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The Role of Spawn in Commercial Mushroom Farming: A Key to High Yield

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Introduction: -

Mushroom spawn, which serves as the planting material, consists of fungal mycelia that are propagated on suitable substrates such as cereal grains. Since mushroom mycelia cannot be directly propagated, they are multiplied on carriers like grains. Similar to other crop production systems, spawn is a crucial input in mushroom cultivation. A major challenge in mushroom farming is the limited availability of high-quality spawn.

- High yield potential
- Freedom from contaminants
- Better economic returns

The production of quality spawn largely depends on the availability of suitable substrates. Additionally, a reliable source of fruiting bodies and a sterile laboratory environment are essential. This process requires specialized technical skills and controlled lab conditions to ensure efficient and cost-effective spawn production.

To understand spawn, spawning, and spawn growth, it is essential to first understand the mushroom itself. The mushroom, which is the fruiting body of the fungus Agaricus bisporus, consists of two primary parts: the cap and the stem. As it matures, the cap opens, revealing the gills where spores are produced. These microscopic spores function similarly to seeds in higher plants and are generated in vast quantities an 8 cm mushroom can release up to 40 million spores per hour. However, because spore germination and mycelium growth are unpredictable, spores are not directly used to inoculate mushroom compost. Instead, spores develop into thread-like mycelium, which is cultivated in laboratories to produce commercial mushroom spawn.

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In the spawn production process, mycelium from a cultured strain is introduced onto steam-sterilized grain. Over time, the mycelium fully colonizes the grain, creating what is known as spawn. This spawn is then used to inoculate mushroom compost. Typically, spawn is produced using mycelium from a preserved culture rather than one derived from spores. This is because spores can develop into entirely new strains with unpredictable characteristics. Spawn production is an asexual propagation method, similar to cutting a potato into sections with "eyes" for planting. Since spawn production is a complex process, it is not practical for most mushroom growers. Instead, commercial spawn manufacturers supply spawn, which is commonly purchased by mushroom farmers.

Types of mushroom spawn: -

1. **Sawdust Spawn:** Sawdust spawn consists of sterilized sawdust inoculated with mycelium, typically using grain spawn. It is usually made from hardwood, with particle sizes ranging from a few milimetres in diameter not too large or too fine. This type of spawn is commonly used to inoculate logs, outdoor mushroom beds, pasteurized straw, cardboard, and various other substrates. It is also utilized to inoculate wooden dowels, which are then used as plug spawn. One of the key benefits of sawdust spawn is its small particle size, which creates numerous inoculation points. This allows for faster colonization of the substrate, reducing the window of opportunity for contaminants to establish themselves. However, sawdust alone lacks sufficient nutrients for optimal mushroom growth. As a result, growing mushrooms solely on sawdust may lead to lower yields. To enhance productivity, sawdust-based mushroom growing kits are often supplemented with bran or other nitrogen-rich additives.
2. **Grain Spawn:** Grain spawn consists of sterilized grain inoculated with spores or a sterile mycelium culture. Various grains can be used, with rye and millet being among the most common choices. Other viable options include wheat, corn, and other cereal grains—even popcorn has been successfully used. This type of spawn is highly versatile and can be utilized to produce more grain spawn, create sawdust spawn, or inoculate pasteurized substrates like straw. One significant advantage of grain spawn is its high nutritional value, making it an excellent choice for expanding spawn or inoculating indoor substrates. However, it is less suitable for outdoor beds, as the grains can attract birds and rodents, making them vulnerable to consumption.

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3. **Plug Spawn (Dowel Spawn):** Plug spawn consists of small wooden dowels infused with mycelium. This inoculation process can be carried out using sawdust spawn or even by utilizing the stems of fresh mushrooms. One key advantage of plug spawn is its effectiveness in colonizing wood-based or fibrous substrates. It readily spreads through materials such as logs, stumps, wood chips, cardboard, and paper, making it an ideal choice for mushroom cultivation on wooden surfaces.
4. **Liquid spawn:** Liquid spawn refers to mycelium that has been cultured in a liquid medium and then homogenized or macerated for use in inoculation. This method allows for mechanized inoculation during spawn multiplication or direct inoculation of substrates. In an experiment with shiitake mushrooms (Lentinula edodes), continuous culturing in liquid medium was used to produce liquid spawn. The mushrooms were grown on a synthetic sawdust substrate, and fruiting bodies developed normally. When solid spawn was used, the incubation period lasted 120 days, whereas liquid spawn reduced it to 90 days, demonstrating its efficiency in accelerating colonization and fruiting.

Production and quality of spawn:-

For effective spawn preparation, selecting the right base material is crucial. Jowar (sorghum) and bajra (pearl millet) are considered the most suitable substrates, with wheat being the next best option. However, in some regions, wheat is both less accessible and more expensive than paddy grains. Additionally, paddy grains are less prone to bacterial contamination due to their harder husk, making them a preferable choice. Maize grains, which are widely available in hilly areas, serve as an excellent base material, particularly for mother spawn production. Despite this, maize is not commonly used for planting spawn due to its larger size and reduced surface area. The protein content of the grain used for spawn has an inverse relationship with mushroom yield. While paddy contains 7% protein and wheat 12%, wheat remains the most effective substrate for button mushroom spawn.

Preparation and Multiplication of Mushroom Spawn:-

a. **Substrate Preparation:** The suitable substrate is first cleaned, washed, and cooked for approximately 30 minutes. After cooking, excess water is drained, and pharmaceutical-grade calcium carbonate ($CaCO_3$) is added at a ratio of 20g per kilogram of cereal grain. This coating raises the pH above 7, promoting rapid spawn growth. Using lower-quality $CaCO_3$ or French chalk may slow down the growth process.

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b. **Filling and Packing:** The processed substrate is packed into polypropylene bags (15x21 cm), each containing 200g for mother spawn or commercial spawn. The bag openings are then plugged with cotton and covered with butter paper to maintain sterility.

c. **Sterilization Process:** The filled bags are sterilized using an autoclave at 121°C under 15 lb pressure per square inch for 1 to 1.5 hours, ensuring the elimination of contaminants.

d. **Mother Spawn Preparation:** The mother spawn, referred to as the T_2 generation, is produced by aseptically inoculating the sterile substrate in saline bottles with the T_1 mother culture.

b. **Spawn Multiplication:** Mushroom growers use spawn for planting mushroom beds. The planting spawn is obtained by further multiplying the mother spawn up to the third (T_3) or fourth (T_4) generation under sterile conditions. However, beyond the T_4 generation, the spawn may lose efficiency and vigor, leading to reduced mushroom yield.

c. **Labelling and Usage:** Proper labelling of the mother and planting spawn is essential, including details such as species name, generation, and preparation date. The ideal spawn for planting is typically 15 to 20 days old.

Storage and Shelf Life of Mushroom Spawn: -

Mushroom spawn can be stored at 25±2ºC (room temperature) for up to 30 days from the date of inoculation. For extended storage, refrigeration is recommended, allowing the spawn remain viable for an additional three months. However, storage beyond two months may result in a gradual decline in mushroom yield.

Contamination and Spoilage

Spawn contamination occurs when bacteria or molds outcompete the mycelia, restricting its growth within the substrate. Bacterial contamination is often identified by the presence of slimy fluid patches, which hinder mycelial expansion. On the other hand, spoilage due to molds such as Aspergillus sp., Penicillium sp., Rhizopus stolonifer, and Trichoderma sp.manifests as discolored patches of mycelia or spores, different from the usual white mycelial growth. Factors contributing to spoilage include: Excess moisture in the grains, Poor-quality grains, Improper sterilization, High storage temperatures.

Conclusion: -

Spawn is a fundamental component of commercial mushroom farming, serving as the essential inoculums for robust mycelial development. Its quality directly influences yield,

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consistency, and overall efficiency. Whether grain-based, sawdust-based, or liquid, high-quality spawn minimizes contamination risks and ensures reliable production. Innovations in spawn technology, including enhanced sterilization methods and genetic improvements, continue to refine the cultivation process. By prioritizing superior spawn and proper handling practices, commercial growers can boost productivity and maintain a sustainable, competitive edge in the industry.

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