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FOR-82

KENTUCKY SHIITAKE PRODUCTION WORKBOOK

Monitoring Moisture Content of Logs

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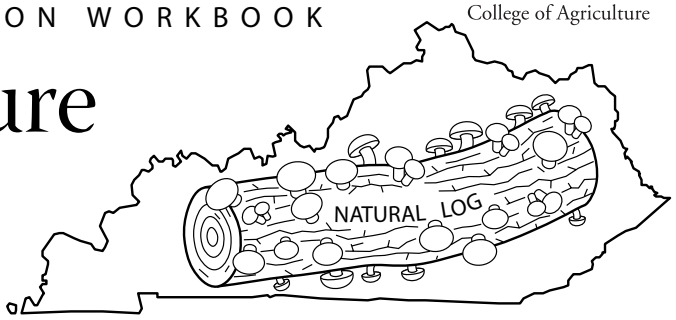


Shiitake spawn cannot survive in logs that have a moisture content (the amount of available water in the log, expressed as a percent) of less than 23%. Ideal moisture conditions for shiitake growth are log moisture content (LMC) of 35% or more. If logs are left in the open air and are not monitored for moisture content, and climatic conditions are dry (less than 1 inch of precipitation per week), the moisture content of the logs can fall to 20% to 25%. Once you have determined the original weight of the log, do not let it lose more than 10% of its original weight. For example, if your log weighs 30 pounds to start with, don't let its weight drop below 27 pounds.

When logs dry out completely, they can no longer absorb water to increase their moisture content when soaked. It is, therefore, very important that shiitake growers monitor the moisture content of their logs on a regular basis. Depending on year-round weather conditions, that could mean once a week or once a month. There are several ways to determine moisture content.

Log Weight

The simplest way to determine moisture content is to weigh the logs *at the time of inoculation,* either on a scale or simply by "heft" (how heavy the log feels when you lift it). Assuming that your production program has been started accurately, that is, the logs are freshly cut from living trees, regardless of the time of year, the logs should be fully hydrated or holding as much moisture as they can. Then, if the weather becomes dry, you can simply re-weigh the logs to determine if the weights are going down.

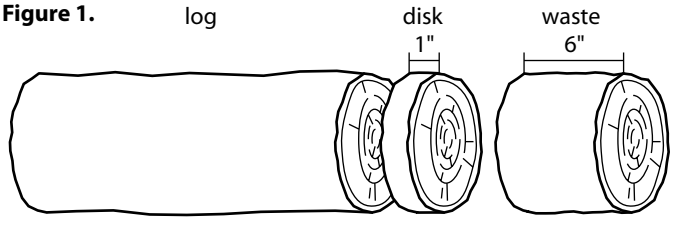
Watching the weather is the most useful thing you can do at this time. If the logs are outside in an incubation or laying yard that is 85% to 95% shaded, and there is rainfall on a regular basis (adding up to at least an inch of rain per week), the level of log moisture is not a problem. If, however, there is a dry spell, especially shortly after the logs have been inoculated, it is important to check them frequently to see if the weights are remaining constant. If the weights begin dropping, you should water the logs with a hose, soaking them thoroughly, every week or every few days if it is especially hot and dry.

Calculating Log Moisture Content

A more formal way of checking the moisture content of the logs is by actually calculating what the dry weight of selected moisture-content logs would be by taking a sample of each of those logs. This is not only a more accurate way of determining moisture content, but it also involves fewer logs.

Select about five logs for every 100 logs in your shiitake production operation. Mark them with special tags so you can find them when you need to re-weigh them, and make sure they are evenly distributed in the log stacks. You can use paint spots, aluminum tags, or plastic flagging to mark them differently from the other logs. The process is as follows on the next page (see Figure 1):

Figure 1.



1. Select the logs for moisture-content monitoring at the time of inoculation.
2. Cut a section about 6 inches from one end of each of the logs whose moisture content you have selected to monitor.
3. Discard the small end and cut another disk, about 1 inch in width, from the freshly cut end of each log.
4. Weigh the small disk immediately and record that weight (use a scale that can also record the weight of the remaining piece of the log).
5. Make sure the disks are marked with a marker so you know which section goes with which log.
6. Weigh the remaining section of each of your selected wet logs and make certain each is also marked so you will be able to match the logs with their disks.
7. Record the weights of the logs.
8. Place the disks in a warm oven (150° to 200°F) and leave them overnight with the door of the oven left ajar (most oven doors will let you leave the door partially open).
9. In the morning, weigh the disks again and record the new weights.
10. Place the disks back in the oven and leave them for another hour.
11. Re-weigh the disks. If there is no change in weight from the previous weighing, you have your final oven-dry weight of the disks. If there **is** a change in the weight, put the disks back for another hour and re-weigh them after that.
12. Continue drying and weighing until the disks no longer lose weight.

The final weight of the disks is called their dry weight (DW).

To calculate the Log Moisture Content (LMC) of the disks from the wet logs, follow either Equation 1 or the Alternate Method.

Equation 1:

$$\frac{\text{(wet weight - dry weight)}}{\text{wet weight}} \times 100 = \%\ \text{disk moisture content}$$

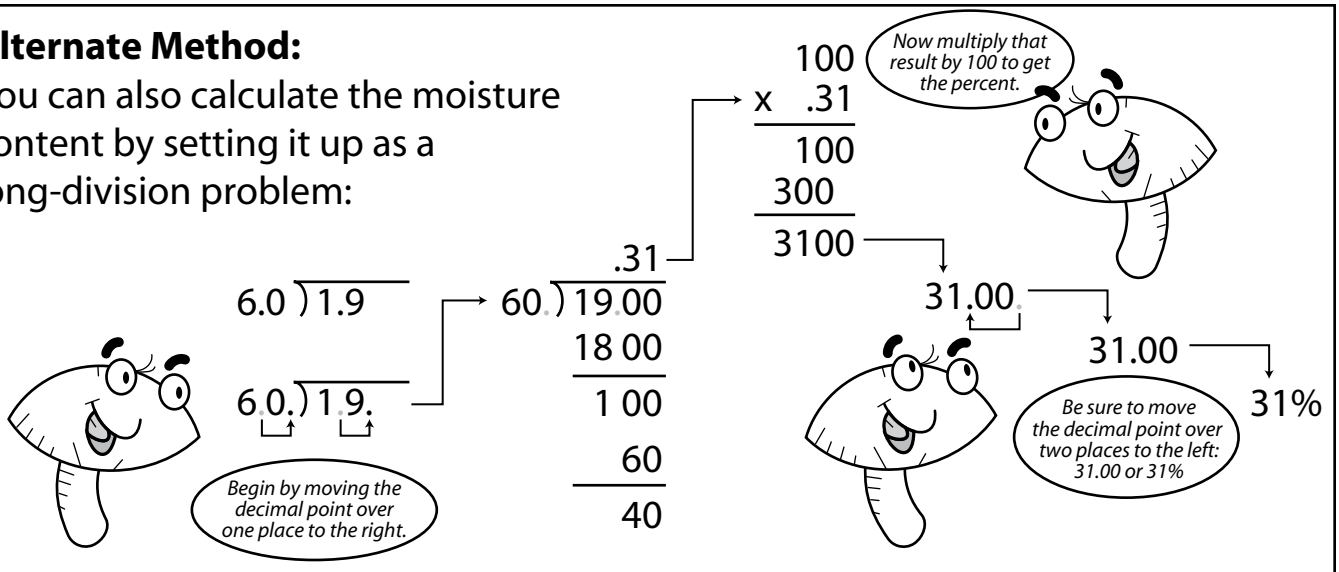
OR

$$\frac{\text{(WW - DW)}}{\text{WW}} \times 100 = \%\ \text{DMC}$$

Assume that the disk weighed 6 ounces to begin with, and 4.1 ounces after drying. The equation would be:

1. $\frac{(6.0 - 4.1)}{6.0} \times 100 = \%\ \text{DMC}$
2. $\frac{1.9}{6.0} \times 100 = \%\ \text{DMC}$
3. $.31 \times 100 = \%\ \text{DMC}$
4. $31\% = \%\ \text{DMC}$

Alternate Method:
You can also calculate the moisture content by setting it up as a long-division problem:



To calculate the log moisture content for the remaining sections of the selected logs, use the same information. You already know the moisture content from the disk of the log. You need to calculate the dry weight of the remainder of the log, which is called the calculated dry weight (CDW). Assume that the remaining log weighs 21 pounds. Calculate the log's dry weight as follows:

Equation 2:

$$\text{log (fresh) wet weight} - \frac{\text{\% disk moisture content} \times \text{log wet weight}}{100} = \text{calculated (log) dry weight}$$

OR $\quad LWW - \frac{(\%DMC \times LWW)}{100} = CDW$

1. $\quad 21 - \frac{(31 \times 21)}{100} = CDW$

2. $\quad 21 - \frac{(651)}{100} = CDW$

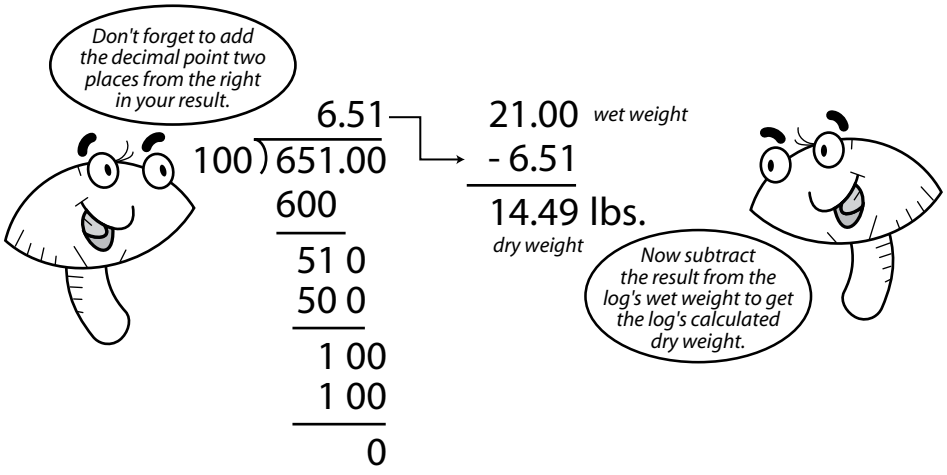
3. $\quad 21 - 6.51 = CDW$

4. $\quad 14.49 \text{ lbs.} = CDW$

Now it is clear that if your test log weighs 23.7 pounds or more, the LMC is at a healthy level (35% or more). If it drops down to 21 pounds, the log is at 31% LMC and if the weight continues to drop, the logs will need watering to keep the spawn alive and growing.

Alternate Method:

Follow Equation 2 for Steps 1 and 2. After you've performed Step 2, set up the fraction as a long-division problem:



Moisture-Monitoring Probes

Electronic devices can be purchased that are used to determine the moisture content of lumber as it is being dried for consumer use. It is possible that these devices, which either use a single electronic probe or a pair of them, could also be used to determine the moisture content of the logs. These pieces of equipment cost $100 to $200, and you may or may not find them to be worth the cost. On one hand, these devices can get the information you need quickly and easily. On the other hand, they may not be reliable in measuring moisture in something as dense as a log. There is information on these items in the publication *Kentucky Shiitake Production Workbook: Resources* (FOR-89).

Conclusion

All mushrooms like moisture, and shiitake are no exception. High heat and dry weather conditions are the greatest danger to keeping the shiitake spawn alive. Warm, moist conditions are especially important for the shiitake logs during the incubation period, when the shiitake organism is working its way around the log and is located primarily right under the bark, making the spawn highly vulnerable to weather conditions.

When the logs are a year or more old and have already successfully produced shiitake mushrooms, the moisture content of the log next to the surface is less important. During the whole productive lifetime of the shiitake log, however, it is very important to make sure that the log contains adequate moisture.

Acknowledgment

This information was adapted from *Growing Shiitake Mushrooms in a Continental Climate* by M. Kozak and J. Krawczyk. 1989.

Shiitake and Roast Turkey Pot Pie

2 cups milk
½ medium oinion
1 each clove
1 each bay leaf
3 tablespoons cornstarch
6 ounces water
1 stalk celery, medium dice
½ medium onion, medium dice
1 each carrot, medium dice
1 cup shitaki mushrooms, stems removed, sliced
½ cup peas
4 ounces turkey breast(chicken can be substituted), diced
1 each pie crust, par baked

1. In a heavy pot combine the milk. onion half, bay leaf, and clove, and bring to a boil.
2. Add the water and cornstarch slurry to the boiling milk to thicken, season with salt and pepper. This mixture will be very thick, this is so it can soak up the excess moisture from the vegetables. Strain through a seive.
3. Par boil the peas and carrots, saute the onion and celery, and shiitake mushrooms.
5. In a large bowl combine the vegetables with the sauce, add the diced turkey.
6. Add the entire mixture to the pie shell, top with pie dough.
7. Bake in a 350* for 30 minutes till golden brown.

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