



Indoor Mushroom Production

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Who are we?

Mycophile's Garden developed out of my love for biology and nature. A friend familiar with my interest in growing edible mushrooms suggested we make a business of it back in 2014.

We now produce 500-700 pounds of mushrooms weekly and support 4 full-time, or near full-time, incomes as well as a number of part time farmers market staff. We also distribute mushrooms for a couple of other Michigan mushroom farms we work with that produce varieties we don't.

We sell about 70% of our product at farmers markets across West Michigan and the Lansing area. The rest is sold through area grocers, restaurants, and produce distributors.

Our most popular mushroom varieties are Lion's Mane, Chestnut, Nameko, Enoki, around a dozen types of Oyster mushrooms, and Shiitake, the 2nd most cultivated mushroom globally.

In addition to fresh mushrooms, we also sell grow-at-home kits for people interested in mushroom cultivation, dried mushrooms, mushroom jerky, mushrooms tea mixes and medicinal mushrooms like Reishi, Chaga, and Turkey Tail in dried and concentrated tincture forms.

Why grow mushrooms?

The market for edible and medicinal mushrooms is one of the fastest growing in the produce and health product industries and has seen impressive annual growth for a decade with no slowing in sight.

Mushrooms are the most space efficient food crop; cultivated vertically indoors but with far greater density and yield per sq. ft. than other vertical crops. Our small, and relatively inefficient, farm can produce 700+ pounds of mushrooms per week, all year long, from a 750 sq ft space. This figure refers only to one of our fruiting rooms and excludes some other space where preliminary work is done. In an ideal world we could pull up to 1,000 pounds weekly from the same space and are working towards that goal.

Mushroom growing requires no intensive lighting as mushrooms derive no energy from the sun. Light is only required at normal indoor levels for your own comfort and the development of melanin and other pigments, as well as vitamin D in the mushrooms, both of which are achieved through virtually the same mechanism by which these compounds are produced in our own bodies.

Mushroom growing requires no agrichemicals. Pesticides, herbicides, fertilizers, etc are completely unnecessary. The only chemicals we use are sanitizing solutions on our equipment.

Counter-intuitively, mushrooms require very little water per pound of food produced compare to other crops, and especially compared to foods with similarly high protein contents like nuts, legumes, and meats.

Mushrooms are unique, exclusive, fascinating, trendy, and possess unique health benefits not found in other foods. Mushrooms are also used in a number of cutting edge technologies like compostable packaging, environmental remediation, meat substitutes, sources for natural dyes, etc. This makes selling them exciting and interesting.

How We Grow Mushrooms

Stage 1: Colonization

- Modern Mushroom Cultivation is a two part process. The first half, similar to the vegetative state in plants, must occur in a sterile, clean room like facility and the steps listed in stage 1 must occur in front of a laminar flow hood, a special type of HEPA filter. All substrates and equipment must be disinfected or sterilized in pressure cookers or autoclaves.
- In most instances, mushroom tissues cultures are introduced, or inoculated into, a sterile medium for fungal organisms in a petri dish. Once the mushroom tissue, or mycelium, has grown throughout the petri dish they are considered fully colonized and ready for the next stage.
- These cloned mushroom tissues will behave similarly to the parent mushrooms from which they are cloned and can be stored indefinitely with proper care. We grow a variety of local oyster mushroom cloned in 2014 and have produced many tons of it over the last decade.
- Petri dish cultures are then used to inoculate bags of hydrated grains that have been heat sterilized in pressure cookers or autoclaves. Wheat, Rye, and Millet are the grains most often used and must not have been treated with anti-fungals.
- Bags of grain are left to colonized in climate controlled conditions for approximately 2 weeks. This colonized grain is known as grain spawn and can be used to inoculate the final medium from which the actual mushrooms grow, known as a fruiting substrate.
- Bags of sawdust based fruiting medium are sterilized in pressure cookers, or atmospheric (non-pressurized) steam pasteurizers.
- These fruiting bags, or blocks, are then allowed to colonize in a climate controlled facility for approximately 2 weeks.

- Facilities must be maintained around 65f-70f, 50%-60% RH, and CO2 levels <900ppm with ample air circulation

Stage Two: Fruiting

- Once mycelium has grown throughout and over the surface of the fruiting medium the bags, or blocks, are ready to fruit.
- Bags are relocated to a fruiting room where the plastic bag is sliced open, or removed entirely, and the blocks of medium, now bound together with mycelium, are placed on shelves.
- Because fruiting substrates are more selective for fungal growth than the petri dish or grain spawn mediums sterility is less important at this stage and mushrooms can be fruited in a clean, but not sterile, facility.
- Mature mycelium kept in proper conditions has it's own immune system and is capable of rendering contaminants (e.g. molds, bacteria) inert through the use of anti-biotics and other immune compounds produced in and exuded from the mycelium. The mycelium then consumes these organisms, as well as nematodes, gnats, and mites by exuding digestive enzymes.
- Conditions in the fruiting room can vary a bit depending on the species being grown, but generally the following parameters are acceptable:
 - Temperature 50f-68f
 - RH 80%-95%
 - CO2 <650
- Mushrooms take in oxygen and exude CO2, the more fruiting substrate in a room, the more air will be required to maintain healthy levels.
- Air must be constantly circulated within the fruiting room to minimize pooling of CO2. All air within the fruiting room must also be displaced with fresh outdoor air on a regular basis to maintain CO2 levels below 650 ppm. This of course requires oversized air conditioning, heating, and humidity systems for the size of the fruiting room.
- One of our 750 sq. ft. rooms requires us to run one 1400 cfm intake fan and two 1400 cfm exhaust fans between 30% and 60% of the day in order to maintain CO2 levels. These run for short cycles of a few minutes on and a few minutes off at all times. We also push some fresh, humidified air into the room constantly through our humidification system.
- Mushrooms are quick and easy to harvest which is great because the process cannot be mechanized to any meaningful degree.

Considerations Before Jumping In

- Despite rapid growth in the industry, mushrooms remain a niche product in the American food system.
- High prices demanded by mushrooms place them outside the grocery budget for a decent percentage of people and outside the sales scope of your average grocery store, relegating them to specialty stores or grocers in affluent areas. Currently, grocery inflation and wage stagnation are hurting the industry.
- High perishability limits storage and distribution options.
- Despite a relatively small startup cost, it will be difficult to develop enough customers to achieve profitability and/or justify time spent for a full-time mushroom-only farm.

- By my estimation developing a sustainable customer base for a full-time, mushroom only farm can only be achieved in urban or suburban areas with little to no existing competition.
- Ten years ago there was plenty of room in the industry, at least in Midwest states, but I suspect we are reaching saturation for producers.
- The internet and social media have created great interest in mushroom cultivation in recent years and also inspired many new mushroom farms, most of which fail spectacularly.
- Failure rate is high due to the extremely steep learning curve between learning to grow mushrooms on a hobby scale versus commercial production.
- Developing a commercial production facility without a few years of small-scale experience puts one in the precarious position of the high likelihood that they will experience a crop failure and lose existing accounts.
- Beyond just producing mushrooms, there is also a learning curve to developing a schedule that allows for consistent weekly harvests and accounts for seasonal changes in environmental modification, pests, growth rate, etc.

HOWEVER...

- Growing mushrooms as an adjunct to an existing farm's production is a great way to develop knowledge without betting the farm on it.
- Selling mushroom through CSAs and farmer markets allows one to sell them when available without the repercussion associated with missing a restaurant or store delivery that is depending on your product.
- Assuming you have a suitable space, like an unfinished basement or climate controlled outbuilding, starting a hobby sized operation can be done for around a \$1,000 dollars
- Growing mushrooms is fun and satisfying

Learning More

I teach courses on cultivation, wild mushroom identification, and one on cooking, eating, and using mushrooms as medicine including a brief history of their use as food, medicine, and spiritual sacrament or tool.

Our 2.5 hour introductory cultivation class is focused on growing mushrooms at a hobby level outdoors, or in low-tech environments.

Our advanced cultivation class uses the same skeleton but focuses on commercial cultivation and includes some hands on instruction in one of our clean rooms.

Visit Mycophile.org or email Chris@mycophile.org to learn more.