



Billets in incubation or spawn run

The optimum temperature required is 18 degree centigrade to 25 degree centigrade with 65-70% moisture. While staking ensure sufficient aeration and moisture to prevent the logs from cracking. The main purpose of this process is to provide a favorable condition for mycelium to spread while disease and competitive fungi are inactive.

In order to provide favorable conditions for spawn run, the following needs to be considered.

- Clean and disinfect the site chosen.
- Make stone soling to prevent the billets from becoming muddy.
- Stack the billets in upright position.
- Add pine needles on the top of the billets.
- Water just enough to keep the pine needles moist.
- Wrap the billets with plastic sheet and cover it with straw mat for insulation during cold season.
- While covering the billets with plastic sheet/ tarpaulin, provide air passages.
- Water billets periodically as per requirement.

6. CROPPING MUSHROOMS

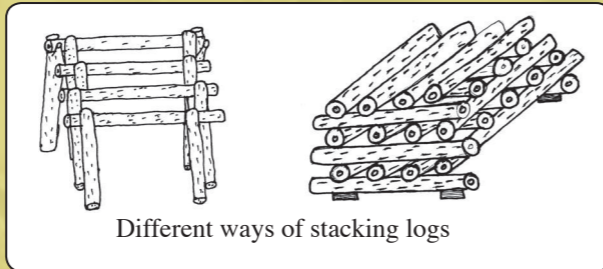
Under good conditions of temperature and humidity, the billets should take about 6 months to mature. The maturity could be observed by the softness of billet condition and by looking at the mycelium color. When the logs are ready it becomes soft and light. The mycelium at the end of the billets turns brown in case of shiitake.



Mycelium run complete

Mycelium run inside log

The billet is then ready for dipping. They are normally dipped in a water tank for a period of 12 to 24 hours depending upon the log moisture content (LOC) of the billets.



Different ways of stacking logs

After completion of dipping hours, the water is drained out from the tank and the billets removed from the tank and wrapped in plastic sheet. Within 3 to 6 days depending on temperature, mushroom (pin heads) will start to sprout from the billets, which are then stacked for cropping as shown in figure above. Spraying of water is also practiced especially with the use of sprinklers.



Soaking billets

A type of mushroom shed

7. HARVESTING MUSHROOMS

After stacking the billets for cropping, mushroom will mature within 4 to 8 days. The billets are then restacked in crib stack position and given a rest period of two months. It is again soaked in water and sprouting induced. Likewise, the cropping pattern is repeated till the billets get exhausted.



Shiitake Mushroom

Oyster Mushroom

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Mushroom Cultivation in Wood logs



Shiitake Mushroom



Oyster Mushroom

ལྷ་ཡོངས་འཕེལ་གྱི་ལས་འགན་ཁུངས་། སེམ་ཏཱ་ཁྲི་གསལ་ལྷ་ས།
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National Mushroom Center
Department of Agriculture
Ministry of Agriculture and Forests
Semtokha, Thimphu Bhutan

INTRODUCTION.

At the moment mainly two mushroom species grown on wood logs, *Lentinula edodes* also commonly called as Shiitake and *Pleurotus spp* (oyster mushroom) are being promoted in Bhutan. Others, such as *Auricularia spp.*, *Pholiota*, *Ganoderma*, etc can also be grown on wood logs

Tree Species Used

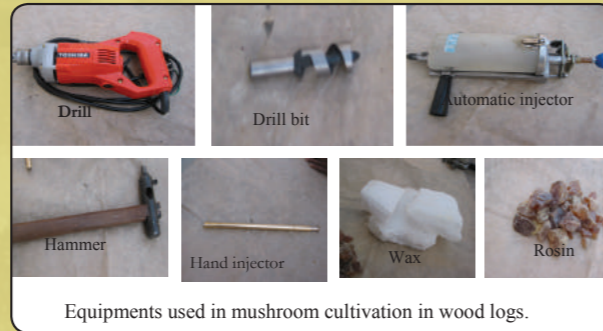
In Bhutan, the wood species used for mushroom cultivation is generally hard wood which includes *Quercus griffithii*, followed by *Q. semicarpifolia*, *Q. lanata*, *Q. glauca*, etc. and *Castanopsis* species. For oyster however soft wood tree species are preferred such as *Alnus spp.*

Season for mushroom cultivation:

Mushrooms can be grown through out the year but the best season for cutting logs is during autumn and winter. The trees at this period are dormant and the barks are firm compared to the season when the sap is active in the plant.

In Bhutan, only the branches and tops and lops of the trees are used. The new shoots that sprout can be used for cultivation within five to six years. This is the sustainable way of harvesting tree logs for mushroom cultivation without damaging the tree.

Necessary Equipments and Materials.



Where electricity is not available, power generators would be required for drilling holes into logs. Hammers can also be used to drill holes instead of drills.

Mushroom cultivation in wood logs consists of the following procedures:-

1. CUTTING LOGS

The ideal length preferred is 90 cm to 120 cm with a diameter of 6 cm to 20 cm. The length of the logs should be uniform as shown in the stacked wood logs below.

The Size (length) of the logs should be uniform. If longer and larger logs are used, it becomes difficult to manage as they can become too heavy upon soaking in water. In case of smaller logs it can break off or be drilled through.



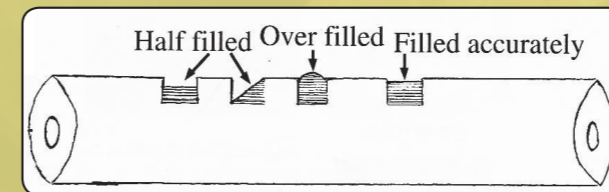
2. DRILLING HOLES

To inoculate spawn, holes have to be drilled into the logs. On a normal length of a log (1 meter), 7-8 holes in each row would be required to be alternately drilled.



3. INOCULATION OF SPAWN

After drilling holes, the logs should be spawned immediately. Otherwise it will result to exposure to disease and other competitive fungi besides drying up. Mushroom spawn is inoculated with the help of a hand injector or automatic injector which are designed to press adequate spawn to fill the holes. Care should be taken not to overfill the hole or leave it half filled as shown in figure below.



While spawning it should provide proper contact of spawn with the surface of wood in holes and enhance penetration of mycelium into the logs. On the contrary, loose contacts do not allow mycelium growth besides causing damage to the spawn while waxing.



4. WAXING

After inoculating spawn in the holes, it is required to be sealed to prevent drying up of the spawn and to protect from disease and other fungi entering with spawn. Wax and rosin are placed in a container at a ratio of 4:1 and then heated to 100 degree to 120 degree centigrade. It is then applied over the exposed spawn thereby sealing the holes.



5. INCUBATION / SPAWN RUN

The billets have to be kept in incubation for the spawn to spread in the logs. During this stage the mushroom mycelium consumes and colonizes the logs. This is called incubation or spawn run. In order to provide ideal temperature and moisture during the incubation period the billets are stacked in upright position and kept covered with plastic sheet.