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Mushroom: A Versatile Gift of Nature

*Dr. Vishakha K. Bagul

Principal, MVP's Agriculture Polytechnic, Chachadgaon, Nashik, India

*Corresponding Author's email: vishakhabagul@gmail.com

The demand for quality food and novel products is increasing with the changes in life style of peoples. To meet these challenges and to provide food and nutritional security to our people, mushrooms are one of the components which help in overcoming the problems of quality food, health and environmental sustainability. This abstract provides a short overview of mushroom production, including key aspects such as what is mushroom, its varieties, nutritional properties, current status, steps of production, pest and disease management, harvesting and marketing. Understanding these fundamental aspects is crucial for successful mushroom production.

Keyword: Nutritional, Mushroom, Sustainability, Security.

Introduction

Recently growing awareness regarding dietary and health consciousness among peoples are increasingly favoring nutrient-rich foods, mushroom is a better alternative. For this reason, the demand for mushrooms production is currently on the rise. In recent years, the demand for mushrooms in the Indian market has increased rapidly and since production is currently falling short, farmers can earn significant profits by starting mushroom cultivation. Mushroom commercial farming is a supplementary business for farmers. It is important to note that specific techniques and considerations may vary depending on the mushroom variety, local climate, available resources and the scale of production. Detailed information on low-cost mushroom production is given below.

What is a mushroom?

Mushroom is a special type of fungal fruiting body belonging to the *Agaricus* genus. It is known by various names such as Alimbi, Futu, Chhatri, Bhimbhaura, Mushroom, Dhingari, etc. It is recognized as a significant dietary component due to its nutritional properties and immunity-boosting capabilities. Once this fungus reaches full maturity, fruiting bodies appear; these are locally known as 'Alimbi' or 'Bhuchhatra', and are internationally recognized by the English name 'mushroom'. In nature, there are countless varieties categorized by their toxicity (poisonous or non-poisonous) as well as their diverse shapes and colors. Before consuming them, ensure that the mushrooms are fit for consumption or not. Globally, a total of 10 types of mushroom are cultivated commercially. Among these, Button, Oyster, Milky and Paddy Straw mushroom cultivation is a popular in India.



Nutritional or Immune-boosting properties of Mushroom

1. Vitamin B-1 in mushrooms aids the digestion of carbohydrates, reduces the constriction of blood vessels and helps in the prevention of Beriberi in young children.
2. The presence of Vitamin C helps prevent scurvy in children, while niacin and pantothenic acid assist in reducing skin diseases and burning sensations in the hands and feet.

3. Mushrooms contain essential amino acids like lysine, threonine, tryptophan, methionine, and cystine, making them a valuable dietary supplement (Thakur, 2020; Ayimbila and Keawsompong 2023).
4. Due to their very low starch and sugar content, mushrooms are beneficial and healthy for individuals suffering from high blood pressure.
5. Due to its various medicinal properties, it is particularly effective in preventing obesity, high blood pressure, heart disease, diabetes, cancer, influenza, polio, asthma, lung diseases, infertility, as well as various viral and bacterial infections.

Types of mushrooms

Mostly four types of mushrooms are cultivated widely in India viz., button, oyster, paddy straw and milky mushroom (Fig. 1.).

1. Button Mushroom S.N.: - *Agaricus bisporus*
2. Oyster Mushroom (Dhingri) S.N.: - *Pleurotus ostreatus*
3. Milky Mushroom S.N.: - *Calocybe indica*
4. Paddy straw Mushroom S.N.: - *Volvariella volvacea*

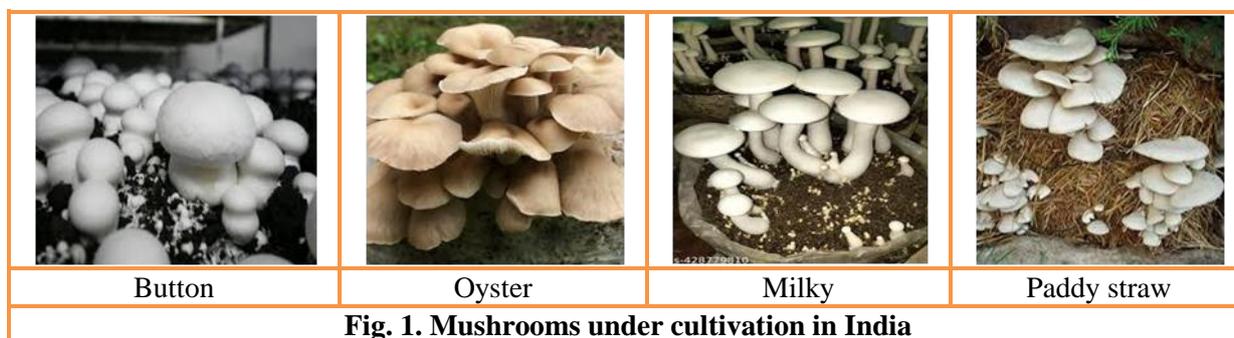


Fig. 1. Mushrooms under cultivation in India

Contribution of different species of mushroom production in India

Button mushroom is an introduced crop in India. Button mushroom is cultivated throughout the year by commercial units and also during winter months by seasonal growers. The cultivation is more in Maharashtra, Gujarat, Goa, Haryana, Punjab, Uttarakhand and Himachal Pradesh.

Cultivation of paddy straw mushroom is localized to Odisha while milky mushroom is more popular in southern part of India. Oyster is more popular in East, even though it is cultivated in many other parts of the country. There are many species of oyster and globally maximum numbers of species of this mushroom are under cultivation (Sharma *et al.*, 2017).

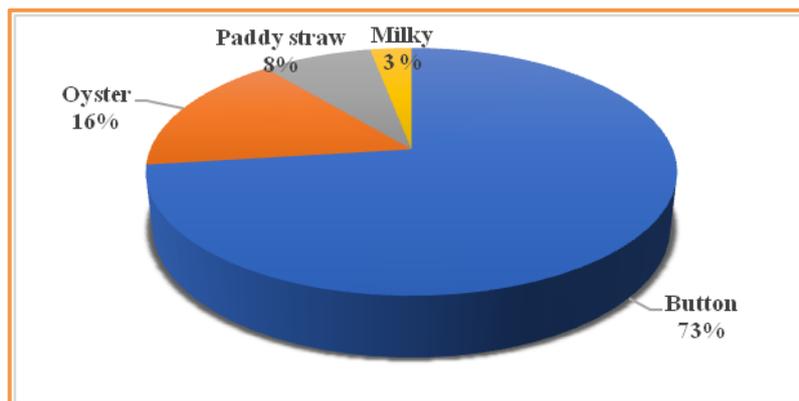


Fig. 2. Contribution of different species in total mushroom production in India

Status of mushroom production in Maharashtra

Maharashtra has emerging potential for mushroom cultivation due to its diverse agro-climatic conditions. The state primarily produces oyster and button mushrooms, with a growing interest in milky and paddy straw mushrooms. The major production centers include Pune, Nashik, Kolhapur, and Satara. Farmers use paddy straw, wheat straw, and sugarcane bagasse as substrates. The Maharashtra Agriculture Department and Krishi Vigyan Kendras (KVKs) provide training and technical support to mushroom growers. (Thakur *et al.*, 2025)

Why is mushroom farming profitable?

1. Mushroom production can be achieved with low capital investment by utilizing recycled agricultural waste. The material left after growing mushrooms, commonly referred as spent mushroom substrate (SMS), can be processed into manure. Thus, mushroom cultivation is an important method to promote sustainable manure-based farming.
2. Additionally, straw or agricultural waste mushroom substrate is also reported to improve the soil health.
3. Due to low time and labor requirements, this can serve as an excellent supplementary business.
4. Simple cultivation practices, high technology is not required.

Improved method for low-cost mushroom cultivation

Materials Required for Production: -

1. Straw or agricultural waste
2. Spawn (Seed)
3. Polythene Bags
4. Formalin
5. Bavistin
6. Water

1) Selection of site for cultivation: Mushroom cultivation requires a shelter that ensures protection from external elements, wind and rain. A room or shed with permanent or temporary construction, a thatched hut, a hut made from bamboo mats or a poultry shed can be used. Ensure that the selected site does not have direct sunlight but remains well-ventilated.

2) Medium for cultivation: Mushroom cultivation can be carried out on any organic matter-rich substrate, specifically using dry crop residues or leaf litter that remain superannuated after harvest. For this, mainly use paddy straw, soybean straw, wheat straw, vari, bajra, maize stalks, leaves. etc. should be utilized.

3) Favorable environmental conditions for cultivation: For cultivation, the natural temperature should range from 22°C to 30°C. A relative humidity of 85% to 90% is essential. To maintain the required temperature and humidity at the cultivation site, cover the floor and surrounding walls with jute bags and arrange to spray them with water using a spray pump. Usually, 25°C temperature is favorable for mushroom growth. High Temperature is harmful to the Mushroom.

4) Cultivation method: Fill a sack with 1-3 cm small pieces of straw or dry leaves required for cultivation and soak them in cold water for 6 to 8 hours. Remove the sack of straw from the cold water and place it on a tripod for 1 hour to drain the excess water.

i.) Straw sterilization: Two methods are used for straw sterilization.

1. The first method involves soaking the bag of straw in hot water (80°C) temperature for 1 hour; then remove it from the hot water and place it on a tripod to allow the excess water to drain off or sterilization should be carried out by exposing it to steam temperature for 1 hour. To cool the substrate, keep it in the shade.
2. The second method for substrate sterilization is to mix 7.5 g Bavistin (fungicide) and 125 ml Formalin (disinfectant) in 100 liters of water, then filled the substrate in bags and soak in this solution for 16 to 18 hours. Remove the soaked straw and let it drain for 4 to 5 hours to remove excess water; subsequently, fill this straw in plastic bags having size 35 x 55 cm that sterilize using 5% Formalin. This process must be conducted in a sterilized, enclosed area.

While filling the substrate, first place a small number of mushroom seeds at the bottom of the bag. Then, add an 8-10 cm thick layer of sterilized substrate and spread the mushroom seeds (spawn) evenly over it. Fill 4 to 5 layers of substrate and spawn. Press the substrate down slightly with your hand while filling. After filling the bag, tie the mouth of bag tightly with a thread then, using a needle or a pin, make holes on all sides of the bag.

Make approximately 40-50 small perforations in the bags. Place these bags in a sheltered area. Once white fungus growth becomes visible throughout the bag, carefully tear the plastic covering on it. 15 to 18 days are required for the fungus to fully develop. The fungus growth holds the substrate to bind together tightly, forming a solid block. This is known as a 'Bed' (Fig.3.).



ii) Care: The beds removed from the plastic bags should be placed on racks at appropriate intervals or secured with ropes. Lightly spray the bed with water 1 to 3 times a day. Spray water on the floor and walls of the room to maintain a temperature of 25° to 30°C and humidity levels between 65% and 75%. Sprouts (pinheads) will begin to appear around the bed within 3 to 4 days, these will grow rapidly over the next 3 to 4 days and become ready for harvesting. The second crop is harvested after 8 to 10 days and the third crop is harvested after another 8-10 days. Typically, one Bed containing 1 kg of dry substrate (straw) yields approximately 800 g to 1 kg of fresh mushroom production.

iii) Water management: After removing the bed from the plastic bag, lightly spray it two to three times a day using a spray pump with a small nozzle during the mushroom's growth period. There is no need to spray the bag during the growth phase of the mushroom fungus.

iv) Crop Protection: Alimbi or mushroom it is a highly perishable and short duration crop. Important issue regarding the cultivation mushroom is affected by diseases and pests.

Diseases: - Fungal pathogens such as *Trichoderma*, green mold (*Trichoderma aggressivum*), and cobweb mold (*Hypomyces* sp.) are most important pathogens to destroy quality of produce.

Some bacterial pathogens can cause diseases in mushrooms, such as bacterial blotch (*Pseudomonas tolaasii*) (Fig.4.).



Pests: - Mushroom fly (*Scatophaga* spp.), mites and other pests like slugs, snails and other crawling pests can damage mushrooms or contaminate growing environments. (Frantisek *et al.*, 2017).

Preventive Measures

1. Maintaining a clean and hygienic environment is crucial to prevent the introduction and spread of diseases and pests. Regular cleaning and disinfection of growing areas, tools and equipment help minimize contamination (Amanuel *et al.*, 2018).
2. Using high-quality spawn to reduces the risk of introducing pathogens or pests into the cultivation system (Artin *et al.*, 2022).
3. Proper handling and storage of spawn, substrates, and equipment, along with maintaining strict hygiene practices, can reduce the risk of contamination by pathogens and competing organisms (Rashad *et al.*, 2019)
4. Implementing a quarantine protocol for incoming substrates, materials and equipment helps prevent the introduction of contaminants into the cultivation process (Faraji, 2023).
5. Adequate ventilation helps maintain air quality and prevent the buildup of excess moisture that can favor the growth of pathogens and pests (Mata *et al.*, 2022).

Chemical control/ Management:

- To manage the rot and flies, it is recommended to apply a solution of malathion or a similar insecticide (Nuvan) at a concentration of 0.02% (2 ml in 10 liters of water) every

time after harvesting. It is important to avoid spraying insecticides when there are fruits on the bed.

- For control of mites using miticides or predatory mites (Esteban *et al.*, 2020).

Integrated Pest Management (IPM): Integrated Pest Management strategies involve a combination of all practices include preventive measures, monitoring, quarantine and targeted control methods. IPM aims to minimize the use of synthetic pesticides and focuses on long-term sustainable solutions. This method includes cultural practices, biological controls (e.g., beneficial organisms) and use of pesticides when necessary. (Patil *et al.*, 2024).

5) Harvesting and storage

Harvesting of mushrooms at the right stage of maturity is important for flavor, texture, and nutritional value. The harvesting time varies depending on the mushroom species and variety. Generally, mushrooms are harvested when the caps have fully expanded and the gills or pores underneath are visible but have not yet released spores. (Dawadi *et al.*, 2022). Mushrooms should be harvested carefully, gently twist or to cut the mushrooms at the base of the stem using a sharp knife or scissors (Amza, 2018). After harvesting, sort the mushrooms based on size, shape, appearance and their quality.

Storage: Mushrooms are highly perishable and it require careful storage to maintain or extend their shelf life. Store mushrooms in a cool, humid environment to slow down deterioration. The ideal storage temperature and humidity levels vary depending on the mushroom species. Gener ally, a temperature range of 0-4 °C with a relative humidity of 85-90% is ideal for most edible mushrooms, (Guo *et al.*, 2023).

6) How can moisture be retained?

In summer season or hot days, retaining moisture in the room (bed) is a significant challenge. If moisture is not retained, the entire crop can suffer damage, leading to reduced yields. Covering the shed with straw or other organic materials can help reduce evaporation.

- Applying mulch can help to retain moisture.
- If there is a risk of drought, it is advisable to apply water every 5 to 6 days.

7) Marketing: Marketing is getting the right product, to the right people, at the right price, at the right time and in the right way. (Patel S.H., 2023). A well-organized marketing system is essential for expanding the mushroom industry.

- By explaining the importance of health and nutrition in every household, providing free samples of the products and preparing various promotional materials to showcase the benefits of the products.
- By demonstrating the products in large malls and hotels, convincing them of their benefits and ensuring that our production adheres to their standards.
- In weekly meetings, in exhibitions, in trade shows and in the city, set up stalls for our products to promote them effectively.
- The formation of cooperatives, public sector marketing initiatives and improved processing facilities will enhance distribution.
- Investment in cold storage, refrigerated transport and processing units will ensure year-round availability in major cities.
- To make mushrooms more accessible and affordable, production costs must be reduced, leading to lower retail prices.
- Strengthening supermarket and retail chain networks, including vegetable stores and mother dairy outlets, can facilitate better market penetration.
- A steady supply of mushrooms throughout the year at reasonable prices will create a stable and sustainable market.

Conclusion

Mushrooms are one of the most popular and valuable gifts of nature. This review placed emphasis on low-cost mushroom production and marketing. Mushrooms play an important role in nutritional importance and economic, ecological and environmental benefits. The mushroom production is simple and inexpensive process; it requires waste material as a

substrate. Nowadays, as the population grows, there is a greater need for nourishment and food is vital, so today mushroom cultivation is growing sector especially for rural people. The article also focused on mushroom marketing, the biggest challenge for farmers and producers to manage market effectively. The article emphasized on mushroom production in along with presenting information about marketing facility.

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