PROJECT GUIDE

CULTIVATION OF SHIITAKE MUSHROOMS

AS AN AGROFORESTRY CROP IN THE MID-ATLANTIC AND NEW ENGLAND REGIONS

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WELCOME…

Welcome to the project! We are excited to have your help. During the following pages we will outline the project, what steps you need to take, what information we need from you, and how to properly organize and record that information.

We have tried to make the process as simple as possible, however you may still find certain parts confusing or too complicated. If you have any questions or concerns about how fill out the paperwork, please contact Bridgett Jamison at either 267-374-9436 or bridgettjamison@gmail.com.

Thank you for your participation in the coming months.

Sincerely,

Bridgett Jamison
Database Manager

IMPORTANT CONTACTS

PROJECT ADVISORS

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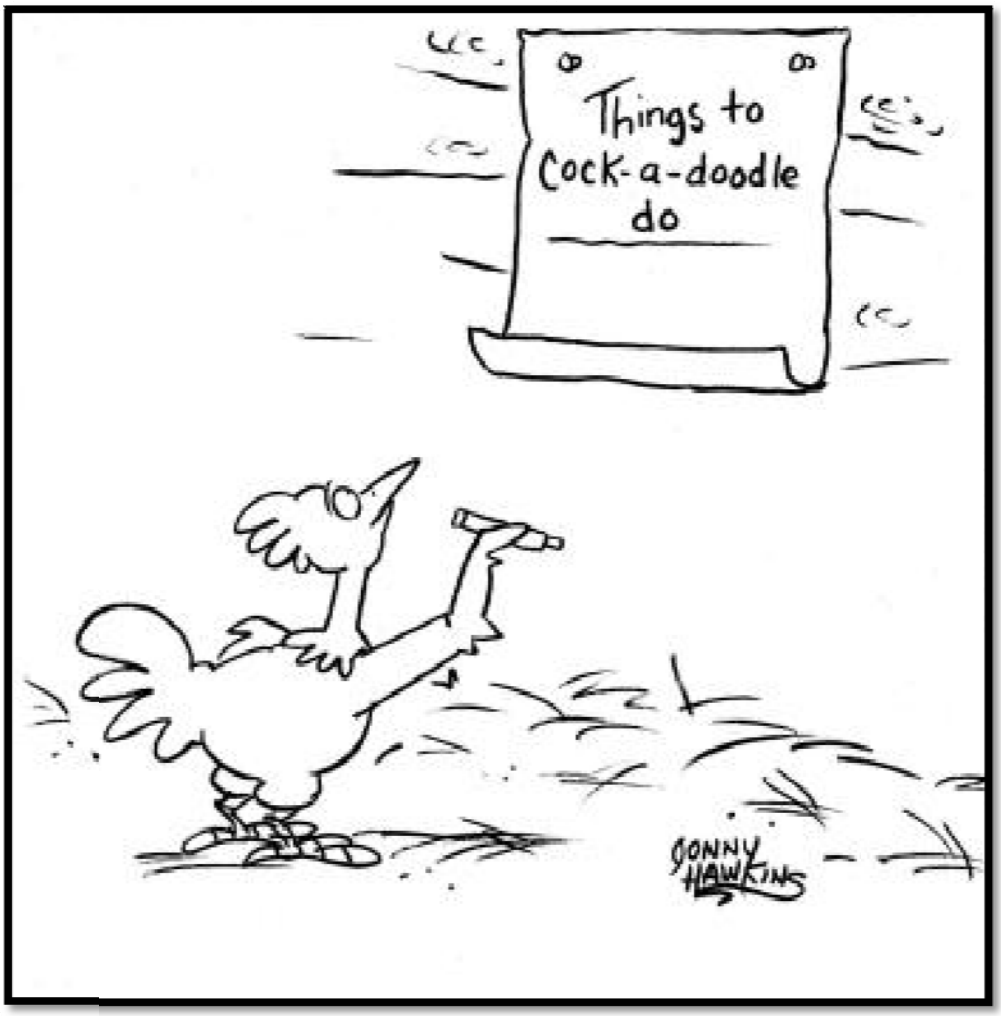
PROJECT OVERVIEW

In the spring of 2011, you will be expected to acquire and inoculate at least 100 logs with Shiitake spawn. Rather than having you collect and report information on every logs' production, we would like you to organize your 100 logs into five log stacks; all the logs in a single stack will have similar characteristics including tree species, felling date, and inoculation date. In addition to recording basic information about each stack, you will also need to record the diameter of every log in each stack. We will use this information to estimate the total log weight of each stack.

As the experiment processes, you will collect, record and report information about each log stack– when a stack was shocked, the daily production of each stack during the fruiting stage, etc. The information will enable us to gain insight as to what species of tree to produce the greatest yields and what sort of profits small growers can expect.

In addition to production information, we are also very interested in the time and money you spend during your enterprise development and how this affected the net profit. We therefore also need you to record the number of hours you, you, family, friends and/or employees spend on different aspects of the project and the cost of the equipment and supplies purchased. We would like you to generalize what aspect of the project these actions served – the inoculation stage or harvest stage or sales stage for example. Lastly, we need to know where and how you sold your mushrooms.

It's a lot of information, but it shouldn't take more than one hour a week to record everything. To help you along, one member of our team will visit your site in the spring of 2011 and the spring of 2012. In addition, we will host two workshops that you are expected to attend.



YEAR TASK LISTS

TASK LIST FOR 2011

- **Acquire 100 logs for the experiment. Be sure to take note of the day the trees were felled -**
  - Record the time it took you to fell and cut trees *(Labor)*
  - Record your expenses while cutting and felling trees *(Expenses)*

- **Stack logs into five log stacks**
  - Record Tree Species *(Stacks)*
  - Record date the tree was felled *(Stacks)*
  - Record the Diameter of every log in each stack *(Stacks)*

- **Inoculate the logs**
  - Record the time it took you to inoculate the logs *(Labor)*
  - Record your expenditures on equipment and supplies used during inoculating *(Expenses)*
  - Record the date the logs were inoculated *(Stacks)*

- **Spend completed worksheets to Bridgett Jamison through email or snail-mail.**
  - Removed and mail the "Log Stacks", "Labor", and "Expenses" Worksheet and mail to
    Attn: Bridgett Jamison
    Plant & Soil Science Department
    University of Vermont
    63 Carrigan Drive
    Burlington VT, 05405

- **Attend a Enterprise Assessment Workshop in late fall**
  - We will host a one day workshops regarding enterprise assessment at one location in VT and two in the Mid-Atlantic region.
  - Exact date and location will be announced later.

- **Optional: Participate in one of the Introduction to Growing Shiitake Mushrooms Workshops**
  - Exact date and location will be announced later.

TASK LIST FOR 2012

- ☐ **Acquire 100 logs for the experiment. Be sure to take note of the day the trees were felled -**
  - Record the time it took you to fell and cut trees *(Labor)*
  - Record your expenses while cutting and felling trees *(Expenses)*

- ☐ **Stack logs into five log stacks**
  - Record Tree Species *(Stacks)*
  - Record date the tree was felled *(Stacks)*
  - Record the Diameter of every log in each stack *(Stacks*

- ☐ **Inoculate the logs**
  - Record the time it took you to inoculate the logs *(Labor)*
  - Record your expenditures on equipment and supplies used during inoculating *(Expenses)*
  - Record the date the logs were inoculated *(Stacks)*

- ☐ **Begin shocking / forcing stacks of logs (one stack at a time)**
  - Record the time it took you to shock the logs *(Labor)*
  - Record the stack number and day that the logs were shocked *(Fruiting)*

- ☐ **Begin harvesting Shiitake mushrooms!**
  - Record the first day the logs begin to fruit *(Fruiting)*
  - Record the fresh weight of the mushroom harvested each day *(Fruiting)*
  - Record any expenses you incurred while harvesting mushrooms and preparing them for sale (Expenses)
  - Record the amount of time spent each day harvesting and preparing shiitakes *(Labor)*

- ☐ **Sell the Shiitake Mushrooms!**
  - Record the time it took for you to sell your mushrooms *(Labor)*
  - Record your expenditures on equipment and supplies that went toward sales *(Expenses)*
  - Record the date of sale, where the shiitakes were sold, how much were sold, and how much you made on the sale *(Fresh Sales or Value Added Sales)*

- ☐ **Spend completed worksheets to Bridgett Jamison -**
  - Removed and mail the "Log Stacks", "Labor", and "Expenses", "Fruiting" and "Sales" Worksheets and mail to
    Attn: Bridgett Jamison
    Plant & Soil Science Department
    University of Vermont
    63 Carrigan Drive
    Burlington VT, 05405

- ☐ **Attend the Northern Mushroom Growers Association in late fall**
  - Location and date to be announced later

TASK LIST FOR 2013

- **Acquire 100 logs for the experiment. Be sure to take note of the day the trees were felled -**
  - Record the time it took you to fell and cut trees *(Labor)*
  - Record your expenses while cutting and felling trees *(Expenses)*

- **Stack logs into five log stacks**
  - Record Tree Species *(Stacks)*
  - Record date the tree was felled *(Stacks)*
  - Record the Diameter of every log in each stack *(Stacks*

- **Inoculate the logs**
  - Record the time it took you to inoculate the logs *(Labor)*
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- **Attend a meeting in late fall**
  - Location and date to be announced later

LOG BASED CULTIVATION OF SHIITAKE MUSHROOMS

ACQUIRING LOGS FOR THE PROJECT

TREES SPECIES

Oak is often considered the species of choice for shiitake production in North America. Research at the Center for Agroforestry by Johannis Bruhn has shown that red and white oak performed about the same as substrate for shiitake. Because oak is a valuable timber species, forest owners who include timber production as part of their woodland management goals may be reluctant to cut large amounts of young oak for shiitake cultivation. However, tops left after logging are often of an appropriate size to be used as bolts and access is usually easy although timing might be less than optimal for mushroom production.

Other species that have been shown to perform as well as, if not better, than red oak include American beech (*Fagus grandifolia*), Sugar maple (*Acer saccharum*), American hornbeam (*Carpinus caroliniana*), and Hophornbeam (*Ostrya virginiana*). Red maple (*Acer rubrum*) is likely to yield less than red oak however yield determination is ongoing.

Other species of interest include Ash, black walnut, chestnut, alder, elm, black locust, tupelo (black gum), sweet gum, and eucalyptus. Although we don't know how well these species will perform, we encourage you to try them out if the trees are available.

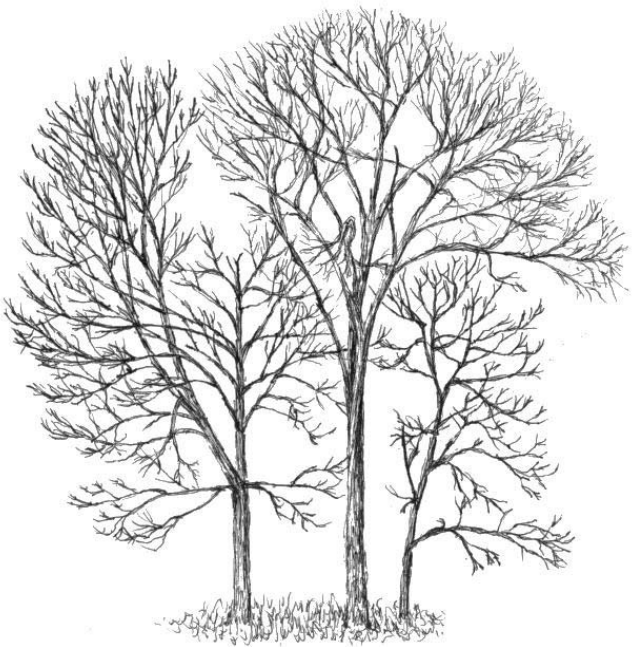
BUYING PRE-CUT LENGTHS (COST $1.00 - $2.00 / BOLT)

Buyers should try to purchase logs in good condition with the bark intact, and few places of rot or scarring. Be sure to ask when logs were cut, what the storage conditions prior to delivery or pick-up were . Remember that if the logs were stored in the sun, the moisture content is likely to be too low.

LOGGING TO OBTAIN BOLTS

Only living trees should be cut down. Mushroom growers who are forest owners (or have a working relationship with forest owners) should establish a management plan for their woodlot and have training in the safe use of a chainsaw. Always remember that operating a chainsaw is can be dangerous if proper precations are not taken.

- Do not operate a chainsaw if you have not had instruction in felling trees or proper safety training.
- Always wear appropriate safety gear including chaps, helmet, eye protection, and ear protection.
- Make sure the saw you are using is well maintained and has up-to-date safety features including a chain brake (the chain cannot move when this is on), a chain catcher (in the event the chain flies off the bar), and a safety throttle switch / throttle lock (must be depressed to initiate chain rotation). Be aware if your saw does not have these safety features.
- Consider how the selected tree fits into your overall stewardship plan as well as how its absence will affect the surrounding trees.
- Cut the tree following a directional felling plan that includes a planned escape route.



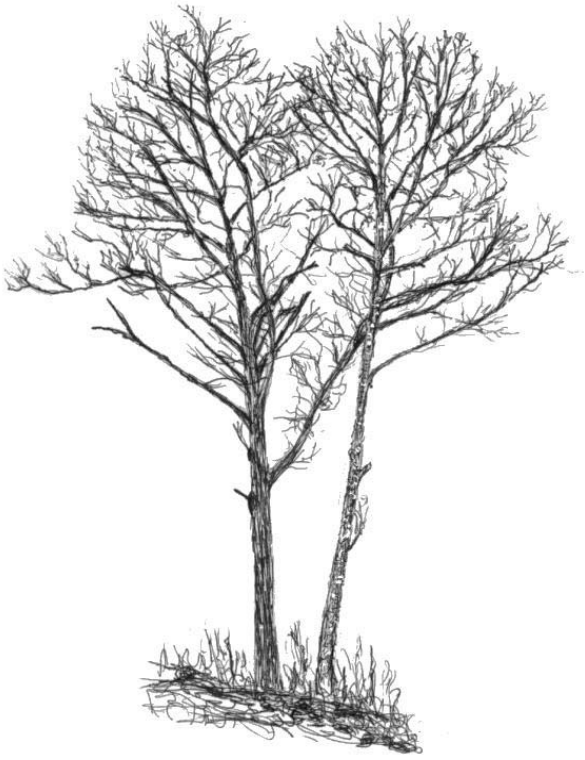
- Stay present and alert and stop before you get tired.

WHEN TO FELL

Early spring, before the trees leaf out, is the season most often suggested for felling trees and inoculating bolts for mushroom production however, other seasons should not be discounted. Because logs are usually inoculated soon after felling, bolts are typically not harvested during the winter months. However, it is possible to cut and inoculate during winter months and obtain yields in the spring of the following year. Farmers who tend to be very busy in the spring season may find this schedual more advanegeous.

BARK DURABILITY

For a healthy mushroom log, the bark should be intact. Damaged bark allows for greater chance of invasion by 'weed' fungi species and increased moisture loss. Over time, bark will naturally begin to slough off, but care should be taken to keep it on the bolts as long as possible. Cutting time affects the likelihood of the bark falling off, or slipping. In the winter months of full dormancy, before bud swell, bark is tighter, and therefore cutting during these months may help in preserving bark integrity*. Conversely, cutting in the summer months may lead to a greater incidence of bark slippage.



WHAT SIZE LOG SHOULD I USE?

All logs used in the experiment should be 36” and 40” in length. You can use logs between 3” to 8” in diameter. Smaller logs tend to produce a greater yield of shiitake per unit mass of log.

CREATING LOG STACKS

WHAT IS A LOG STACK?

A stack of 20 logs with the following properties:

- Same species of tree
- Same date felled
- Same inoculation date
- Same inoculation strain
- All logs shocked on same day

WHY IS IT NECESSARY

Rather than collect information on every log in your experiment, you will collect and report information on log stacks. Log stacks are stacks of 20 logs that have similar characteristics including tree species, fell date[1], and inoculation date.

Through the duration of the experiment, logs within log stacks will undergo the same treatments on the same days. For example, all the logs in a certain stack should be shocked on the same day in the same manor for the same length of time.

Every year, for the next three years, you will need to create 5 new log stacks, each with 20 logs. After three years, you will have 15 log stacks with 300 logs in circulation. It is very important to not mix logs from different stacks. Please keep track of log stacks by clearly marking each stack with a sign, tag, or flagging.

FREQUENTLY ASKED QUESTIONS

Do the logs need to be same size?
No. You will measure the diameter of each log at the beginning of each year.

What if a log becomes contaminated or broken during the experiment?
You can remove the log but please do not add a new log to replace it. Continue the experiment with 19 logs in that log stack. Be sure to note when and why the log was removed in your records

Do all the logs in a log stack need to be from the same tree?
No. Logs can come from any number of trees so long as all the logs are from the same species of tree.

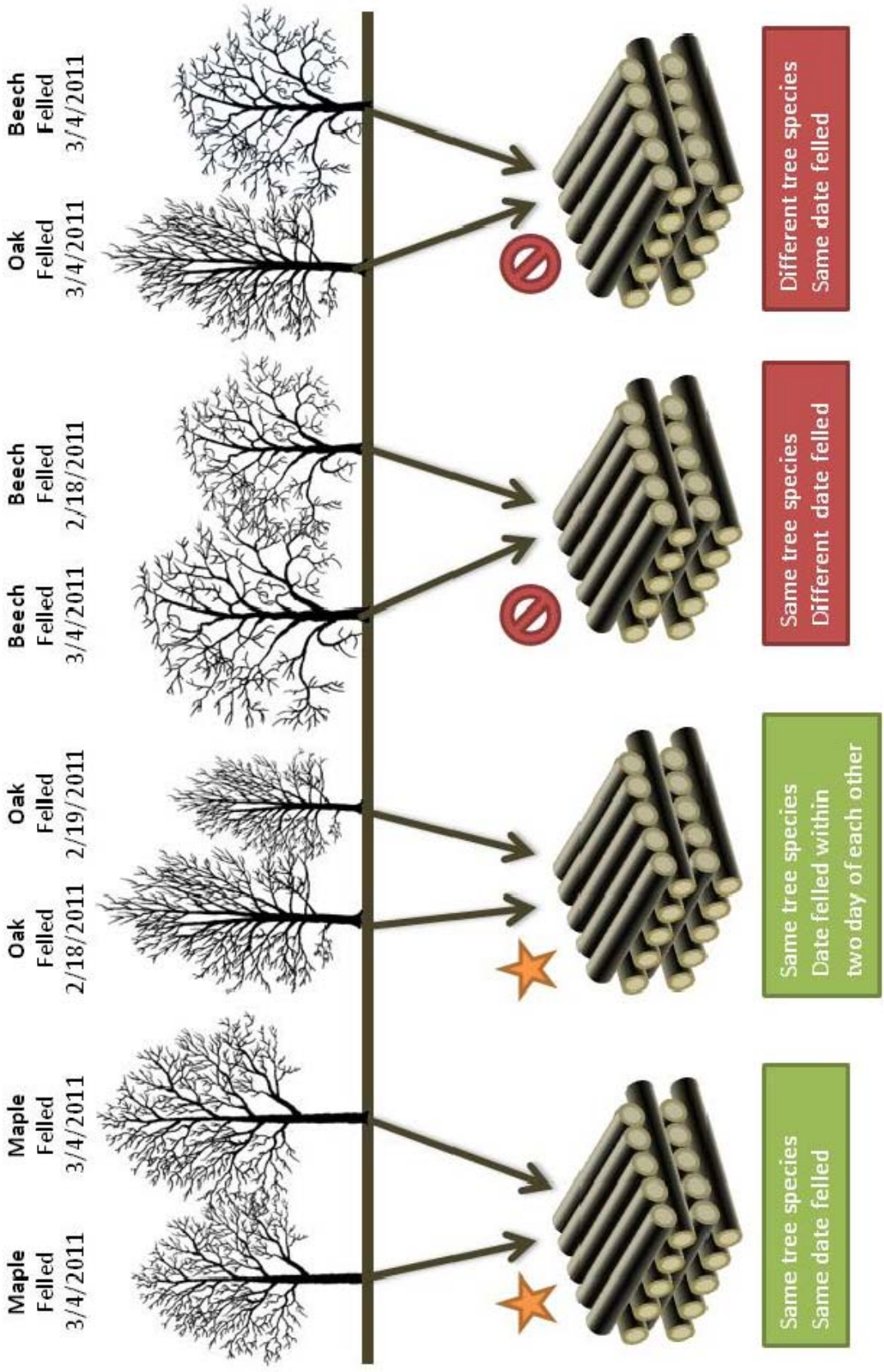
Do all the logs in a log stack need be from trees felled on the same day?
Yes, Ideally. If that is impossible for some reason, they can be felled within two days of each other.

Why do I need to measure every single diameter?
We need a way to estimate the weight and volume of logs in each of your log stacks so we compare your harvests not only from stack to stack but from farmer to farmers. By measruing every diameter we can eliminate the production biases that would arise if one farmer used 3 to 6 inch log and another farmer used 6 to 8 inch logs.

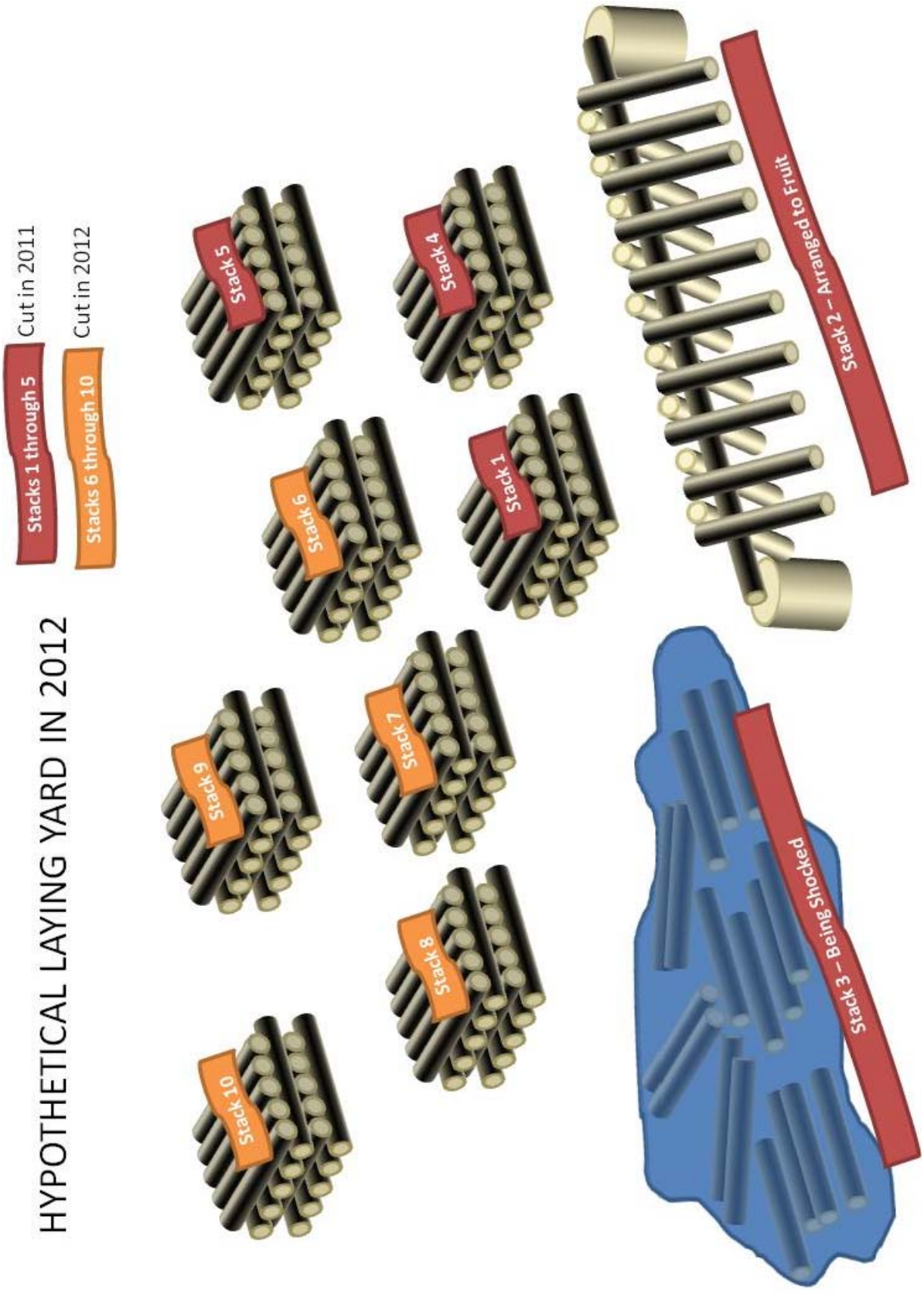
[1] Fell Date: The date the tree was cut down

How should I mark the stacks?
We recommend using spraypaint to mark the stacks.

EXAMPLES OF GOOD AND BAD LOG STACKS



HYPOTHETICAL LAYING YARD IN YEAR TWO (2012)



INOCUTING THE LOGS

HOW SOON AFTER FELLING THE TREE TO BEGIN INOCULATION

We recommend that the logs be stored between one week and three months before being inoculated.

Regardless of how long you wait to inoculate, do not store bolts in the sun. If a log is cut and left to sit for an extended period of time before inoculation other species of fungi can invade the log or log can dry out. It is undesirable for other species of fungi to be growing in the shiitake logs because they will be using the same food source, the cellulose and lignin in the log, and will therefore be in competition with the shiitake mycelium. If the log moisture content becomes too low, the mycelium will not colonize the log or will do so more slowly.

It has also been hypothesized that inoculating immediately after felling may be less effective due to the presence of natural fungicides synthesized by living trees. However, it unclear whether these compounds are present in the selected tree species at all. If so, initial levels are unlikely to severely affect the mass mycelia addition of inoculation.

HOW TO STORE THE SPAWN

Once spawn has been purchased, it is important to store it in conditions that will keep it alive. The spawn should be kept at about 4 C (39 F) ; too warm and it will grow mushrooms which will rot, too cold and mycelium may stop growing and die. Keep the spawn in a sealed plastic bag (try wrapping a second bag around an already opened batch) to prevent moisture loss. Small, deformed mushrooms may begin to grow in a bag of sawdust spawn. If this happens, simply break them up through the bag.

Spawn can be stored for up to 6 months under the right conditions. However, if the spawn dries out too much, the mycelium will die.

DRILLING HOLES FOR SPAWN

The first step in inoculation is drilling holes into the bolt. Outfitting an angle grinder with a drill bit is another method of drilling holes into the log. While equipping an angle grinder with a drill bit is expensive, it is possible to move very quickly with this tool, reducing the time spent per log. They are especially useful for larger operations.

For sawdust-based inoculation, use a 7/16" drill bit size and drill to a depth of 1.25". A diamond pattern should be used to maximize the speed of colonization. This is because mycelium grows faster with the grain than against it (length wise down the bolt rather than across it). More holes are not detrimental and in fact are likely to speed up colonization of the log. However, as spawn is an input cost, ideally the system is optimized for minimal use of spawn and maximal colonization.

After the holes are drilled, it is time to place the spawn in the holes, bringing the shiitake mycelium in contact with its new food source, the log. Stab the inoculation tool into the spawn once or twice, taking care that the tool is full place the tool over the hole and depress the plunger at the top to compact the spawn into the hole; the hole should be full so that the spawn is level with or just below the surface of the log. Repeat this process for all holes.

WAXING

Waxing the holes helps seal in moisture so that the spawn does not dry out. By sealing off the holes, the chance of contamination by competing fungi species is reduced.

During this step each hole is completely sealed using food grade wax. There are a number of different types:

- Food grade paraffin wax (Cheese wax) (cost: $27.50 - $35.00 / 10 lb)
- Beeswax (cost: $65 + / 10 lb)
  It may be possible to get lower quality beeswax leftovers from a local beekeeper for a lower price.

To melt the wax, place it in a metal pot or container that has been specifically designated for the purpose and then the pot is placed on a heat source. Electric skillets work particularly well. They are sturdy, portable, and the temperature control is easy. Otherwise, use a double boiler system to ensure the wax does not overheat. Heat water in a pot slightly larger than the chosen wax container. This is the outer pot. Place the pot with the wax (the inner pot) into the outer pot; sometimes a clamp is necessary to avoid floating of the inner pot. The inner pot should not touch the bottom of the outer pot. The heat will transfer to the water and then to the inner pot in an even and controlled manner.

If using cheese wax, the wax should be a clear liquid when applied. The melting temperature of cheese wax is about 145 F. Beeswax melts at temperatures between 144 and 147 F. Never leave melting wax unattended. Wax is highly flammable. If the melted wax is smoking, it is too hot. Immediately turn down the heat source or remove the pot of wax from the heat.

You can apply the wax in a number of different ways. Foam paint brushes ($0.50 - $0.80 / brush) are very effective and many people already own a foam paint brush. One to three inch brushes work best. These can be reused many times (until the brush comes off of the wooden handle). Cotton daubers ($30.00 / 144 pc = $0.21 / 1pc)) are cheaper than foam paint brushes, these small cotton balls on the end of a wire handle are available from select mushroom product suppliers. They can be reused and are very effective.

To apply the wax, use the chosen applicator to transfer the hot wax onto each hole in the log. Care should be taken to seal the hole. One dip of the applicator should complete a few holes. Re-dip the applicator and continue until all holes are covered.

ENDS OF THE LOG: TO WAX OR NOT TO WAX

Some growers choose to wax the ends of each mushroom log either by dipping the log directly into the pot of melted wax or by painting each end with a paint brush soaked in wax. Other growers choose to skip this step. The importance of this step may vary based on climate, which largely governs how crucial it is to strictly manage moisture levels. Waxing the ends will keep moisture in and prevents competitive fungi from gaining a foothold. However wax also is one of the main production costs and the waxing process adds considerable time to the inoculation process. A cost-benefit analysis of additional wax cost and shiitake yield has not yet been conducted.

THE LAYING YARD

WHAT IS A LAYING YARD?

A laying yard is the outside space in which mushroom production takes place. After bolts are inoculated they are placed in a laying yard to allow the mycelium to colonize the log. This period of time is called spawn run and takes five to seventeen months. The logs usually remain in the laying yard for the rest of their productive lifetime, which includes both fruiting and harvest.

SHADE

Adequate shade is crucial to mycelium growth. Because the mushroom mycelium will die if the log becomes too dry, it is important not to expose logs to sustained direct sunlight. An evergreen canopy is ideal because it provides year-round shade. A deciduous canopy provides shade during the late spring, summer, and early fall months, but not in the winter when the trees have lost their leaves. During the winter months it is therefore necessary to provide extra shade. If the laying yard is in a climate with heavy snowfall and the logs are low enough to the ground, it may be that the sustained snow cover is enough shade for the logs. If not, an artificial shade method can be used. Shade cloth can also be used to provide artificial shade. It can be bought in a variety of shade percentages, materials, sizes, and colors. It is easy to transport and can be added or removed whenever necessary.

WATER

A water source is necessary for fruiting under a forced production model as well as for maintaining a threshold moisture level in the logs. It is simplest to have a laying yard that is exposed to inclement weather such as rain and snow. This will reduce the need for external water sources. Take into consideration how close and convenient each possible water source is. Particularly think about locomotion through the laying yard and common use patterns. If there is a dry spell and the logs must be wetted to maintain moisture levels, logs may be submerged under water or dampened under a sprinkler. It is critical that the moisture content of the logs does not fall below a threshold level necessary for the survival of the mycelium. Logs typically begin at about 40 -45 % moisture content and should not drop below 20 %.

STACKING METHOD

CRIB STACK (RICK STACK)

- Crib stacks are simple and quick to make. First four to five logs are laid down on a flat surface, then four to five logs are placed on top of them in the opposite direction; the pattern is continued until there are no more logs or the stack would be unstable with more logs.
- In this technique only the logs on the top of the pile are easily accessible making it inconvenient for fruiting and harvest.
- Crib stacks are a very space efficient way to keep logs as they make use of vertical space, compactly storing large numbers of logs.
- This stacking method is excellent for the spawn run period. It is also good for the winter when logs are dormant although it tends to elevate the logs above snow cover, which may be undesirable for some growers.

HIGH A-FRAME

- A high A-frame consists of logs leaning upright on one or two sides a supporting beam, such as a cut sapling lashed horizontally onto two trees or a taut wire.
- This stacking method works well for the fruiting and harvest stages. Logs are well aerated, mushrooms are easily visible, and picking is easy as there is maximum access to each log. Because the log is vertical, slug damage to mushrooms may be less than when logs are fruiting closer to the ground.

- Because logs stacked in A-frames take up a lot of space in a laying yard, they are usually not left on the A-frame for any other part of the process; this is especially true for a forced production model.

LOW A-FRAME

- A low A-frame is similar to a high A-frame except that the supporting beam is low to the ground or on the ground.
- This stacking method has similar advantages and disadvantages as the high A-frame. Slug damage and contamination may be greater than with the high A-frame as logs are lower to the ground (?).
- Logs are kept in a low A-frame year round will receive greater snow cover than those kept in a high A-frame year round.

JAPANESE HILLSIDE STACKING METHOD

- This stacking method is more complex to set up, but allows for mushroom production on hills and mountainsides.
- This technique creates a very stable, aerated stack in which mushrooms are highly visible and easy to pick. The majority of logs are raised off the ground, potentially reducing slug damage.
- The disadvantages of this method are that (1) only logs at the top are moveable and (2) it can be hard to incorporate into a forced production model. Stacking and unstacking logs is time consuming and can be particularly labor intensive on a steep incline. A water source for shocking, necessary for forced production, can be tricky to set up without flat ground and developing a rotation schedule for fruiting logs can be challenging due to the fixed nature of the stacks.

FRUITING

In a natural production model, growers do not do anything to the mushroom logs to make them fruit. Logs are left to fruit naturally, having heavy flushes either when there is heavy rainfall or when a temperature change encourages fruiting. In a forced production model, growers control when logs fruit. Logs may sometimes also fruit naturally, but the majority of harvests are induced according to a preplanned log rotation schedule. Because yields can be predicted and kept relatively constant in this model, it has greater retail potential.

SHOCKING

Shocking, or forcing, is the process used to induce logs to send up fruiting bodies. Soaking logs in cold water for an extended period of time or exposing the logs to blunt impact (e.g. dropping them on end or hammering on them) are the two methods of shocking logs in a forest farming setting. Soaking the logs is most typical.

To soak the logs, place them in the water source for anywhere between 8 and 36 hours. Typically older logs should soak for longer than young logs. When the logs are removed they are stacked in a way that will be conducive to the upcoming harvest. In 3 – 5 days, the log will begin pinning, or sending up the beginnings of mushrooms. These will grow and develop into full-sized shiitake mushrooms (See Harvest for when to pick).

HOW OFTEN TO SHOCK

After fruiting, logs need to be rested for 6 - 8 weeks before being forced again. The more often the logs are shocked, the shorter their lifetime is likely to be. Shocking twice a season is reasonable. Some growers prefer to slow to once a season in the third and fourth production years.

It should be easy for the grower to identify which logs have been shocked when in the laying yard. Growers can and should develop a plan that takes into account the number of times each log will be forced a season, when logs will be forced, how logs will move through the laying yard, when mushrooms are needed, when the plan predicts mushrooms will be available, and when logs will be retired at the end of their lifetime.

HARVESTING

It is not the size of the mushroom that determines when it is picked, but its growth progress. Gills should be visible (or tangible) on the mushroom. The outer edge of the mushroom should be slightly curled under, but not tightly so. If the edge has flattened out, the mushroom is slightly over ripe, but still edible. Shiitake are usually ready 7 - 10 days after shocking; colder temperatures will slow growth and ideal conditions will make it more rapid.

HOW TO PICK

Using a knife is quick, easy, and ensures a clean cut on the stem. It also does not rip or damage any bark. It is also possible to pick mushrooms by hand, but it easier to accidently remove the bark this way.

HOW MUCH TO EXPECT

Mushroom logs will peak production in their second and third years. At this time it is reasonable to expect 0.5 lb per log per flush.

STORING FRESH MUSHROOMS

Never store fresh mushrooms in a plastic bag. Use paper bags and keep them refrigerated.

MARKETING AND CONSUMPTION

IDEAS TO HELP YOU DEVELOP A MARKET

- Talk with people in your area. Get your name and business out there so people know what you sell and how they can reach you. Be friendly, not pushy.
- Offer free samples, recipes, or pamphlets to help customers realize how tasty and fun mushrooms can be.
- Talk with local chefs to see it they might be interested in your product. It's nice if you have some information to leave them that has your contact info clearly visible.
- Ask if they would like you to bring in sample product. Perhaps they would like some to trial before they buy.
- If certain restaurants are willing to buy particularly large quantities, consider offering a bulk discount.
- Grocery stores will most likely pay lower prices than selling at other venues, but can handle a lot of product on a regular basis.
- Stores that put emphasis on buying locally or eating healthy foods are good choices for your product. At the right venue, your buyers will be pleased to have a great product like yours that makes the store look good to consumers.

KEEPING A MARKET

- Make sure that the mushrooms you are selling are always top quality and as fresh as possible.
- Be considerate of your buyers.
- Communicate; listen to what your buyers need and when. Be open to hearing their thoughts.
- Try to be consistent with delivery times and quantities. If you have promised a certain amount of product, make sure you have planned that into your rotation schedule.

RECORD KEEPING

LABOR WORKSHEET DESCRIPTION

Please record the total number of hours you, your friends, or your employees spent cultivating and selling shiitake mushrooms.

FIELD DESCRIPTIONS

DATE: The date the work was completed

AFFILIATION CODE: The person or persons who completed the work. Please choose from the categories of Owner, Volunteer or Employee. See the chart below for more information.

CODE	DESCRIPTION
OW	**Owner** *You, your partner, or any family members not being paid to complete the task but expect to be compensated by profits generated from the enterprise.*
VO	**Volunteer or Friends** *Any person that is not being compensated with money and does not expect any portion of the net profit. This includes volunteers at a training event or gatherings wherein assistance on a task is obtained in return for something like pizza and beer.*
EM	**Employee** *Any person you employ or pay a wage. This may include family members or friends if that person is being paid any regular salary or stipend.*

NO. OF PEOPLE: The number people who completed the work who are of the same affiliation code.

HOURS: The number of hours spent working on a task

WAGE: The hourly wage your employee is paid. Leave blank for any work completed by owners, volunteers or friends

LABOR CODE: Generalize what task best describes the work.

CODE	DESCRIPTION	CODE	DESCRIPTION
LY	**Laying Yard Maintenance**	**PP**	**Processing and Packaging Shiitake** *Cleaning, Drying, Bagging and Boxing Shiitake for Sales*
CT	**Cutting and Felling Trees**	**AD**	**Advertising** *Talking to restaurant owners, stores, etc.*
IN	**Inoculating Logs**	**SA**	**Selling Mushrooms** *Time spent at Farms Markets or grocery stores*
SH	**Shocking / Forcing Logs**	**TR**	**Transporting Shiitake** *Driving to and from sales*
HA	**Harvesting Shiitake**	**OT**	**Other**

AN EXAMPLE

The owner of the shiitake business, his wife, and his four friends spend six hours inoculating logs on April 19th. Three days later, the owner pays his son fifty dollars to spend five hours to arrange the logs in the laying yard.

DATE	AFFILIATION CODE	NO. OF PEOPLE	HOURS	HOURLY WAGE	LABOR CODE
4/19/11	OW	2	6	n/a	IN
4/19/11	VO	4	6	n/a	IN
4/21/11	EM	1	5	10.00	LY

FREQUENTY ASKED QUESTIONS

LABOR WORKSHEET

DATE	AFFILIATION CODE	NO. OF PEOPLE	HOURS	HOURLY WAGE	LABOR CODE

AFFILIATION CODES:
OW: Owner
VO: Volunteer or Friend
EM: Employee

LABOR CODES:
SH: Shocking
AD: Advertising
LY: Laying Yard Maintenance
HA: Harvesting Shiitake
TR: Transporting
CT: Cutting Trees
PP: Processing/Packaging
OT: Other
IN: Inoculation
SA: Sales

EXPENSES WORKSHEET DESCRIPTION

Please record all of your equipment and supplies expenses and what aspect of the operation they benefit.

FIELD DESCRIPTIONS

DATE: The date the item was bought

ITEM: A brief description of the item

Cost: Total cost of item or items.

DURABLE? Is the item a durable good? Write "Y" for yes and "N" for no. A durable good is one that does not quickly wear out or more specifically, one that yields utility over time rather than being completely consumed in one use. They are typically characterized by long periods between successive purchases or items that are not immediately consumed.. If you are unsure if an item could be characterized as durable or non-durable, please write "?". Examples of durable goods include a chainsaw, a drill bit, a tub for soaking logs, and scale for weighing mushrooms. Examples of non-durable goods include chainsaw bar oil, cheese wax, bags for mushrooms,

USE CODE: What area of production or sales is the item for? See the chart below.

CODE	DESCRIPTION	CODE	DESCRIPTION
LO	**Logs Purchases**	**PR**	**Processing (Cleaning, Drying Etc.)**
CT	**Tree/Log Cutting Equipment**	**PA**	**Packaging**
IN	**Inoculation Equipment**	**AD**	**Advertising**
SH	**Shocking/Forcing Supplies**	**TR**	**Transportation Costs**
HA	**Harvesting Supplies / Equipment**	**OT**	**Other**

AN EXAMPLE

The owner of the shiitake business buys a dehydrator for $50.00 and three boxes of plastic bags for $10.00 dollars each. He also pays a graphic designer $200.00 to design a label for his mushrooms and then buys 100 labels at $1.00 each.

DATE	ITEM	COST	DURABLE?	USE CODE
5/1/12	DEHYDRATOR	50	Y	PR
5/1/11	PAPER BAGS	30	N	PA
5/13/11	LABEL DESIGN	200	Y	AD
5/25/11	LABELS	100	N	PA

FEQUENTLY ASKED QUESTIONS

Should I add the cost of labor and wages?

No. Do not include any payments you make for labor in this chart. Please include that in the chart above.

Should I include mileage on my vehicle as an expense?

Yes. Include any mileage under the "Use Code" Transportation Costs at the rate of $0.50 per mile

Should I include items like chainsaws which have multiples uses?

Yes. Include these items. We will take that into account when we complete the overall analysis.

It this where I record supplies for making value added products (containers/jars, other food stuffs, cooking equipment)

Yes. Some of these expenses would be durable (cooking equipment) and some are not (containers, food stuffs).

EXPENSES WORKSHEET

DATE	ITEM	COST	DURABLE?	USE CODE

USE CODES:	LO: Log Purchases	CT: Tree Cutting	IN: Inoculation	SH: Shocking
	HA: Harvest	PR: Processing	PA: Packaging	AD: Advertising
	TR: Transportation	OT: Other		

LOG STACKS WORKSHEET DESCRIPTION

The following pages provide us with information about your log stacks.
You need to complete these records only once, in the spring, for every log stack.

FIELD DESCRIPTIONS

STACK NO: Number 1-5 correspond to the first year, 6-10 are for the second year, etc.

TREE SPECIES: The tree species the logs belong to

DATE FELLED: The approximate date the trees which you obtained the logs for were felled. If a stack contains logs from multiple trees felled at different times but within a two week range, chose a central "average" date.

DATE INOCULATED: The date the logs were inoculated with spawn.

IDENTIFYING: This field is for you to record how you are marking the logs for your identification purposed. This field is not required.

LOG DIAMETER: Record the Diameter of each log in the log in these boxes in either Inches or Centimeters rounding to the nearest centimeter or half inch.

EXAMPLE

Stack No.	Tree Species	Date Felled	Date Inoculated	Identifying Features
1	Sugar Maple	March 10, 2011	5/5/2011	Red Flagging

Log Diameters				
6	7	6.5	7	5
4.5	5	6.5	3.5	3.5
8	3.5	3	6	6
7	5	5	5.5	5
4	7	7	3.5	4

FREQUENTLY ASKED QUESTIONS:

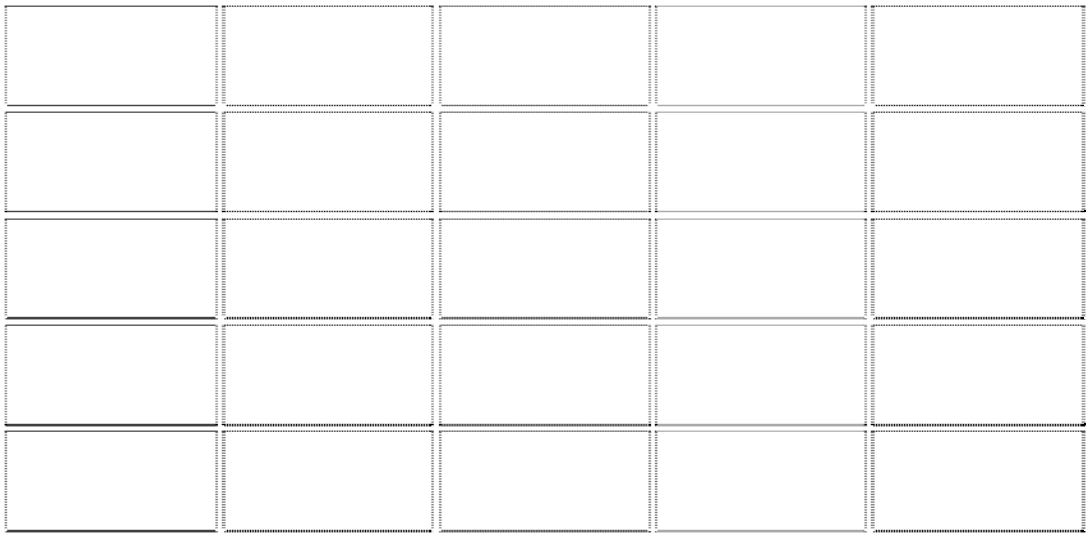
What if I bought my logs from someone who doesn't know when they were felled?
Try you best to a good educated guess from them. You should be able to at least narrow them down to a month.

LOG STACKS WORKSHEET

1

Stack No. | Tree Species | Date Felled | Date Inoculated | Identifying Features

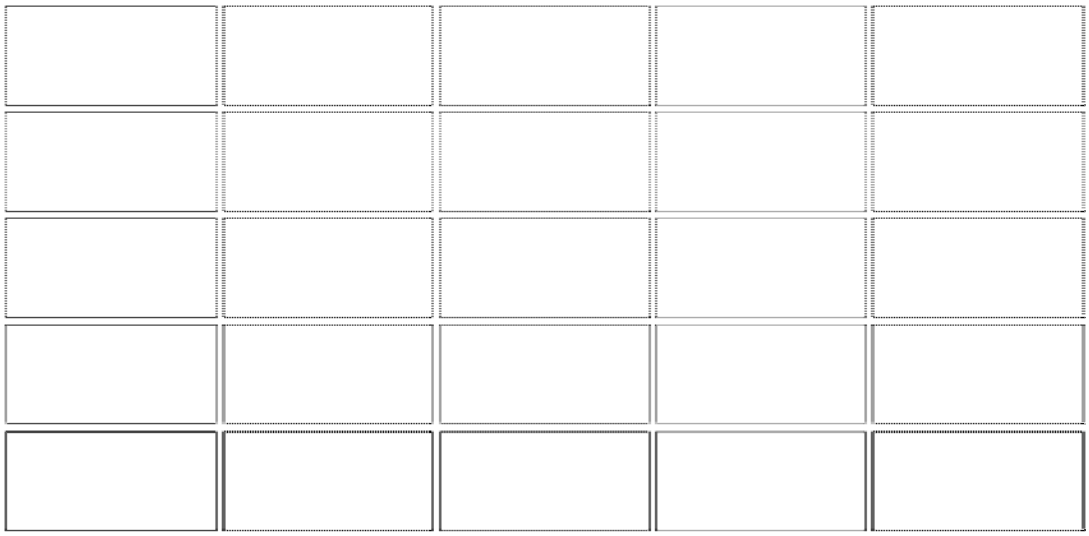
Log Diameters



2

Stack No. | Tree Species | Date Felled | Date Inoculated | Identifying Features

Log Diameters



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DATE FELLED: The approximate date the trees which you obtained the logs for were felled. If a stack contains logs from multiple trees felled at different times but within a two week range, chose a central "average" date.

DATE INOCULATED: The date the logs were inoculated with spawn.

IDENTIFYING: This field is for you to record how you are marking the logs for your identification purposed. This field is not required.

LOG DIAMETER: Measure the diameter of every log in your stack to the nearest centimeter. Then tally on the worksheet how many logs in a given stack are of an approximate diameter. See example below.

EXAMPLE

Jane cut down an oak tree on March 3rd and cut it into 27 logs. She measured the diameter of each log and recorded the following numbers: 5, 7, 8, 4, 4, 4, 6, 7, 3, 5, 7, 7, 8, 4, 7, 8, 4, 5, 5, 7. She then put a blue spay-paint slash on the end of every log. She inoculated the logs on March 23rd.

Stack No.	Tree Species	Date Felled	Date Inoculated	Identifying Features
4	Oak	3/3/2011	3/23/2011	Blue slash

3 cm	4 cm	5 cm	6 cm	7 cm	8 cm
1	5	4	1	6	3

TOTAL NO. OF LOGS AT IN EACH SIZE CATEGORY

FREQUENTLY ASKED QUESTIONS:

What if I bought my logs from someone who doesn't know when they were felled?
Try you best to a good educated guess from them. You should be able to at least narrow them down to a month.

LOG STACKS WORKSHEET

1

Stack No. | Tree Species | Date Felled | Date Inoculated | Identifying Features

NO. OF LOGS AT APPROXIMATE LOG DIAMETERS

2

Stack No. | Tree Species | Date Felled | Date Inoculated | Identifying Features

NO. OF LOGS AT APPROXIMATE LOG DIAMETERS

3

Stack No. | Tree Species | Date Felled | Date Inoculated | Identifying Features

NO. OF LOGS AT APPROXIMATE LOG DIAMETERS

4

Stack No. | Tree Species | Date Felled | Date Inoculated | Identifying Features

NO. OF LOGS AT APPROXIMATE LOG DIAMETERS

FRUITING WORKSHEET DESCRIPTION

Each time your shock your logs by submersing them in water, please record the day the log were submerged in the water and the log stack. After the logs are shocked and begin to fruit, you will need the weigh the mushrooms produced by log stack every day for the entire period they are fruiting.

FIELD DESCRIPTIONS:

STACK NO: The log stack number of the logs you are harvesting from

DATE OF SHOCKING: The date the logs were first submerged

FIRST FRUITING DAY: The first day you find mushrooms fruiting on the logs after they have been shocked.

DAY 1 PRODUCTION: The fresh weight of all mushrooms produced by the log stack on the first day they begin to fruit.

DAY 2 PRODUCTION: The fresh weight of all mushrooms produced by the log stack on the second day since they begin to fruit.

FREQUENTLY ASKED QUESTIONS

What if my bolts fruit for more than 12 days?
If your logs produce shiitake mushrooms for more than 12 days, make a note on the worksheet and continue on the next line. Therefore, in the "Day One" box write the "Day 13" value for pounds of shiitakes produced. Be sure to make this clear on the worksheet by writing "Continued" in the "First Day Shocked" box.

I don't have a scale. What should I do?
You will need to purchase a scale in order to participate in the project. The scales should cost between $20.00 and $30.00 dollars. We recommended searching the term "Food Scale" online to see a variety of models. The one pictured to the right, for example, costs only 20 dollars.

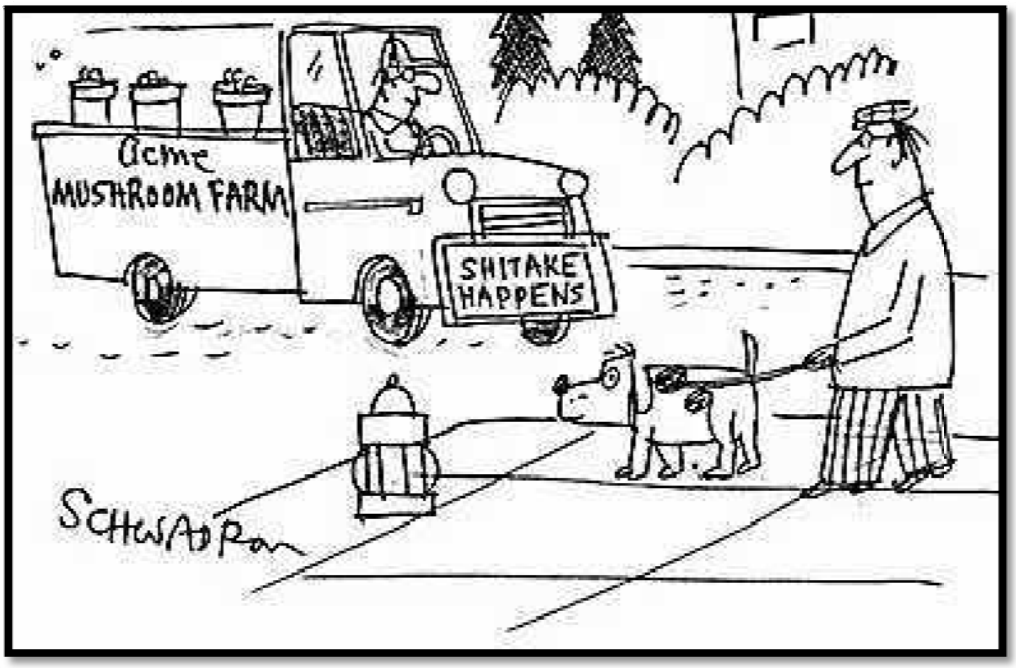
Do I need to record everything in pounds?
No. You may record the shiitake weights in whatever units yours scale provides. Just make it clear what units you are using on the top of the worksheet.

I missed a day. What should I do?
If you skipped a day, simply write "0" in the box corresponding to that day and continue on.

FRUITING WORKSHEET

Stack No.	Date Shocked	Date of First Fruiting	*Shiitake Fresh Weight Production per Day (lbs.)*											
			Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**

SALES WORKSHEET DESCRIPTION



We would like you to record all of your shiitake mushrooms sales – specifically where you are selling your mushrooms, what quantity you are selling, and how much money you are making. For record keeping purposes, we'd like you to separate your sales of fresh mushrooms from your sales of value-added products like dried shiitake mushrooms, shiitake baked goods, shiitake pâté, etc.

FRESH SHIITAKE SALES WORKSHEET DESCRIPTION

Use the following worksheet to record your sales of fresh shiitake mushrooms. This is also the place where you will need to record the weight of any mushrooms culled (thrown-out).

FIELD DESCRIPTIONS:

Date: The date the sale took place.

Location Code: Where are you selling your product? Choose one of the codes below.

CODE	DESCRIPTION
RE	**Restaurant**
GS	**Grocery Store**
FM	**Farmer's Market**
DS	**Direct Sales**
	Sales directly from your farm such as a farmer's stand
OT	**Other**

Pounds Sold: Record the fresh weight, in pounds and ounces, of your shitake mushroom sales.

Pounds Sold: Record the fresh weight, in pounds and ounces, of any shiitake mushrooms that were culled (thrown out or unsellable).

Earnings: Record the amount of money you received through the sale of the shiitake product.

EXAMPLE

The owner of the business sells 20 pounds of mushrooms each week to a local restaurant at $10.00 dollars a pound. She also attends a farmers market where she sells 10 pounds of fresh mushrooms at $15.00 per pound. After the market, she was left with 2 pounds of unsold mushrooms which, having sat in the sun all day, were no longer good enough to sell.

DATE	LOCATION CODE	POUNDS SOLD	POUNDS CULLED	EARNINGS
8/1/11	RE	20	0	200
8/4/11	FM	10	2	150

FRESH MUSHROMS SALES WORKSHEET

DATE	LOCATION CODE	POUNDS SOLD	POUNDS CULLED	EARNINGS

LOCATION CODE: RE: *Restaurant* FM: *Farmer's Market* GS: *Grocery Store* DS: *Direct Sales* OT: *Other*

VALUED ADDED SHIITAKES SALES WORKSHEET DESCRIPTION

Use the following worksheet to record your sales of any value-added shiitake product including dried and processed mushrooms.

FIELD DESCRIPTIONS:

Date: The date the sale took place.

Location Code: Where are you selling your product? Choose one of the codes below.

CODE	DESCRIPTION
RE	**Restaurant**
GS	**Grocery Store**
FM	**Farmer's Market**
DS	**Direct Sales** *Sales directly from your farm such as a farmer's stand*
OT	**Other**

Description: Describe the product. Was it a spread, baked good, dried mushrooms, etc. Include an estimate of size, if applicable. For examples, how large was the jar of shiitake pâté?

Quantity: How many items or how many pounds of items did you sell?

Earnings: Record the amount of money you received through the sale of the shiitake product.

EXAMPLE

At a farmers market, the business owner sells 10 jars of tomato sauce with shiitake mushrooms. Each jar had approximately 2 pound of fresh mushrooms and sold for $8.00 a jar. In addition, he sells 15 pieces of Shiitake pizza at $4.00 dollars a slice. She estimates that every piece of pizza had 0.1 pounds of mushrooms on it. Lastly, he sells 5 pounds of dried mushrooms for $20.00 a pound.

DATE	LOCATION CODE	DESCRIPTION	QUANITY	EARNINGS
8/1	FM	16 oz jar of tomato sauce	10 jars	80
8/1	FM	Shiitake Pizza	15 slices	60
8/1	FM	Dried	5 lbs	100

VALUE ADDED SHIITAKE SALES WORKSHEET

DATE	LOCATION CODE	DESCRIPTION	QUANITY	EARNINGS

LOCATION CODE: RE: *Restaurant* FM: *Farmer's Market* GS: *Grocery Store* DS: *Direct Sales* OT: *Other*