

Chapter 6: Production

Shiitake production is very labor intensive and often begins as a family affair and ends when children go off to school. Plan for labor-intensive periods such as tree felling, inoculation, soaking, and harvest periods. Remember that logs are heavy, especially after being soaked, and that you should accommodate lifting with back support, forklifts, or other aids.

The most profitable log operations fruit their logs year-round and are reliable weekly product sources for buyers. Unfortunately, outdoor production alone does not accommodate year-round production. By inoculating outdoor logs with various seasonal strains, production can often be extended and you may be able to force fruit logs up to four times per year. Forced fruiting is accomplished by creating conditions that stimulate fruiting. If the spawn strain is a cold-weather strain, you may be able to fruit logs in December or January by soaking them in warm water. You will be able to fruit them again in March or April and again in October. It will be difficult to force cold-weather strains in the summer; therefore, you should have a selection of wide-range and warm-weather strains for summer fruiting. These strains will naturally fruit in April and October. They can be forced to fruit in June or July if allowed to get slightly dry and then soaked in cold water.

To determine if it is time to fruit the logs, first check for spawn run. If the inoculation sites are white and the log ends have white v-shapes at the end, the logs are probably ready to fruit. If logs are grown in forest or outdoor conditions, they will fruit naturally when the weather and moisture change in the spring and fall. Logs fruited indoors but left outdoors during spawn run, should be brought indoors and soaked when sufficient logs are showing significant spawn run. Logs kept indoors all season should be soaked on a 12-week

schedule, once spawn run is completed. To increase the yields, be sure logs are maintained as suggested below.

In most cases, logs are soaked to force fruit. Soaking helps concentrate production and increases yields. The soaking time depends on the dryness of the logs. After logs are placed in the soak tank, water replaces air in the logs and forces bubbles to the surface of the tank. Remove logs before bubbles quit forming. Typically, 12 to 72 hours is the range. However, denser wood species such as oak, large logs, and young logs require longer, while older logs and wood species such as sweetgum require less time in the tank.

Soak tanks should have drains at the bottom. A source of hot water is desirable for force fruiting in the winter. Tanks should have a lid or some other means to hold the logs under water; otherwise, logs will float and not absorb sufficient moisture to produce marketable mushrooms. Soaking logs and removing them from the tanks is one of the most difficult activities in log production, but it is also one of the easiest to mechanize. Tanks can be buried in the ground and lifts or tractors used to lower racks into the tank and remove them.

After logs are removed from the tanks and placed in a fruiting area, the logs will begin to dry, which initiates the pinning phase of fruiting. Pinning is the primordium formation or the beginning of mushroom development (Figure 16, next page). During summer months, logs, once removed from soaking tanks, can be placed in front of fans that will help dry the surface and cool the log. Fans should be removed at the first sign of pinning.



Figure 16. Pinning or primordium formation occurs two to four days after soaking. Once pins start to form, logs and pins should be kept dry and temperatures should be at least 60 to 65 degrees F.

Forest-Grown Mushrooms

Many risks are associated with growing shiitake mushrooms outdoors. These include weather conditions, pests (including wild animals), theft, moisture loss, seasonal fruiting, and quality control. Once logs are placed in the laying yard, production management includes the following:

- Maintaining burlap or log covers and checking to be sure they have not blown off or been removed
- Checking moisture of logs. Weighing logs to determine moisture loss. Checking logs for contaminants and to determine if logs are staying too wet.
- Looking for deer, slugs, and other animals that might steal the spawn or later eat the mushrooms.
- Watching for spawn run at inoculation sites and log ends to determine mycelium growth progress in the logs.
- Forcing logs to fruit in the summer by soaking logs in cold (50 to 60 degrees F) water. Forcing logs to fruit in winter using warm-weather strains, warm logs by

- increasing exposure to sun for 2 weeks. Covering with clear plastic may also warm logs. Once logs are warmed, soak in water that is cooler than the logs. If you can warm logs to 60 degrees F, then soak in 50-degree F water. If you use cold-season strains, soak logs in warm water (60-degree F) without warming the logs.
- When mushrooms are fruiting, checking all logs for slugs. Slugs are very destructive and will go from one mushroom to the next making numerous holes. If your logs are free of slugs after soaking, keep them off the ground and surround the fruiting area with a circle of copper sulfate or salt (sodium chloride). When slugs crawl across these chemicals, they will shrivel and die. If the copper sulfate or salt dissolves due to rain or excessive canopy moisture, reapply it.
- Fruiting logs must be checked daily and in summer months, twice a day. Because mushrooms grow rapidly in warm weather, those just forming in the morning may need to be picked by late afternoon.
- Refrigerating mushrooms as soon as possible. Mushrooms grown outdoors in the summer are warm and will deteriorate rapidly.

Forest-Outdoor/Indoor Production

Logs left outdoors for spawn run and recovery between fruiting periods should be maintained and observed as forest-grown mushrooms described above. However, logs that will be brought indoors should be fruited on a 12- to 15-week schedule. The indoor production facility is described in the next section.

Divide logs by strain. Determine the best fruiting time for each strain. All logs with strains that can be fruited at the same time should then be divided into 12 to 15 groups, depending on the number of weeks between fruiting. If you have 150 logs inoculated with warm-season strains that you want to fruit in June and you plan to fruit them every 15 weeks, divide 150 by 15. You will then

have 15 groups of 10 logs. A different group can be soaked each week for 15 weeks. At the end of 15 weeks, you can begin fruiting the first group again. Keep groups separated by labeling or painting the ends and recording each group's soak date. The following is an example of a soaking and fruiting schedule:

Week One

- Bring 10 logs into the production house. Do not soak during week one.

Week Two

- Soak the logs brought in the previous week; bring in 10 more of the logs in the group.
- After 48 hours, remove the logs from the soak tank.
- Fruiting will begin within 2 or 3 days.
- When logs are no longer fruiting, move them back outdoors.
- Refrigerate mushrooms during the week and sell them when the majority of mushrooms are harvested for the week.

Week Three

- Soak the second set of logs brought into the house and bring in the third set.
- Proceed as in Week Two.

Continue this process until you have fruited all 15 groups of logs. When all 15 groups have been fruited, you can begin again with group one. This way you ensure yourself a steady production of mushrooms across all 15 weeks.

Indoor Production

Logs left indoors year-round and fruited indoors should be divided into 12 groups. As described for outdoor and indoor production, rotate fruiting for each group but create only 12 groups. When all 12 groups have fruited, begin soaking the first group again. Indoor logs can recover faster than outdoor logs because their environment is controlled to maximize mycelium recovery.

Ideally, the mushroom house should be divided into fruiting and log resting sections. The fruiting section should be cooled or heated as appropriate, have good ventilation to remove excess carbon dioxide and spores, and have a humidity of 85 to 90 percent. The log resting area should be dryer and also be heated in winter or cooled in summer. Maintain indoor temperatures at 70 degrees F during the resting period, reduce to 55 degrees F before soaking, and slowly raise to 65 degrees F to initiate pinning and for fruiting.