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Growing and Marketing Mushrooms in Tennessee: Basic Considerations

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Introduction

There are multiple species and varieties of edible mushrooms that can be grown in Tennessee. There are also different approaches to producing these mushrooms. Given the growth of interest in vegetarian and reduced-meat diets, as well as growing interest in local products, mushrooms could be a good fit for some Tennessee producers. Some key considerations for prospective mushroom growers are; what kind of mushrooms you want to grow, whether there is a market for those mushrooms, and what kind of production system you want to use.

Market Description

Mushrooms attract attention as a potentially profitable crop from a broad spectrum of food producers. The U.S. mushroom industry increased from 15 million pounds produced in 1927 to 816 million pounds in 2020, valued at \$1.15 billion. Pennsylvania, where mushrooms have been cultivated since the 1880s, produces over 60 percent of all U.S. white cremini mushrooms (*Agaricus bisporus*). Other states, including Tennessee, are now also high-volume mushroom producers, as food retailers and foodservice demand year-round and regional supply. High-volume indoor mushroom production is a mature industry with

many long-established producers and high levels of capital investment. Most high volume producers focus on *Agaricus* mushroom varieties (common button mushrooms, portabellas, etc.).



Several varieties of specialty mushrooms at market.
Source: [pixabay.com](https://www.pixabay.com)

Producers across the country, especially those selling directly to consumers and foodservice, have found some success in lower-volume production of specialty mushrooms (non-*Agaricus* types). Shiitake and oyster mushrooms are the most commonly grown specialty mushrooms. Smaller-volume, log-grown mushroom enterprises have long been possibilities for utilizing space in woodlots as part of an agroforestry system. This fact



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sheet is written primarily to provide information for producers interested in adding a specialty mushroom enterprise to either complement existing production or as a new, standalone enterprise for rural or urban agricultural entrepreneurs.

Marketing

Mushrooms are growing in popularity, with USDA and industry reports of exceptionally strong demand from 2017 to 2020. Mushrooms were named the hottest produce item in the National Restaurant Association's list of top restaurant trends for 2020. Consumer demand for mushrooms is also maintaining strength at food retail, where consumers show interest in blending mushrooms into protein entrees and featuring mushrooms more prominently in meals. Mushrooms are frequently promoted as part of a healthful diet. However, producers should exercise caution when making any unsubstantiated health claims regarding healthful or medicinal benefits of mushrooms that may not be supported



Mushrooms have grown in popularity and are common meat replacements or supplements in vegetarian dishes
Source: pexels.com

by medical research. Proper postharvest handling, including safe handling practices, is essential for maintaining mushroom quality and food safety.

Mushrooms may be marketed outside traditional fresh produce marketing seasons. Log-grown shiitake mushrooms, for example, can be managed for a nearly year-round harvest in Tennessee and nearby states through careful planning of rotating varieties of shiitake in with the seasons. Producers may choose to add a mushroom enterprise to sell at winter farmers markets or wish to include mushrooms in

a winter CSA share or similar subscription service. Mushrooms may also be produced under enclosed spaces, in climate controlled conditions. Managing production for a steady supply is a benefit when marketing to consumers and foodservice (restaurants, institutions, niche wholesale).

Labor and Economics

It is important to develop a plan for marketing a new product. Even though consumer interest in mushrooms is strong, just one producer could potentially saturate demand for a specialty, locally-grown product like mushrooms. New producers should seek to identify the amount local consumers would be willing to pay for specialty mushrooms and whether that market price would generate profits based upon an estimated cost of production and marketing. This section will identify major cost categories and refer to published university estimates and budget tools that can help producers estimate costs of production for log-grown mushrooms.

Establishing a log-grown mushroom enterprise requires substantial time. Accounting for and valuing that labor will help producers determine whether likely prices for mushrooms are truly profitable. Cutting logs will take 24 hours per 500 logs, according to Virginia estimates. According to Kentucky and Virginia estimates, annual pre-harvest labor time for log-grown shiitake mushrooms is 40 to 48 hours per 500 logs for site preparation, drilling and inoculating logs, and moving logs in and out of soak tanks.

Labor for harvesting and packing the mushrooms depends on harvest and production methods, packing specifications and the intended market for the mushrooms. Harvest time estimates for a 500-log operation may range from 20 to 50 hours annually, depending on the production methods used and total volume produced. The highest harvest labor requirements are typically in the second harvest year.

Time needed to market specialty mushrooms varies greatly, according to the market outlet. Regular deliveries of mushrooms to nearby restaurants or specialty grocers will typically take less time than selling mushrooms directly to consumers at a farmers market, where someone must set up, staff, and take down the market stand during the entire market

time. Estimates for a 500-log shiitake operation, for example, count annual marketing time after packaging from as little as 20 hours (large-volume wholesale) to as much as 160 hours (direct marketing with mushrooms as the sole product).

It is widely recommended to develop a production budget before beginning production of a new crop. The tables below are intended to help a new producer think through the cost categories and probable costs for specialty mushroom production. More detailed budget worksheets and spreadsheets are also available from these other university extension resources:

The Basics of Hardwood-Log Shiitake Mushroom Production and Marketing (500-log production estimates; Virginia Cooperative Extension, 2020)
https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/ANR/anr-102/ANR-329.pdf

Shiitake Log Enterprise Budget Template (1000 log production budget spreadsheet; Cornell University, 2016)
<https://blogs.cornell.edu/mushrooms/factsheets/>

Shiitake Mushroom Enterprise Budget (University of Maryland Excel spreadsheet, 2003)
Users can update this interactive spreadsheet with current input costs to estimate current costs of production.
<https://extension.umd.edu/resource/rural-enterprise-series-shiitake-mushrooms-budget-worksheet-0>

The worksheet divides possible mushroom production costs into variable and fixed costs. Variable cost categories change with the quantity produced, such as the number of logs or number of hired labor hours needed. Fixed costs are costs that do not change based on the units produced; there will be depreciation and maintenance costs on equipment, like a chainsaw or a high-speed drill, each year. There may also be one-time startup costs if equipment is needed that is not already owned. For log production of specialty mushrooms, this might include a chainsaw, high-speed drill and soak tanks.

Varieties

Oyster and shiitake mushrooms are typical choices

for those getting started with mushroom production. They are suitable for outdoor production, are relatively simple to grow, and are at least somewhat familiar to consumers. They are hardly the only options suited to growing in Tennessee. Growers might also explore Lion's Mane, Wine Cap and Hen of the Woods, among other mushroom species. Note that many of the species will be unfamiliar to most consumers and are part of a very niche market in many places. Growers may have success marketing these mushrooms through markets specializing in Asian products or alternative medicinal products. As with all farm products, don't assume there is a market for all these products just because you can grow them.

Production Systems

Mushroom production is fundamentally about



Chanterelle mushrooms sold here in quart containers
Source: [pixabay.com](https://www.pexels.com/photo/chanterelle-mushrooms-in-quart-containers/)

inoculating an appropriate substrate (typically wood material) with spores from a desirable species of fungus. When the spores have taken over the substrate, they will send up fruiting bodies which are harvested and eaten.

Depending on the scale of production that interests you, there are several different approaches to producing mushrooms. The most intensive, highly managed, and potentially productive system involves constructing grow houses and a laboratory in which a grower produces pure inoculant, which is then added to engineered substrate (typically wood fiber pressed into blocks, or something similar). This process is very technical and requires a degree of up-front investment that many growers will find difficult to justify. Some of these labs actually market "grow

your own” mushroom box kits that are sold directly to customers. Some mushrooms can only be grown in these kinds of systems. It is more likely that many small-scale producers in Tennessee will initially pursue opportunities related to outdoor log-grown mushroom production.

Forest-based production systems provide a low-impact opportunity to utilize forest land that otherwise may not be part of the current farming operation. Given the relatively high density of the production systems, it also is a good option for producers who have limited and highly forested land. Log- and Forest-Grown Mushroom Production As with vegetables and fruits, different mushrooms have various requirements to thrive. This includes different species of wood on which they will grow, different environments, and even different approaches to “planting.” For example, shiitake mushrooms and some other species are cultivated by harvesting hardwood logs (or bolts) with their bark intact and inoculating them with purchased plugs. Inoculation includes drilling holes into the logs and then hammering the dowel-shaped plugs into the wood, then sealing the holes with wax. The logs can then be stacked up and kept moist in a shaded location until they produce fruiting bodies; a process which will take a minimum of a year in most cases. In contrast, species like oyster mushrooms tend to thrive better in a “stump” or “totem” system where a larger stump or log is placed on end and a series of cuts are made on the sides of the log. Inoculum is then pressed to the cuts, allowing it to permeate the log. The totems are then kept moist, and the fungus can produce fruiting bodies. There are excellent videos demonstrating this process available from Cornell University linked in the “Additional Resources” section below. Logs can be inoculated at any time of year, but inoculation generally takes place in spring or in fall when environmental and fresh cut log conditions are ideal.

Once inoculated, it is critical to keep the logs moist. Shaded areas in woodlots help to reduce evaporation from the logs, but during periods of dry weather, irrigation will be necessary. This might include a simple hosing down of the logs or could involve a more complex automated irrigation system. In this region, mushrooms can be reliably produced outdoors from March through October. If you want your logs to ac-

tively produce mushrooms year-round, they will need to be kept in an indoor environment. It will generally take between 6 and 18 months for inoculated logs to produce fruiting bodies (the mushroom portion we eat).



Agaricus bisporus is marketed under different names depending on its state of maturity. These immature brown caps are sometimes marketed as “baby bella” mushrooms

Source: [pexels.com](https://www.pexels.com)

Harvest and pest considerations

Harvest for most mushroom species is somewhat simple. Mature fruiting bodies are either cut or twisted off the substrate. The fruits should be stored in refrigerated cardboard or plastic containers that provide some protection to the delicate caps. Shelf life of fresh mushrooms is partially dependent on variety but is also dependent in part on proper packaging and storage; most common varieties can also be dried for longer storage.

Mushroom production can be impacted by competing fungal infections such as *Trichoderma* mold, and the logs can also be affected by typical wood pests like termites, carpenter ants, bark beetles. Wildlife like squirrels, deer, or snails and slugs might also cause issues in the fruiting bodies.

Wood Species (text box)

Oaks (*Quercus*), black willows (*Salix*. spp.) and sugar maples (*Acer saccharum*) have been found to be excellent wood species for the cultivation of shiitake mushrooms, but many different hardwood species will work well for producing shiitakes. Oyster mushrooms grow best on species like Poplar (*Populus* spp.), willow (*Salix* spp.), and box elder (*Acer negundo*). Logs cut in late winter or spring will have a higher relative amount of sap, providing better nutrition for the inoculated fungus.

Mushroom Cost Worksheet

Variable costs	Quantity	Unit	Price per Unit	Total
Pre-harvest year				
Logs (Purchase or costs of harvest)				
Mushroom spawn				
Wax				
Drill bits				
Inoculation supplies				
Hired labor (Log harvest, inoculation)				
Fuel				
Fencing or other wildlife barriers				
Miscellaneous costs				
Total Pre-harvest Variable Costs				
Harvest Year				
Site maintenance				
Replacement logs, mushroom spawn, wax				
Hired labor – harvest				
Hired labor – packaging				
Hired labor – marketing				
Transportation costs (fuel, etc.)				
Packages				
Miscellaneous costs				
Total Harvest Variable Costs				

Fixed Costs	Quantity	Unit	Price per Unit	Total
Depreciation of Machinery, Equipment				
Insurance				
Land Rent or Taxes				
Utilities				
Total Fixed Costs				

Additional Resources

A General Guide to Pricing for Direct Farm Market-ers and Value-Added Agricultural Entrepreneurs
<https://utextension.tennessee.edu/publications/Documents/PB1803.pdf>

Choosing Direct Marketing Channels for Agricultural Products
<https://utextension.tennessee.edu/publications/Documents/PB1796.pdf>

From Harvest to Market: Developing a Viable Specialty Mushroom Enterprise (Cornell University Extension, 2019)
<https://smallfarms.cornell.edu/projects/mushrooms/harvest-to-market-guide/>

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