

# Livelihood and Nutritional Security Through Adoption of Mushroom Farming in Uttar Pradesh: An Overview

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Food and Agriculture Organization (FAO) have recognized mushroom as food item contributing to the protein nutrient to the diet of developing countries like India, where there is heavy dependence on cereal diets. The significant feature of mushroom is that this nutritious and tasty food is cultivated entirely from waste products and converts a wide spectrum of agricultural and industrial waste into substrate on which the growth of mushroom is supported. After harvesting the mushroom, the solid residual left is organic compost with natural nutrients to further enrich the soil. In addition to converting the waste into valuable products, it enhances the income and provides additional gainful employment to the producers. Edible mushrooms cultivation is becoming increasingly successful in many regions of India because of suitable climatic conditions, short growing cycle, low input requirements, huge immunotherapeutic benefits for production and easy production technology.

## Present Scenario of Mushroom Production and Consumption in India

Scientific mushroom cultivation in India started in 1962. At present, the total mushroom production in India is approximately 0.258 million tons in 2021. The state-wise mushroom production is highest in Bihar while Punjab, Maharashtra, Uttar Pradesh, and Orissa are the other leading states. In India, five mushroom species viz., white button mushroom (*Agaricus bisporus*), oyster (*Pleurotus spp.*), paddy straw mushroom (*Volvariella volvacea*), milky mushroom (*Calocybe indica*), and shiitake (*Lentinula edodes*) are under commercial cultivation. Even though cultivation technologies of many other mushroom species were standardized at Indian Council of Agricultural Research- Directorate of Mushroom

Research (ICAR-DMR) Solan, the commercial markets are still dominated by *Agaricus bisporus*, *Pleurotus spp.* and *Volvariella volvacea*. These three mushrooms are contributing about 96% to the total mushroom produced in India.

In India, mushroom consumption is about 70 gram per capita. In China, per person per year consumption of mushroom is about 22 kg, whereas the global average consumption is approaching 6 kg per person per year. Thus, there is an ample scope of promoting mushrooms in our country. In the coming years, the demand for mushrooms is going to increase and hence need for cultivation overcollection.

## Status of Mushroom Production and Consumption in Uttar Pradesh

By and large, Uttar Pradesh is a traditional area for mushrooms which are found growing widely in the forest areas. Mushroom varieties available in the local market as fresh mushrooms collected during rainy season are: *Agaricus*, *Auricularia*, *Clitocybe*, *Lentinula edodes*, *Pleurotus*, *Schizophyllum commune*, *Termitomyces*, *Tricholoma* and *Volvariella*. The natural production of mushrooms is, however, not substantial to meet the requirement and ensure round the year supply of mushrooms. There is a long gap during winter when no mushroom appears naturally.

There are three types of mushrooms cultivated in the state, namely, white button, oyster, and Milky mushroom. The total production of mushrooms in Uttar Pradesh is around 24 metric tonnes, which includes approximately 17 tonnes button, 5 tonnes oyster and Milky 1 tonne and others 1 tonne mushroom. The modern technology in commercial cultivation of mushroom was introduced under a few externally aided projects implemented in the state. Mushrooms are popular for their mushroom delicacy,

flavour as well as food value. Mushroom cultivation is an important component of diversification in agriculture. There is a vast untapped potential and need to promote awareness about mushroom production as well as mushroom consumption.

## Nutraceutical Components of Mushroom

Edible mushrooms have nutritional components and bioactive compounds in them. Secondary metabolites (including terpenoids, polyphenols, sesquiterpenes, alkaloids, lactones, sterols, and sesquiterpenes) are a subset of the bioactive compounds found in mushrooms. A variety of bioactive polysaccharides or polysaccharide protein complexes derived from medicinal mushrooms seem to improve innate and cell-mediated immune responses as well as demonstrate anticancer effects in both animals and people. Numerous of these mushroom polymers have been noted to have immunotherapeutic effects in the past by promoting tumor cell growth suppression and death.

The most well-known and effective mushroom-derived compounds with anticancer and immunomodulating activities are polysaccharides. The anticancer polysaccharides extracted from mushrooms are acidic or neutral, have potent antitumor activity, and have chemical structures that vary greatly. Glycans with antitumoral properties range widely, from homopolymers to extremely complex heteropolymers. In other words, mushroom polysaccharides do not directly kill tumor cells; rather, they have an anticancer effect through triggering the immunological response of the host organism. Many edible mushrooms' anticancer, immunomodulating, anticholesterolemic, antioxidant, and neuroprotective properties can be attributed to -glucans. Additionally, they have been shown to be effective immune stimulators in humans and have the potential to treat several disorders. The human immune system is vividly stimulated by fungal -glucans, and they protect against pathogenic microorganisms as well as the negative impacts of environmental pollutants and carcinogens that damage immune systems.

The functional components of mushrooms include bioactive proteins, which are also highly prized for their potential as drugs. Non-immune

proteins or glycoproteins called lectins attach particularly to the carbohydrates on cell surfaces, and numerous mushroom lectins have recently been identified. They are active in a wide range of pharmaceutical processes and have immunomodulatory, antitumoral, antiviral, antibacterial, and antifungal characteristics. Some of them have extremely strong antiproliferative effects on specific tumor cell lines. A new class of bioactive proteins called fungal immunomodulatory proteins, which were discovered in mushrooms, have shown promise as adjuvants for tumor immunotherapy due to their ability to inhibit tumor invasion and metastasis.

Eating mushrooms can provide a source of polyunsaturated fatty acids, which may help lower blood cholesterol. Ergosterol, a primary sterol generated by edible mushrooms, has antioxidant effects. A diet high in sterols has been found to be crucial for the prevention of cardiovascular problems. These antioxidants are biologically active and provide strong defense against cancer, heart disease, and degenerative disorders. Linoleic acid, an important fatty acid for humans, participates in a variety of physiological processes; it lowers blood pressure, triglyceride levels, cardiovascular disease, and arthritis.

## Scope of Mushroom Production in Uttar Pradesh

Primary substrates required for mushroom cultivation are crop residues. Chief crops grown here are rice, wheat, maize, millet, pulses, sugarcane, and oilseeds. Rice and Wheat are the major food grain crops cultivated in Uttar Pradesh. The total production of the state including cereal grains, pulses, oilseeds, and sugarcane is approx. 58.32 million tonnes producing an agro-residue to the tune of 60.0 million tonnes.

Further, the state has a high area of temperate to sub-tropical zones, and tree biodiversity which is helpful for cultivating various types of mushrooms. The inhabitants of the state already have the habit of mushroom consumption by collecting it from the wild. Moreover, the mushroom industry would offer an employment opportunity for the unemployed and educated youth, landless farmers, and women. The

agro climate conditions prevailing in many parts of the state provide ample scope for the cultivation of mushrooms. The mushroom production in the state is very low against the potential of the state for mushroom growing as ample raw material is available, manpower is available, and temperature profile of the state is suitable for mushroom cultivation throughout the year. Moreover, mushroom consumption habits of the local inhabitants/ tribals of the state are helpful in dissemination of mushroom cultivation in the state.

For better promotion of mushrooms there is a need for systematic and integrated efforts in the areas of human capital, awareness generation, research, and development (R&D), hubs for quality seed (spawn) and compost production, and scheme/ policies to popularize mushroom cultivation. By doing so, farmers would be able to earn more from limited areas in a sustainable manner and the result would be production of quality food with health benefits from agro- residues. The compost left after cultivation can be recycled into the soil, thereby improving soil health and promoting lesser use of fertilizers. There is a need for concerted and integrated efforts by farmers, entrepreneurs, marketers, scientists, policy makers and administrators to promote production and consumption, to plug the loopholes and to learn from the success of other countries. Looking to the future, it is clear there are significant benefits and opportunities for continued growth of mushrooms in the state. To ensure proper markets it is important that mushrooms become a part of our kitchen in both rural and urban areas and do not just remain an item in the menu of social functions. Market research worldwide shows

that we can use strong health messages to drive increased consumption.

### Conclusion

The climatic conditions and other resources available in the state for edible mushrooms along with market potential augur well for promoting the mushroom entrepreneurship in the state of Uttar Pradesh. The potency of mushroom cultivation as a tool for waste to wealth' fits well into the sustainable farming and increasing mushroom production seems a viable and attractive option. Growers, stakeholders, and state government collectively and Scope of Mushroom Farming in Uttar Pradesh could focus more on development of infrastructure of trainings and spawn production, development, and supply of ready to fruit bags, increasing markets, expanding consumer awareness, developing new products and technology, and building up networking with other agro-food industries. The production of edible mushrooms and extraction of bioactive molecules is a crucial component for the development of effective biotechnological approaches to access these metabolites. Numerous studies have demonstrated that some components found in mushrooms have exceptional abilities to prevent or treat a variety of ailments. Providing appropriate incentives, especially to new venture and small-scale entrepreneurs, for running business may ease the burden of grower's production costs. Developing mushroom cultivation as an agri-business activity requires a professional approach and systematic development of manpower, infrastructure, awareness, and hand- holding to ensure that there are no problems in the cultivation, processing, and marketing of the product.

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