



Mushroom Farming

The mushroom farming industry could use a few more good growers. Learn how to begin this crop on your farm.

by Rick Gush

About the Author

Rick Gush is a freelance writer and small farmer living in Italy.

The mushroom farming industry could use a few more good growers. Less than 300 growers produced last year's U.S. crop. Amazingly, half of those mushroom farmers are located in Chester County, Pa.

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So few growers might indicate an opportunity for new farmers who are looking for a major year-round crop. After all, mushroom prices stay fairly steady, and customers are loyal. But any would-be mushroom farmer better know what he's doing.

Today's big fungi farmers operate expensive, labor-intensive businesses. Those less-than-300 growers produced over 800 million pounds of mushrooms last year. They're well capitalized, and have large established sales and distribution systems that certainly intimidate new entrants to the market.

On the other hand, while a farmer who grows only a hundred logs of mushrooms may not be counted as a full-time mushroom grower, he can still enjoy profit from his crop. A rustic farmer who sterilizes his compost in a barbecue pit and raises only 12 beds in his basement won't qualify as an official mushroom grower either, but he'll likely enjoy a ready local market for his crop.

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Mushroom farming is not for everybody. It takes a knack and careful attention to important cultural details. Whether you're considering building a large commercial *Agaricus* facility or growing a few Shiitake logs in the barn, profitable mushroom farming, like raising any farm crop, is a just a matter of hard work and careful procedures.

Mushroom farming is a lot like making cheese. It's a delicate balance in which farmers must variously encourage and suppress the growth of desirable and undesirable microorganisms.

Organisms that support the mushroom bloom must be made to grow, and those that can spoil crops must be halted. Successful mushroom farming on any level is about establishing the procedures that ensure the right balance of control.

Even the seasonal mushroom growers who do not use climate-controlled environments have to maintain a strict adherence to bed preparation and mycelial growth procedures.

One key to any new mushroom-growing operation is good record keeping. As new growers experiment with different techniques in an effort to find the most productive methods for their farm, good records will allow them to more easily duplicate their most successful attempts.

[Create a Mushroom Growing Medium](#)



The mushrooms we see on top of the surface are the fruits of plants made up of thin, threadlike cells called mycelium. Just as tomatoes are the fruit of tomato plants, mushrooms are the fruit of organisms that spend most of their lives in the form of a mycelium.

The basis of any mushroom-growing operation is the growing medium that supports this mycelium.

Mushroom fungi are saprophytic, which means that they eat dead plants rather than produce chlorophyll to trap energy from the sun like common green plants. They do not grow well in regular soil, but prefer more fiber-filled environments.

There are two basic categories of cultivated mushrooms: those that prefer composted materials, like Agaricus (button mushrooms), and those that prefer woody or straw-type mediums, like Pleurotis (oyster mushrooms) and Shiitake mushrooms.

Is darkness essential when growing mushrooms?

Mushrooms do not require darkness to grow. Rather, because they can grow in dark environments, the mushrooms compete well when growing with other organisms like weeds.

In the United States, the first mushrooms were grown in greenhouses in Pennsylvania, making use of the spaces under the benches.

Dark places are not heated by sun exposure, and therefore stay moister, a condition favorable to mushroom growth. Button mushrooms like a temperature of 65 degrees, and the darkened facilities make maintaining this cool temperature easier during the warm months. For the new farmer, the wood and straw types are the easiest to grow. To decide what species of mushrooms you will grow, you must first know what sort of medium you might use. For example, to try to grow Portobello mushrooms on cotton waste would be difficult, but Pleurotis mushrooms would thrive.

Types of Growing Mediums

Most U.S. commercial growers produce button mushrooms in tiered beds of compost that are housed in climate-controlled rooms. A fair amount of European farmers grow crops on hay bales in darkened greenhouses. Many Asian farmers grow their crops in rooms full of thousands of glass jars filled with spent barley husks. Tall plastic bags of straw are hung from the ceiling in some other facilities.

Many growers are now growing their crops on cut tree logs, either inside or in outdoor, open sheds. Probably the most popular new method is to grow mushrooms in plastic bags filled with sawdust. New growers can take their choice of designing a system that fits their situation, or following the methods of an established grower.

The basic requirements are the same: Growers must provide a controlled medium on which the mycelial growth can spread.

It's no surprise then that a grower's ability to locate a steady supply of the base materials they use to prepare their growing medium is a key point.

A nearby dairy farm, a field-crop refuse supply, or a relatively inexpensive source such as animal fodder or processing waste, are all possible material sources. Smaller growers may weigh the cost of slightly more expensive materials such as stove pellets or feed cubes. Compost

The historical method of medium preparation is to make compost from hay mixed with animal manures. The composting process encourages the growth of microorganisms that pre-digest some of the organic materials and make the food within them more easily obtainable for the young mycelium.

Mushroom Kits

Very reliable kits are available for many mushroom varieties. Kits are a great way for prospective farmers to try out new species.

Retail nurseries stocked mushroom kits in the past, but these days the Internet is a more reliable source.

Some great sites for finding mushroom kits are: www.gmushrooms.com www.mushroomadventures.com www.fungi.com www.oakshire.com www.naturalmushrooms.com During the first stage of composting, material is turned and watered every few days. At the end of the composting process, the heat produced by decomposition is allowed to accumulate in order to



dissipate excess ammonia and kill undesirable pest organisms.

The goal of mushroom composting is to create a uniform material. Large-scale compost production requires a constant flow of raw materials and a fair amount of handling equipment and processing experience. In today's more ecological-conscious society, many outdoor composting facilities are under pressure to maintain strict odor-free and non-polluting programs.

Logs

Shiitake mushrooms have traditionally been commercially produced in beds or bags of sawdust. But today's market believes that Shiitake mushrooms grown on logs taste better, so many commercial growers are now converting parts of their operations to log culture. This is feasible for farmers who have a steady supply of logs from their own brush clearing or woodland management efforts, but the cost of buying logs decreases the chance of profitability.

Logs to be used must come from hardwood trees. Oaks are generally the most commonly used, but beech, liquidambar and sycamore also grow good crops. Walnuts and conifers contain oils and resins that make them mostly unsuitable, and eucalyptus and cedar logs actually repel mycelium growth.

Collecting Mushrooms Commercially

To collect wild mushrooms, you must be careful and know what you're doing. It would be best to find a teacher who can give you the benefit of their experience, but mushroom collecting is not nearly as common in the United States as it is in Europe and Asia.

The truffles from France and the Porcini from Italy are two well-known collected mushrooms. One species that is particularly abundant in the woodlands of the United States are the Morels. As a commercial collector you must be a registered business, and you must let consumers know that the mushrooms are collected. The logs need to have a diameter of at least four inches to be a reliable growth medium. Small logs will mature the mycelium more quickly, but growth will not last as long as larger logs. The logs must have a relatively high moisture content, and cannot be allowed to dry out. Fresh-cut logs are preferred for this reason. In addition, fresh-cut logs are less likely to have other fungus organisms already growing on them.

Logs are "inoculated" by inserting bits of young mycelium or "spawn" material. An inoculated log generally needs a year to allow mycelium growth before fruiting can begin. Logs that are in a fruiting stage can be shocked into production by soaking in ice-cold water for a day. Logs are usually fruited for a month or so, and then allowed to rest for several months before they are shocked into production again. A log will produce mushrooms for many years unless allowed to dry out.

Straw and Sawdust

Growers of Pleurotis mushrooms have been using straw in various formats for many years. Abundant supply and inexpensive cost make straw a desirable growing medium. Growers that use straw in a baled form also save on handling costs by not having to repackage the material prior to inoculation.

Sawdust is a newer growing medium. It wasn't until after the button mushroom industry was well established that western growers discovered a whole group of mushroom species that preferred sawdust to traditional compost beds.

Once Shiitake and Pleurotis farming became more popular, growers started inventing many different methods for handling the sawdust. Today's straw and sawdust users enjoy the flexibility that plastic packaging allows, and most farmers stuff plastic bags or tubes full of the growing medium.

Pasteurization and Sterilization

Pasteurization is the process of heating a substance in order to destroy harmful bacteria within.

The process of composting includes a final stage where the temperature is high enough to accomplish pasteurization. But most other growing mediums must consider a process of purification that is even more intense: sterilization.

Conventional steam sterilization uses high temperatures and generally kills everything in the mixture, even some possibly helpful organisms. Large ovens are a common means of sterilizing growing mediums. In previous years, methyl bromide and other fumigants were employed. Today, other organic methods of sterilization, such as using hydrogen peroxide, are becoming popular with many growers.

Mushroom farmers have always been self-reliant and inventive. Today's growers are no different, having devised a wide



range of custom sterilization methods including using barbecue pits to heat oil drums filled with growing medium, and using tractor motor emissions to fumigate materials.

While tractor emissions certainly aren't officially sanctioned, farmers and nurserymen have used this cheap fumigant occasionally for years by putting a vent pipe from the tractor into a tarp-covered pile of soil, then airing out the treated mixture well before using it.

Farmers must use their brains to figure out clever solutions that make use of what they have at hand, rather than simply picking procedures out of a manual. Mushroom farming, particularly small mushroom farming, seems to be a specialty of particularly resourceful and innovative growers. The successful growers are making up their own systems rather than following others' systems. If you're considering becoming a mushroom farmer, you too will want to put your brain to work devising a sterilization system that's right for you.

Inoculate

Mushroom growers don't use spores to directly start growth in the beds. Instead they use small pieces of a juvenile mushroom mycelium known as spawn. The mycelium spawn is stirred up, broken apart and mixed into the growing medium to inoculate it. Each small piece of the mycelium then grows and if properly controlled, will bear mushrooms. For growers using logs, the inoculation process includes drilling shallow holes in the logs, filling them with spawn and then plugging the holes with wax.

Once your mushroom facility is up and running, to save the expense of purchasing commercial spawn, you may want to make spawn yourself by culturing pieces of mushroom cap. In general, the more spawn used in the inoculation process, the faster the mycelium will grow and the sooner the medium will be ready to produce mushrooms.

Cultivation

Once the medium is inoculated, the grower will control the environment to encourage maximum mycelial growth. This control may include slightly cooler temperatures and increased carbon dioxide levels in bed cultivation. Log growers usually leave the inoculated logs outside under a tarp for a year. Once the mycelium is mature, farmers can use a variety of methods to induce fruiting; most involve some change in temperature and humidity.

Casing

In button mushroom bed culture, there is a process known as casing in which a layer of organic material, usually treated peat moss, is spread onto the tops of the mature beds. This is odd, but it works. The casing material perhaps represents a layer of leaf mold on top of the soil. The mycelium doesn't actually colonize the casing in the same way as the growing medium underneath, but the moist and nutrient-free casing makes a good launching area for fruiting bodies to form.

Harvest

If you're growing in conventional beds, you'll see mushrooms start to pop up about three weeks after casing. Similar time frames accompany other culturing methods. Shocked logs and irrigated straw bales also produce new mushrooms within a month. Once the mushrooms start appearing, they should be harvested frequently while they are producing. Growth flushes produce new fruit every week or so for a while.

Mushrooms are extremely perishable and require great care after harvesting. The fruit self-destructs quickly and starts decomposing the moment it's picked. Growers try to keep the harvested mushrooms as cold as possible to minimize deterioration, and most large outfits have storage rooms that keep the packaged crops just above freezing. Mushrooms also bruise easily, so careful harvest and handling methods must be employed. Have You Developed a Marketing Plan? Market research, potential customer interviews and the design of product packaging systems should all occur before the first crop is inoculated.

New growers will have a difficult time competing against established outfits. Instead, new growers must find a niche market, which is likely to be the small local grocer or farmer's market. New growers may also be able to find a spot in the value-added marketplace by incorporating their mushrooms into a cooked food product.

The demand for specialty mushrooms is booming these days. Portobellos are particularly hot right now, but that's a difficult type to grow if you don't already have a large compost-type facility. There's no doubt that mushrooms are popular with consumers.

Historically, mushrooms were considered a food for the aristocrats, and both the Romans and Egyptians considered them the "food of the gods." Since the first large-scale European mushroom cultivation in the limestone caves near Paris in the 18th century, mushrooms have been growing in popularity, and today U.S. mushroom consumption is around 750 million pounds per year.

Mushroom-growing industries are springing up in many countries around the world including Mexico and Bolivia. Huge



quantities of mushrooms are grown for the Asian market, which is the largest in the world. Asian consumers also are devout believers in the medicinal value of mushrooms—over 50 different species are regularly prescribed by Chinese doctors.

Understanding Commercial Mushroom Varieties

There are two main types of mushrooms: mycelial and mycorrhizal. Essentially all the cultivated types are mycelial and can grow wherever there is an appropriate growing medium.

Mycorrhizal types need to grow in association with the roots of a living plant or tree. Morels, chanterelles and truffles are examples of mycorrhizal types. There are some efforts to develop systems for growing truffles and morels, but essentially all of the commercially cultivated mushrooms are of the mycelial type.

Far and away the most commonly cultivated types are varieties of *Agaricus* button mushrooms; 835 of the 853 million pounds of mushrooms produced by the major U.S. growers last year were white button-cap *Agaricus* species. There are also many other types of cultivated *Agaricus*, most notably the Italian brown-capped Crimini mushrooms.

Next in line are the big brown Shiitake varieties, which are also popular dried. Wild Shiitake were originally found growing in Japan, where their name means “oak-tree mushroom.” The gray-fruited *Pleurotis* varieties, known as oyster mushrooms for their distinctive taste, are also widely grown. Beyond those three types there are many other popular cultivated varieties, including the *Hericium* mushroom (Lion’s Mane, Pom Pom Blanc) which has a crab-meat flavor, and the long-stemmed Enoki mushrooms.

If the idea of mushroom farming appeals to you, there’s no better time to get started. A bit of research, a little Yankee ingenuity, and you’ll be ready to start producing delicious mushrooms.

This article first appeared in the December/January 2003 issue of Hobby Farms magazine. Pick up a copy at your local newsstand or tack and feed store. [Click Here](#) to subscribe to HF.