues.

Economically, oyster mushroom cultivation offers employment opportunities and additional income for farmers, entrepreneurs, women, and rural communities. The spent mushroom substrate can further be utilized as organic manure, animal feed, or compost, enhancing resource utilization efficiency.

10. Challenges in Mushroom Cultivation

Several factors may affect successful mushroom production.

Contamination by molds and bacteria can reduce yield and quality. Poor spawn quality, improper sterilization, inadequate humidity, and pest infestations may also negatively influence production.

The short shelf life of fresh mushrooms remains a challenge for marketing and transportation. Proper post-harvest handling, refrigeration, drying, and value-added processing can help overcome these limitations.

11. Conclusion

Oyster mushroom cultivation represents a sustainable biotechnology-based enterprise capable of addressing nutritional, environmental, and economic challenges. The successful production of oyster mushrooms largely depends on quality spawn preparation, appropriate substrate management, and maintenance of suitable environmental conditions. Oyster mushrooms are highly nutritious, possess medicinal properties, and contribute to efficient agricultural waste recycling. Their cultivation offers substantial opportunities for income generation, rural development, and food security. Continued research and technological advancements will further enhance productivity and commercial viability of oyster mushroom farming.

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