e-GRO Edible Alert

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Make Room for Mushrooms

Oyster mushrooms (Pleurotus spp.) are the second most widely produced mushroom behind button mushrooms (Agaricus bisporus) worldwide and are often grown commercially in controlled-environments.

For local and regional producers, oyster mushrooms can serve as another high-value crop to help diversify the business and generate additional cash flow. Fortunately, mushroom production requires relatively little space compared to growing plants, and many growers will find there are several parallels between growing plants and mushrooms.

Figure 1. Oyster mushrooms growing in in polypropylene bags. https://tinyurl.com/28y6czsy

This e-GRO Edibles Alert provides a quick overview of oyster mushroom production and discusses one of the key decisions in mushroom production, which is selection of a soilless substrate.

Basics of oyster mushroom production

There are multiple ways to start the mushroom growing process. A reliable method is to first obtain high-quality liquid-cultured spores and mycelium from a reputable supplier

Then, inject the liquid spore solution into sealable (usually 1 quart) containers with a sterilized grain such as rye following supplier recommendations. Organic growing substrate needs to be pasteurized or sterilized before mushroom production, otherwise other fungi, bacteria, and microbes will compete with your mushrooms and potentially create food safety issues. Pasteurization can be achieved by moistening the substrate (~65% moisture content) and steam-heating to >180°F for at least 45 minutes. Once the substrate cools to <100°F, it can be inoculated with the prepared rye grain spawn. Sometimes additional fertilizer nutrients are added at this time. Inoculated substrate is then placed in a container that allows for the retention of moisture without prohibiting gas exchange. A polypropylene bag with an integrated filter patch is common (Figure 2).

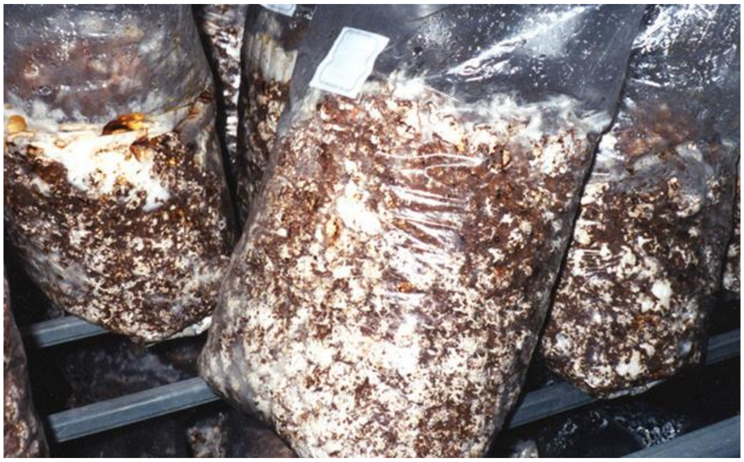

Figure 2. Polypropylene bags with integrated filter patch with substrate being colonized by mycelium. https://tinyurl.com/ycksjsc3

The inoculated substrate is kept moist and in low light in a controlled-environment space, such as a growth chamber or shaded greenhouse area. Growing beds stacked vertically or shelves are popular designs to maximize the efficiency of production space. Ideally, temperatures are maintained between 60 and 80°F. Once the mycelia have visibly colonized the substrate, there are a variety of methods used to initiate production of the mushroom caps or fruit depending on the exact oyster mushroom species and spore strain (consult the supplier). For example, many strains develop fruit in response to a sharp cold temperature treatment (Shen, et al., 2014), whereas others may require the substrate to be saturated for a period. Growers can often get multiple harvests or “turns” before having to replace the substrate.

Figure 3. Oyster mushrooms grown in polypropylene bags using an organic wheat straw substrate

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Figure 4. Oyster mushrooms growing inside buckets on an amended wheat straw substrate

Figure 5. Chopped wheat straw being inoculated with colonized grain spawn, prior to filling bags

Figure 6. Sterilized sawdust being used as substrate for oyster mushrooms. https://tinyurl.com/4sa2sk59

Selecting the appropriate substrate

A wide range of substrate materials are used to grow oyster mushrooms, since most producers rely on locally or regionally available agricultural waste materials. Common and suitable materials include rice straw, wheat straw , various wood products cotton fibers and husks, hemp fibers, and almost any other type of plant waste. Mushroom yields will vary some between agricultural waste products used as substrate, because differences in lignin content between the products influences the ability of the mycelium to degrade the substrate and harvest carbon and nutrients (essentially, decomposition).

Although many materials will work as a substrate, there are a few exceptions. For example, alfalfa waste and other plant materials with very high nitrogen (N) content can negatively affect the degradation of lignin. For products low in N and with very high carbon:nitrogen (C:N) ratio of >100:1, such as sawdust and other wood materials, extra inorganic fertilizer or organic manure may be needed to supply additional N. Ideally, a C:N ratio between 25:1 and 35:1 is ideal for oyster mushrooms.

Agricultural waste materials should be chopped or milled to have an appropriate particle size distribution before use as a mushroom substrate. Substrates with too small of particles easily become water-logged with low oxygen, reducing mushroom yield. Substrates with very large particle sizes have reduced surface area for mycelial colonization and lower water-holding capacities, which also reduces yield. A particle size distribution with a majority of coarse-sized particles, roughly 8 and 12mm in diameter, is recommended for high yields (Tembe, 2018).

Other basic requirements of mushroom substrates are like those for greenhouse container substrates—the substrate materials must be relatively inexpensive, readily available in the amounts needed, and of a consistent and uniform quality. Like container substrates, a low bulk density and high porosity are desired, meaning the substrate is easily handled and growers have better control over water, air, and nutrients.

The "biological efficiency" of a substrate refers to the ratio of mushroom yield to prepared substrate on a weight basis. For example, rice straw substrate has been shown to have a 95% biological efficiency with oyster mushrooms, meaning 95 lbs. of mushroom yield were harvested per 100 lbs. of substrate. Sawdust has been shown to have a 62% biological efficiency, whereas wheat straw has been shown to have <60%. Although a useful metric and benchmark for comparing substrate materials, it is important to note biological efficiency is influenced by many interacting factors including substrate properties, amendments with fertilizer and limestone, moisture content, and various environmental and cultural conditions.

The amount of prepared substrate used has a direct impact on harvested mushroom yield and represents a major variable cost influencing the profitability for mushroom producers (Shah et al., 2004). When getting started, it is critical mushroom producers compare the effects of substrate materials and cultural practices on yield in addition to the substrate material cost.

Conclusion

Consider the potential of growing mushrooms for profit. Oyster mushrooms are relatively easy to grow and can command high prices at local and regional markets. Mushroom production is space efficient and require some of the same inputs as growing plants.

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