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Welcome

Firstly, on behalf of the Directors and Staff at Mushroom Guru, I extend a warm welcome and trust that you will have fun doing this course and learning a new skill.



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Nikki takes care of:

- Workshop enquiries
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- All things Reishi (*Ganoderma lucidum*)
- Mushroom spawn and cultures
- Mushroom cultivation support
- Technical consulting for grow rooms
- Research and development
- Joint ventures

Thank you for choosing to take this introduction course with us and we trust that it will inspire and propel you into an industry, which has for many years been secretive and unwelcoming. The information that we will be sharing has been carefully compiled from our experiences and best practices, to give you the best outcome possible.

This introductory course will specifically teach you how to inoculate a wood substrate with dowels (dowel spawn) that you have purchased. It will start off with only the most important theory that you need to know, then move over to the three EASY steps on how to inoculate a log.

This course does not cover the bag method of cultivation or any commercial topics. The course that covers the bag method of cultivation is called Fungiculture.

Once you grasp these concepts and apply the skill, you will better understand how a mushroom grows and what it requires to fully mature. You can then start to explore various other aspects of cultivation with different species, using multiple techniques. There will be other courses made available to teach you the various techniques.

To understand the full scope of mushroom cultivation, you will need to:

- know how to make your own cultures
- know how to isolate mycelium
- know how to make grain spawn
- know how to grow different species using multiple techniques
- understand the concept of Aeroponics.

This course will teach and demonstrate the easiest cultivating method, helping you to get a clear understanding of the "why, what and how" of log inoculation.

The Magic World of Fungi

As fungi comes into your awareness and if you decide to learn more about them or wish to cultivate this extraordinary organism, you begin to realise that fungi are vastly different from plants and incredibly similar to humans.

Mushroom cultivation is not for everyone but those who have experimented, explored and therefore pioneered the industry, have created various opportunities to apply their passion through diversification.

You too can explore any one of these opportunities within the industry:

- Cultivation - growing fresh gourmet and/or medicinal mushrooms to supply restaurants, hotels, stores and markets.
- Cultivation supplies - provide supplies needed for cultivation
- Culture library - make and maintain cultures. If you love lab work, this is for you.
- Spawn- make master grain, multiply grain spawn and supply spawn for cultivation. The skill level here is highly specialised.
- Grow bag manufacturer - prepare substrates, inoculate them and make grow bags. This is a very viable option and in demand by those who do not have the time or aptitude to make their own grow bags. This also includes making starter kits or mushroom growing boxes.
- Technical products - support the industry by producing innovative cultivation solutions e.g. terrariums, grow boxes and grow rooms/environments
- Value added mushroom products - develop products like mushroom chewy sticks, mushroom stocks, bottled and pickled mushrooms or medicinal products.

All of the above opportunities start with learning "how to grow mushrooms". It is therefore best to get started with the "easy" stuff, which allows you to stay excited about the process of growing your own food. Then once you've succeeded in growing mushrooms, you can work toward refining the process and improving yields. At this point you can move on to more complex aspects of working with mycelium and exploring the other opportunities.

What is mycelium?

Fungi come in many shapes, sizes and colours. Macrofungi is a general category used for species that have a visible structure that produces spores, which are generically referred to as fruiting bodies. Unlike the leaves of green plants, which contain chlorophyll to absorb light energy for photosynthesis (the process by which plants convert Carbon dioxide and water into organic chemicals), mushrooms rely on other plant material (a substrate) for their food.



You might think that a mushroom grows like a plant, in other words that it has roots and grows out of the substrate, but nothing is further from the truth. The “root” structure is the actual organism of the fungus and when the organism’s existence is threatened, it produces a mushroom which is its reproductive organ. The mushroom then releases spores with the hope to survive its species.

Knowing this allows you to treat the mycelium in a certain way or manipulate it, so that it will produce mushrooms.

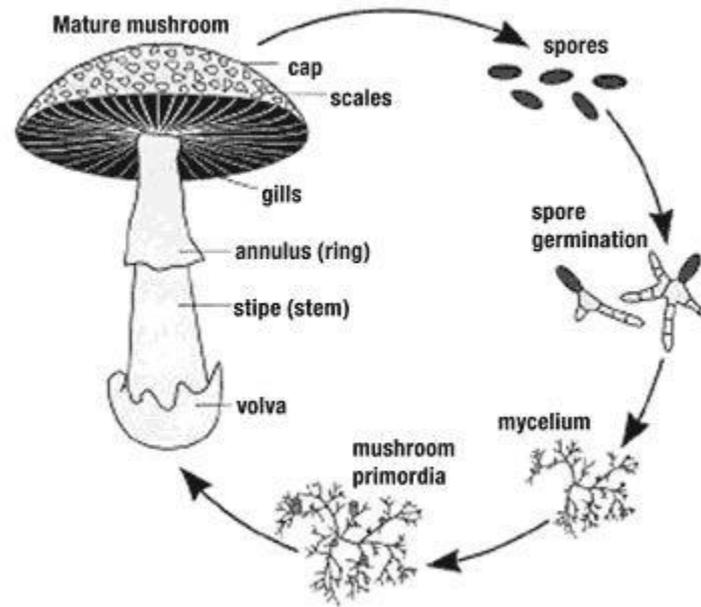


One of the primary roles of fungi in an ecosystem is to decompose organic compounds. Petroleum products and some pesticides (typical soil contaminants) are organic molecules (i.e. they are built on a Carbon structure) and thereby present a potential Carbon source for fungi. Hence, fungi have the potential to eradicate such pollutants from their environment unless the chemicals prove toxic to the fungus. This biological degradation is a process known as bioremediation.

Mycelial mats have been suggested as having potential as biological filters, removing chemicals and microorganisms from soil and water. The use of fungal mycelium to accomplish this has been termed mycofiltration.

Since 2007, a company called Ecovative Design has been developing alternatives to polystyrene and plastic packaging by growing mycelium in agricultural waste. The two ingredients are mixed together and placed into a mould for 3–5 days to grow into a durable material. Depending on the strain of mycelium used, they make many different varieties of the material including water absorbent, flame retardant and dielectric materials.

Fungi are essential for converting biomass into compost as they decompose feedstock components such as lignin, which many other composting microorganisms cannot. Turning a backyard compost pile will commonly expose visible networks of mycelia that have formed on the decaying organic material within. Compost is an essential soil amendment and fertiliser for organic farming and gardening. Composting can divert a substantial fraction of municipal solid waste from landfills.



The cycle starts, as the mushroom releases spores from their gills or pores. These spores then germinate when the temperature, pH and moisture content are favourable. Each spore has small nodes on its surface called basidia. A fine thread, hyphae, grow from the basidia in search of a mate. The mating of two opposite, male and female hyphae, creates the true "body" of the fungus called mycelium.

Mycelium grows under the grass or under leaves and other organic matter. Its growth can stretch for miles. Each species of mycelium has its own characteristics. Some mycelium grows into thick ropes/strands while others are very fine and wispy.

The more you get to understand fungi and their unique characteristics, the more you fall in love. Humans and fungi share characteristics that will make you wonder and in turn, help you come to conclusions about this extraordinary organism which allows you to successfully cultivate it.

Fungi breathe oxygen and expel Carbon dioxide. When there is more Carbon dioxide present than the fruit body needs, the stem of the mushroom begins to elongate as it reaches out for higher ground in the hope to find fresh air. The elongation of a mushroom stem is therefore caused by too much Carbon dioxide.

Substrate

Noun - an underlying substance or layer.

- the surface or material on or from which an organism lives, grows or obtains nourishment
- a substance on which an enzyme acts



With regards to fungi, a substrate or food source can be any dead (non-living) organic plant matter or even a live insect, plant or tree. To explain how fungi relate to their food source, you need to know that there are three fungi groups, namely: Saprophyte, Mycorrhizal and Parasite.

Since Shiitake mushrooms are Saprophytes, we will only outline this group here. The other groups will be covered in Fungiculture.

Saprophytes:

Examples: Oyster, Shiitake, Button, Shimeji, Enokitake, Maitake, Psilocybe, Turkey Tail



Shiitake mushrooms are saprophyte mushrooms, thus they grow on a wide variety of dead, organic, plant matter. A well-colonised substrate is one of the most important requirements for fruiting body formation. If your substrate has the right amount of nutrients and the pH is around 5.5 or higher it will colonise quickly, leaving little chance for other contamination to overrun your substrate.

Saprotrophic fungi are sometimes called saprobes, saprotrophic plants or saprophytes (sapro- + -phyte, "rotten material" + "plant").

What you need to know

There are a few myths that need to be dispelled so that you can understand the delicate intricacies of cultivating fungi.

Many people believe that;



1. Mushrooms grow in the dark
2. A mushroom has roots - you plant a seed and it grows roots.
3. Mushrooms need a lot of water to grow
4. Mushrooms breathe Carbon dioxide, the same as plants
5. You can eat all store-bought mushrooms raw

Fact 1:

Mushrooms need light for its pigment to change colour. If a mushroom is grown in the dark, it will stay white or be very pale in colour. The same mushroom grown in the light will form its natural colours, some very prominent. The temperature of light is measured in Kelvin. "Warm white", for instance is 1300k, "Cool White" is 2500k, "Day Light" is 6000k. Mushrooms form their true colours from 3000k and up.

Fact 2:

Mushrooms don't have roots at all. In fact, the "roots" are the actual organism of the fungus, which is called mycelium. Mycelium can grow for miles under the grass or plant debris without producing a single mushroom. When cultivating mushrooms, you would use spawn to inoculate the growing medium. Spawn is a "transfer medium" used to transport the mycelium from the petri dish to the grow bag. Mushrooms don't have seeds, they produce spores, which in turn create hyphae and ultimately, mycelium. Our task as a cultivator is to germinate mushrooms spores in an environment that will ensure the success of the mycelium. The germinated spores are then multiplied using a sterile liquid, grain or any other organic plant matter and then used to inoculate a growing medium.

Fact 3:



We think that mushrooms need a lot of water to grow and we get this idea from seeing mushrooms pop up everywhere after a heavy rain.

What is important to know is, that as it begins to rain the ground becomes waterlogged and the mycelium begins to suffocate as the rain cuts off its Oxygen supply.

The more rain, the greater the threat as the more water the ground holds. After a heavy rain, the mycelium takes a few days to recuperate as the water evaporates, after which it will produce a mushroom or mushrooms so that it can survive its species.

Fact 4:



Now that you know that the mycelium is the actual fungal organism, and not the mushroom itself, you will also find it interesting that the mycelium breathes Oxygen as it grows and searches for food. Unlike plants, which breathe Carbon dioxide, fungi take in Oxygen and produce high volumes of Carbon dioxide. This can be very useful if you are wanting to add extra Carbon dioxide to a plant grow room or facility. One small 2kg grow bag with a colonising substrate can raise the Carbon dioxide level in a 2m x 3m plant grow room by 1,200 ppm (parts per million). This is very useful if you are wanting plants to grow at maximum speed.

Fact 5:

It may be a little risky for you to eat raw mushrooms, as the mushroom cell wall contains a compound called chitin. For some people, chitin can cause serious stomach upset. In others, they may feel that their liver is taking strain because chitin is not digestible for most people. There is a small category of the population that can eat any mushrooms raw without any gastric issues. It is best to fry mushrooms on a high heat, so that the cell wall of the mushroom is broken down to assist digestion.

Cultivating mushrooms

All mushroom growing techniques require the correct combination of humidity, temperature, substrate (growth medium) and inoculum (dowels, spawn or culture). Many of these features encompass what is known as Aeroponics.

As you now know, plants and fungi are vastly different in what they need to thrive. Plants need light and plenty of water to survive, yet fungi don't need light at all and in fact, hunt for their own food. It is much easier to plant a seed and water it than make a mushroom grow bag and control the air exchange. If mushroom cultivation were easy, everyone would be growing mushrooms.

Cultivation Methods

Due to the lack of limitation to human imagination, there are literally hundreds of methods in cultivating fungi. They will generally fall into one of a few categories:

- bag
- log
- bottle
- tray
- outdoor beds

Log Method

Mushrooms can be grown on stumps or logs that are placed outdoors in stacks or piles, as has been done for hundreds of years.

Wooden dowels carrying the fungus of choice are inserted into a sacrificial log and then left to colonise. The log is wet once a week, depending on the weather, and within roughly a year, mushrooms grow from the surface of the log.

Sterilisation is not performed in this method. Since production may be unpredictable and seasonal, less than 5% of commercially sold mushrooms are produced this way. Fruiting or pinning, is triggered by seasonal changes, or by briefly submerging the log in cool water. Shiitake and Oyster mushrooms have traditionally been produced using the outdoor log method, although controlled techniques such as indoor tray growing, bag method or artificial logs made of compressed substrate have been substituted.

Shiitake mushrooms can be cultivated on a variety of hardwood logs including Oak, Maple and Chestnut. Softwood should ideally not be used to cultivate Shiitake mushrooms, as they decompose too quickly. The resin of some softwoods, such as Pine or Gum trees inhibit the growth of Shiitake mushrooms making it impractical as a growing substrate.

In order to produce Shiitake mushrooms, 60-100 cm long hardwood logs with a diameter ranging between 10-15 cm are inoculated with the dowel spawn mycelium of the Shiitake fungus. Inoculation is completed by drilling holes in hardwood logs, filling the holes with dowels or inoculum, and then

sealing the filled holes with hot wax. After inoculation, the logs are placed under a shaded area or canopy and left to incubate for about 12 months (12-15 months for lager logs). Once incubation is complete, the logs are submerged in water for 24-48 hours. Seven to ten days after being submerged, Shiitake mushrooms will begin to form, grow and can be harvested once fully matured.

Shopping List



Below is a list of equipment and cultivation supplies that you will need after this section to be able to duplicate the log inoculation process:

- 1 deciduous hardwood log 60 cm's long x 10-15 cm's in diameter
- 50 Shiitake dowels (dowel spawn)
- power drill
- 8 mm masonry drill bit
- candle wax
- pot
- paint brush
- permanent marker
- steel nail and steel hammer
- raw hide hammer
- 50 litre container

Type of log and dimensions

Hard wood species are great to use as they take longer for the mushroom mycelium to decompose, therefore your log lasts longer and you get more mushrooms. Soft wood species like poplar, don't last at all. Some wood species are too hard, like Ironwood. If you can get Oak, you will have the best of both worlds. The log needs to be about 3-4 weeks old, 15-20 centimetres in diameter and 60-100 cm's long (you can use longer and wider logs, just keep in mind that you will need to fully submerge the log after about 12 months. The log should therefore not be bigger than the biggest container you have. A swimming pool is not recommended, as the chlorine will overpower the mycelium.

Wood Types

The following trees are also good candidates for log and stump inoculation:

- Acer spp. (Maples)
- Quercus spp. (Oaks)
- Vachellia spp. (formerly Acacia) - Indigenous Spp available
- Betula spp. (Birches)
- Castanea spp. (Chestnuts)
- Cinnamomum (Camphor)
- Fagus spp. (Beeches)
- Fraxinus spp. (Ashes)
- Liquidambar (Sweetgums)
- Malus spp (Apple)
- Morus spp (Mulberry)
- Pinus spp (Pines)
- Populus spp (Poplars)
- Prunus spp. (Plums)
- Searsia spp. (Formerly Rhus spp.) Karree - Indigenous Spp
- Robinia spp.
- Ulmus spp. (Elms)

Three easy steps

Step 1

Firstly you need to get a log or logs measuring 10-15 cm's in diameter and 60-100 cm's in length. Once inoculated you will need space to position/store them so that they aren't disturbed for roughly a year. Obviously, the more logs you have the more mushrooms you will grow. For a household of four, 3 to 5 logs would be great.

You will notice that when your mushrooms start to grow, the more logs you have the better you can rotate your "crops". A shaded spot is what you need. The trick is to keep them off the ground to stop other contaminants growing on your valuable Shiitake logs and not too high that you lose the advantage of the humidity coming from the ground beneath the log.

Step 2



You will need to order and receive dowel spawn. A log measuring 10-15 cm's in diameter and 60 cm's in length will need about 50 dowels.

Wooden dowels are used to inoculate your logs. Spawn producers first grow a Shiitake culture, then transfer bits of the culture to sterilised sorghum. Once the sorghum is fully colonised, we transfer the spawn to dowels that have been soaked and sterilised. Don't worry, this is all taken care of, you just need to order and receive your dowels.

The dowels are spaced 10-12 cm's apart from each other over, all around the whole log. You can use slightly less dowels for a log with the dimensions we've provided and preferably not more dowels (this is a bit of a waste).

Drill 8 mm holes 30 mm's deep into the log (not on the cut side only on the surface covered with bark). The dowels that you will receive are 20 mm in length, therefore if the hole is 30 mm deep, you will have a 10 mm pocket inside the log and behind the dowel, which will aid mycelial growth.



Place a dowel into each hole and using a wooden or rawhide mallet, knock the dowels flush or slightly below the bark.



Place wax in a pot on medium or low heat and keep an eye on the wax. Do not leave the pot unattended on the stove or gas burner. Once all the wax has melted turn the stove or gas burner off. Handle with care!

Once you have all your dowels inserted, you can seal the hole with hot wax using a paint brush. Dab the slightly cooled wax over each hole containing a dowel. This is to seal the dowel in the hole and prevent insects from getting in and eating the mycelium.



Step 3

Place your log in an area that gets the 100% shade. Competing fungi would love to grow on your log, so place it on bricks or other pieces of wood. Wet your log/s twice a week. Make sure to saturate the ground underneath the log.

After a few months you will notice mycelium growing on and in the log. When these patches of mycelium are thick and look like they are ready to grow mushrooms (about 12 months), submerge your log under water for 48 hours (submerge means completely under the water with no part of the log exposed to air, therefore if necessary place bricks on to keep the log under the water-this is to cut off the oxygen supply so that the mycelium is under threat of dying).

Take the log out the water and place it vertically in the shade, allow it to drip dry for one day, then take it inside. Snails and insects love mushrooms, so placing your log/s in a protected area will prevent losses. After 6 to 8 days, you should see mushrooms pushing out from under the bark. Once you have harvested your mushrooms, let the log/s stand for two weeks and then submerge them again.



Please note, that there are cold weather strains and warm weather strains of Shiitake, so if you inoculate your logs with a cold weather strain, expect it to fruit in cold weather and visa versa. Keep in mind that it takes about a year for a log to fully colonise, so calculate when your log will fruit and use the correct strain. To help you with the dowel ordering process, we inoculate dowels with a Winter strain in Winter and a Summer strain in Summer, so you don't have to calculate the time to fruition.

Thank
you

Thank You and Contact Us

It has been a great pleasure compiling this content for you and I trust that you have sufficient information and instruction now, to grow your own Shiitake mushrooms at home.

- To view our online SHOP, place an order for dowel spawn or any other mushroom cultivation supplies, please click [here](#)
- To be added to our mailing list and be kept informed on all things mushroom please click [here](#)
- To stay in touch with us on Facebook, please click [here](#)

I will be adding many more content and "how to" videos and tutorials going forward and I trust that they will be extremely helpful.

- How to grow oyster mushrooms using the bag method and bought spawn
- How to build a glove box
- How to make a magnetic stirrer
- How to optimise a grow room
- Please feel free to contact us if you have any questions.

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