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By George de Piro

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MALTING

*M*alting your own grain is labor intensive, time consuming, and infinitely more fun and educational than reading a book (or magazine article!) about it. An in-depth knowledge of malt is key to formulating outstanding beers. To truly understand the malting process one must get one's hands dirty and actually do it.

Like commercial malting, home malting can be separated into three basic steps: steeping, germination, and kilning.

Steeping is performed to bring the relatively dry grain to a moisture content of about 45% so that germination can commence. During this phase the grain will be alternately submerged in water and then drained and allowed to rest. The sequence and timing of these phases vary based upon the character of the barley and the preferences of the maltster. Monitoring the moisture content of the grain is critical during this phase.

During ***germination,*** growth of the tiny barley plant begins inside the seed and roots sprout and grow on the exterior. Physical and chemical changes take place during this growth that make the kernel suitable for use in brewing. While moisture content is still important during this phase, the goal will be to achieve a certain degree of growth. This is assessed by checking to see how much progress the acrospire or barley shoot has made in growing from the root end of the kernel toward the tip. In low-modification malts, it will cover only one-half to two-thirds of the distance; in well-modified malts, three-quarters or more will be covered.

EXAMPLE STEEPING SCHEDULES

For German 2-row Barley[1]

	Time/Temp	Moisture Content at end of step
Wet Steep	4 hr @ 54° F (12° C)	32%
Couch	20 hr @ 63° F (17° C)	34%
Wet Steep	4 hr @ 54° F (12° C)	38%
Couch	20 hr @ 70° F (21° C)	40%
Wet Steep	2 hr @ 59° F (15° C)	44%

Home Malting of Harrington 2-row Barley[2]

	Time/Temp	Moisture Content at end of step
Wet Steep	11 hr @ ~50° F (10° C)	35%
Couch	3 hr @ ~70° F (21° C)	—
Wet Steep	6 hr @ ~50° F (10° C)	38%
Couch	5 hr @ ~70° F (21° C)	—
Wet Steep	11 hr @ ~50° F (10° C)	42.5%
Couch	3 hr @ ~70° F (21° C)	—
Wet Steep	4 hr @ ~50° F (10° C)	43.5%

In all schedules, wet steeps must include aeration every one to two hours. Couch phase must include CO2 removal every two to three hours.

1: Adapted from Kunze, *W. Technology Brewing and Malting.* VLB. Berlin. 1996. p 124.

2: Data provided by Ray Daniels.

Overgrown malt

Kilning dries and toasts the grain, halting growth and imparting many of the flavors we associate with malt. In most cases, drying occurs first at lower temperatures (100-120° F or 37.7-48.8° C) and toasting proceeds only after moisture content has been reduced to about 10 percent. To a large extent, the temperature of toasting determines the final character of the malt.

The equipment you need to accomplish each of these steps and produce your own malt is in large part dependent on the amount of malt you wish to produce. You can make a pound or two using small plastic containers and other common kitchen items. For larger amounts, up to 15 lb (6.8 kg) or so, your malt can be made using stuff that most all-grain brewers already possess. Here is a basic equipment list:

Scale: A scale with the ability to accurately measure mass up to 200 g in 0.1 g increments is useful for moisture determinations. A scale with larger capacity can be used to measure of grain and malt.

Steep tank: This can be a 5-gallon, food-grade plastic bucket with holes drilled into the bottom placed into another 5-gallon bucket without holes drilled in the bottom. The old "Zap Pap" lauter tun works perfectly!

Malting floor: Aluminum roasting pans work well, as would any shallow, flat pan or plastic container. If you have a particularly clean basement floor, you could try just spreading the malt on it. Most home maltsters will opt for a container of some sort.

Household space heater: Useful for low-temperature kilning. For small batches, food dehydrators can be used.

Household fan: A fan is useful for drying malt at low temperatures prior to kilning.

Kiln: A kitchen oven can be used successfully, but temperature control is likely to be laborious and imprecise. Still it is the best most of us can hope for. There are reports of people using clothes dryers, but I have no experience with them (other than their obvious use).

Thermometer: An accurate thermometer with a temperature range of at least 45-212° F (7-100° C) is very useful. A higher range will enable you to make more accurate temperature measurements when making crystal and roasted malts.

Commercial and home malting are theoretically similar, but there are some important differences. While each lot of barley must be treated differently regardless of size, small-scale maltings can germinate much faster than larger batches. This may be due to the intensive aeration that is possible when malting small amounts of grain. Malting schedules must therefore be looked upon as guidelines rather than gospel. It is important to use your senses of taste, smell, touch, and sight to determine when to move on to the next phase. The one objective analytical tool that can help you monitor the progress of your malt is moisture content. Before we move on to discuss the three phases of malting, let's discuss this important procedure.

MOISTURE CONTENT DETERMINATIONS

The moisture content, also referred to as the *degree of steeping,* can be determined in two ways. The first is to take a sample of

PHOTOS BY RAY DANIELS

grain from the batch, weigh it, dry it and then weigh it again. This technique can be used at any time and at any phase of the malting process. Short of burning the kernels during drying, it is fairly foolproof. We'll call this the "drying method."

The second method that can be used is to entrap a small sample of grain in a perforated container (called a Bernreuther apparatus) that is included in every step of the process. By weighing the grains before processing begins and knowing their initial moisture content, you can directly determine moisture content by weighing them again at any point in the process. This technique depends on two things. First, you have to maintain exactly the same population of kernels in the container throughout the process. Second, the grains in this sample must receive exactly the same treatment as the rest of the batch so that they are representative of the whole batch. We'll call this the "direct method."

In both systems for assessing moisture content, we will be working with the same equation:

Equation 1: (weight of moist grain – weight of dry grain) / weight of moist grain x 100 = % moisture content

Using the *drying* method, a sample is accurately weighed and then placed in an oven on a baking sheet or similar device in a thin layer and heated at 212-220° F (100-104° C) for three hours. (Note the grain should not become brown or burnt during this procedure – if so, your oven may be too hot.) After the drying is complete, you weigh the grain again and use the values you have obtained in the equation above.

Using the *direct* method, you would first determine the moisture content of your barley using the drying method. The sample of grains used for this purpose would be discarded. Next you would put some barley in your Bernreuther apparatus (the perforated container), remembering that during steeping the grains will swell to occupy nearly 50 percent more space than when dry. Once you have selected the sample, weigh it and then return it to the apparatus. You will now know the moisture content of your barley and the weight of your initial sample. In order to do calculations using Equation 1 during the malting process, you will need to calculate the dry weight of your sample using equation 2.

Equation 2: sample weight x (1 - moisture content as a decimal) = dry weight of sample

Once you begin the malting process, you will be able to remove the Bernreuther apparatus from the batch, open it, weigh the grains and then return them to the apparatus and the batch in process. The weight you determine each time will give you the "weight of moist grain" needed for use in equation 1. You will use the value for "dry weight of sample" from equation 2 for the "weight of dry grain" value in equation 1.

The primary value of the direct method is that it allows very rapid assessment of current moisture levels during malting whereas the drying method requires a three-hour delay. Also, when small batches are being produced the drying method may result in the loss of a significant amount of grain by the end of processing.

THE MALTING PHASES

Now that you are familiar with the main quantitative measure used to aid in malting, we are ready to discuss the individual phases of the operation.

Steeping is performed to bring the relatively dry grain to a moisture content of about 45% so that germination can commence. Water uptake will be influenced by several factors including: steeping time, temperature of steep water, kernel size, barley variety and character.

Steeping consists of two stages: wet steeps and air rests. During the wet steeps the grain is covered with clean, cool water. During the air rests, the water is drained from the grain to allow for respiration of oxygen and removal of carbon dioxide.

The length and number of steeps and rests can vary widely based upon the character of the barley and the maltster's preferences. Indeed, most maltsters conduct a series of pilot maltings on small samples before beginning to malt a production-size batch. This helps *(continued on page 58)*

Roast, Toast *(from page 29)*

pine, spruce, or other softwoods, as they'll impart resiny, creosote flavors, resulting in—technically speaking—yucky beers.

As for wet or dry wood, I haven't yet seen the value of soaking my wood. It's just going to dry up and burn eventually, isn't it?

If you wish, you can heat things up a bit and let your malts toast while they smoke. Just stir the malt every now and then to keep it from scorching, and observe the waiting period noted above before using it to brew a batch.

Once you start roasting and smoking your own, you'll find that these techniques can be a valuable tool in your search to create unique, delicious, homebrewed beers. I wish you happy roasting, smoking, brewing, and of course, drinking!

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Home Malting *(from page 33)*

them to determine the best steep/rest schedule and germination conditions. Figure 1 shows some steep schedules that have proven successful with US-grown Harrington barley.

Now, here's my basic procedure for steeping using a Zap-Pap double-bucket style mashtun. The grain is placed in the bucket that has holes drilled in the bottom. This bucket is then placed into the "unholy" bucket. The grain is covered with cool water (50-55° F) and rinsed with a continuous overflow of water for about 15 minutes to remove debris. After the grain is clean enough for your tastes, it is left covered with cool water to steep. After an hour, the interior bucket is removed from the other and set down. The oxygen-depleted steep water is dumped out and the wet grain is poured back and forth between the buckets several times to ensure thorough aeration. It may then be covered with fresh, cool water again.

This aeration should be performed every hour for the first few hours of the first wet steep. The moisture content of the grain can be assayed at the end of the steep and may as high as 30%. After the grain has been steeped, the water is drained off, the grain turned, and is then allowed to remain in the steep vessel without water for the first air rest.

During the air rest the grain continues to absorb the moisture adhering to it and germination begins. The respiring grain will generate a fair amount of heat and carbon dioxide and may become dry to the touch. Frequent turning and rinsing with cool water will keep the grain aerated and moist.

Be sure to smell, feel, and taste the grain during this process. The grain should not smell or taste sour or rancid at any time. It should taste clean and grainy. As germination begins it will take on an odor similar to cucumbers or unripe apples. This is your sign that everything is going well.

Near the end of steeping, the grain will show the first signs of germination, namely *chitting*. Chitting is when you see a small white spot or bump at the broad end of the barley kernel. This whitish structure is the rootlet beginning to emerge.

Once your grain achieves the target moisture level it is time to move on to germination.

Germination in traditional maltings occurred on a malting floor. At home, you are not likely to want to spread malt all over your house to allow it to germinate. Not only would this be of questionable sanitation, but the people you cohabitate with may be justifiably annoyed, and your dog will find the malt delicious.

Shallow aluminum roasting pans or plastic bins (available at fine supermarkets and hardware stores everywhere) are ideal for germinating small quantities of grain. Transfer the moist grain to the malting pans in layers about 2" (5 cm) deep and watch the fun unfold.

During germination, the rootlets which began to emerge in the steep tanks grow rapidly. To keep them from tangling into an inseparable clump, the malt must be gently mixed and turned at least twice a day. Also, the grain must be misted with cool water frequently to maintain the desired moisture content. Finally, the temperature of the grain should be maintained in the range from 55-65° F (12.8-18.3° C).

The temperature during germination has a big effect on the quality of the malt. Those practicing floor malting tend to keep the