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Popular Article

Seasonal Cultivation of Mushrooms: Growing Fungi in Tune with Nature Rhythms

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Mushrooms have become well-known globally for their nutritional and therapeutic values. Cultivating them is a beneficial bioconversion method transforming waste materials into potentially valuable resources. Mushrooms grow under a wide range of temperatures (10-35ºC) and pH 6.0 to 8.0, secretes a wide range of enzymes that are capable of degrading lignocellulosic biomass of substrates thus utilizing agro-solid wastes for valuable and nutritive rich food. Mushroom farming, a practice that has been around, for centuries has evolved into a thriving industry due to its versatility, nutritional value and delicious flavour. Over time we have gained knowledge and advanced techniques that enable us to cultivate mushrooms throughout the year. By adapting our cultivation methods based on the seasons we can optimize their growth. Ensure yields and quality. This article explores approaches and important factors for cultivating mushrooms in seasons providing a comprehensive guide, for both mushroom enthusiasts and cultivators. Mushrooms hold significant importance in future generations for several compelling reasons. First and foremost, mushrooms are a sustainable and eco-friendly food source. They can be grown using various waste materials, including agricultural byproducts, making them a potential solution for reducing food waste and promoting a circular economy. With the growing concern about food security and sustainable agriculture, mushrooms present a viable option to address these issues.

Mushrooms are highly nutritious and rich in essential vitamins, minerals and proteins [1]. As global populations continue to increase, finding alternative protein sources that are both nutritious and sustainable becomes crucial. Mushrooms can supplement or even replace traditional protein sources, offering a healthier and more sustainable dietary option. In addition, mushrooms possess medicinal

properties and have been used in traditional medicine for centuries. They contain bioactive compounds with potential health benefits, including anti-inflammatory, antioxidant and immune-boosting properties [2]. Research into the medical potential of mushrooms is ongoing and they could play a significant role in the development of new pharmaceuticals and healthcare solutions [1,2]. Furthermore, mushrooms play a critical role in ecological sustainability. They have a symbiotic relationship with plants, promoting healthy soil and aiding plant growth. Some mushrooms also help remediate contaminated environments by breaking down pollutants and converting them into less harmful substances. Incorporating mushrooms into agriculture and environmental restoration practices can create a more sustainable and healthier planet. However, cultivating gourmet and exotic mushrooms has gained popularity in the culinary world, offering unique flavours and textures to various dishes. As culinary appreciation grows globally, the demand for these specialty mushrooms will likely increase, providing economic opportunities for farmers and entrepreneurs [3]. Therefore, mushrooms have immense potential to address future challenges related to food security, nutrition, health, sustainability and economic development [4-6]. Harnessing this potential through research, innovation and sustainable cultivation practices is essential for a brighter and more sustainable future for coming generations [7-10].

Key advantages of mushroom cultivation

1. A good source of protein, mushrooms are rich in minerals and vitamins. Some varieties have medicinal properties as well.
2. Very cheap source of vitamin D.
3. Potential of utilizing agro-solid wastes without causing pollution and health hazards.
4. Indoor crop growth independent of the fertility status of land and vagaries of weather.
5. Demand increasing at a rapid rate for immune-boosting activities.
6. Cultivation is labour-intensive and provides employment in rural areas [3].
7. Cost-benefit ratio is appreciable, hence a potential profit-earning crop.
8. Zero-waste industry cashes in on crop residues.
9. Good scope of export, so a source of earnings foreign exchange.
10. Mushrooms are a beautiful gift of nature, unique, interesting to look and bring a sense of visual excitement to any home or garden.
11. Eco-friendly and production per unit is high.

Climate-wise availability of mushroom species

Generally, there are about 3,000 prime edible mushroom species and around 100 species have been cultivated so far. In India, five varieties *viz.*, *Agaricus* (Button), *Pleurotus* (Oyster), *Volvariella* (Paddy straw), *Calocybe* (Milky) and *Lentinula* (Shiitake) are commonly commercially cultivated [11,12]. The climate of our country is suitable for cultivating different mushrooms because hot, humid,

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temperate, tropical, sub-tropical etc. is available in different regions of the country. Therefore, it is possible to grow different types of mushrooms in sequence in our country because they require different temperatures to grow. In the plains, white button mushroom is grown in autumn from November to February, summer white button mushroom from September to November and February to April, oyster or dhingri mushroom from September to May, paddy straw or parali mushroom from July to September and milky mushroom can be grown from February to April and from July to September. In hilly areas at medium altitude, the white button mushroom is grown from September to March, the summer white button mushroom from July to August and March to May, the shiitake mushroom from October to February, oyster or dhingri mushroom throughout the year and milky mushroom can be grown from April to June. In high-altitude areas, white button mushrooms can be grown from March to November, oyster or dhingri mushrooms from May to August and shiitake mushrooms from December to April. In this way, farmers can get employment by growing different mushrooms throughout the year in different types of climates [13].

Commonly cultivated mushroom species

Mushroom species	Scientific Name	Common Name	Optimum Temperature (ºC)		Cultivation Months
			Spawn Run	Sporocarps Production	
	*Agaricus bisporus*	White Button mushroom	22-25	14-18	November-February
	*Agaricus bitorquis*	Pavement mushroom	28-30	24-26	February-April September-November
	*Pleurotus spp.*	Oyster or Dhingri mushroom	15-25	14-26	Whole year except June and July
	*Calocybe indica*	Milky mushroom	25-30	30-35	June-August
	*Volvariella volvacea*	Paddy straw mushroom	32-34	28-32	June-August
	*Lentinula edodes*	Shiitake mushroom	22-26	15-20	November-April
	*Auricularia spp.*	Black ear mushroom	20-34	12-30	February-April

(Source: DMR Solan, 2010), [13]

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Seasonal cultivation of mushrooms

1. **Spring cultivation:** Spring is a favorable season for cultivating mushrooms like morel (*Morchella* spp.) and oyster mushrooms (*Pleurotus* spp.). Spring temperatures and humidity levels are conducive to their growth. Morel mushrooms are particularly sought after and can be cultivated by mimicking their natural habitat, typically consisting of forested areas with specific soil compositions [14].
2. **Summer cultivation:** While summer is not traditionally considered ideal for mushroom cultivation due to high temperatures and lower humidity, certain species like the wine cap mushroom (*Stropharia rugosoannulata*) thrive during this season in foreign countries. Wine cap mushrooms are relatively resilient and prefer warmer temperatures, making them suitable for summer cultivation. In India milky mushroom (*Calocybe indica*) is generally cultivated because this species of mushroom requires high temperatures (30-35ºC) for its growth and development [14].
3. **Autumn cultivation:** Autumn is often called the mushroom season. The cooling temperatures and increased humidity provide an excellent environment for various mushroom species, including shiitake (*Lentinula edodes),* maitake (*Grifola frondosa*) and different species of oyster mushrooms (*Pleurotus* spp.). These mushrooms can be cultivated using logs or substrate bags in a controlled environment [14].
4. **Winter cultivation:** Winter presents a unique challenge for mushroom cultivation due to lower temperatures and reduced natural light. However, certain cold-loving species like the lion's mane mushroom (*Hericium erinaceus*) and snow mushroom (*Tremella fuciformis*) can be cultivated during this season. Indoor cultivation with appropriate temperature and lighting control is essential for successful winter mushroom cultivation. Different species of oyster mushrooms are also cultivated during winter months [15].

Key considerations for seasonal cultivation

1. **Indoor cultivation:** Regardless of the outdoor season, indoor cultivation provides the flexibility to grow mushrooms year-round. Utilizing controlled environments such as mushroom grow rooms or greenhouses allows growers to maintain optimal conditions for mushroom growth, regardless of external weather.
2. **Temperature and humidity:** Understanding the temperature and humidity requirements of specific mushroom species is crucial for successful cultivation. Maintaining the right conditions is essential for the different growth stages, including mycelial colonization and fruiting.
3. **Substrate selection:** The appropriate substrate for the specific mushroom species is vital. Common substrates include straw, wood logs, sawdust and grain, depending on the cultivated mushroom.

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4. **Lighting and ventilation:** Providing adequate lighting and ventilation, especially for indoor cultivation, is essential to support the healthy growth and development of mushrooms.
5. **Hygiene and sterilization:** Maintaining a clean and sterile environment is critical to prevent contamination and ensure a successful harvest.

Conclusion

Seasonal cultivation of mushrooms is a pivotal strategy, enabling growers to fine-tune growth conditions for diverse mushroom species, thereby ensuring successful harvests year-round. By comprehending the distinct requirements of each mushroom and employing appropriate cultivation techniques, growers can foster a flourishing mushroom cultivation enterprise. Be it the revitalizing aura of spring, the warmth of summer, the bountiful autumn, or the serene winter, meticulous planning and catering to the unique needs of each season empower cultivators to achieve a consistent and fruitful mushroom harvest, showcasing the adaptability and potential of this fascinating fungal realm. Therefore, seasonal cultivation of mushrooms holds significant importance for various reasons. Different mushroom species have specific growth requirements related to temperature, humidity and light, among other factors. Adapting cultivation practices to suit the natural seasonal variations optimizes these conditions, enhancing overall yield and quality. With a population of more than 140 crore, India is a huge mushroom market. However, due to a lack of awareness, consumption is quite low in India (about 20-25 grams per capita per annum). Hence, there is an urgent and utmost need to generate awareness among the people about the mushroom's multifarious benefits to increase their demand in the country. Mushroom farming is likely to poise for a phenomenal rise in production and consumption in the coming years. The farmers of India therefore have the opportunity to develop mushroom production as a remunerative subsidiary occupation for sustainable livelihoods and development by valorisation of agro-solid wastes.

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