How to Malt Barley (or Wheat) for Beer (or Whisky/Whiskey)

I. Start with Good Quality Barley (or Wheat)

A. When purchasing grain for malting, first ask about what types of chemicals might have been used on the grain and then about the grain's history: when it was harvested, how it was stored, etc.

B. Inspect the Grain

1. Bits of chaff – and even the occasional dead bug – are quite normal and are of little concern. This sort of debris can easily be removed later when the grain is washed. It will usually float to the surface of the water where it can be skimmed off in a matter of minutes.

2. Grain that has live bugs should generally be avoided, as such bugs will spread to other grain stores and feast on all available grain until it is ready for use. Some of those bugs will also contribute a strong off-smell and off-taste, as well. However, buggy grain can occasionally be had for free, and there are a few types of bugs that do minimal damage to the grain if they are not allowed much time to do their worst. But definitely proceed cautiously with live bugs.

3. The presence of foreign seeds mixed in with the grain may or may not be problematic. A few kernels of corn, a bean or two, a few oats, etc., should not be cause for concern, but if there are unknown seeds mixed in with the grain, ask what they are and act accordingly.

4. Examine the color of the grain and avoid any that has a grayish hue, as this would indicate that the grain was mildewed, either in the field or in storage. Mildewed grain will have a low germination rate, but equally problematic is the fact that such grain – and its resulting malt – will tend to smell like a moldy bath towel unless the grain is judiciously rinsed or soaked in chlorinated water to destroy the mildew and wash away its taint.

5. Look for broken kernels and other sorts of physical damage as this will bear on the germination rate of the grain and the resulting malt, as well.

6. Look for pebbles. For every pebble seen during a quick inspection, there may be five or ten more that will show up later. All of these pebbles will have to be removed, one way or another, before the malted grain is milled or they will damage the malt-mill.

7. Avoid any grain that smells or tastes off.

C. It is possible to use inferior grain, but the resulting malt should be used accordingly. For example, grain that has a mediocre germination rate but otherwise smells and tastes alright could theoretically be used as a base malt if the lower germination rate is factored into the brewing process and other non-diastatic additions to the mash are kept to a minimum. However, it is probably better to toast such a malt and use it to add nutty or biscuity types of flavors, rather than relying on it for its diastatic power.

II. Clean the Barley

A. Put about 5 kilos (or 10 pounds) of barley into a suitable 20 liter (5 gallon) plastic bucket (half-full or a bit more).

B. Pour as much water into the bucket as it will hold, stir the grain by hand, and remove any floating debris.

C. Scoop barley by hand from that bucket into a second bucket, trying to leave behind any soil, pebbles, etc., that sank to the bottom of the bucket.

III. Steep the Barley
A. Cover the grain with a fresh batch of water – about 5 cm (2 inches) above the surface of the grain – and allow it to steep for six hours.

B. Thoroughly drain the barley for 10 minutes using a piece of food safe mesh (stainless mesh, polypropylene mesh, chemical-free burlap, etc.) a stainless colander, or a hanging cotton/jute/linen bag. (Note: It is possible to use aluminum window-screen for short-term grain contact, but aluminum dissolves in acidic or alkaline environments and can leave black areas on the grain.)

C. Spread the barley out 3-8 cm (1-3 inches) deep, either: a) on glass, ceramic or stainless baking trays; b) on a clean patch of concrete; c) on a piece of medium or heavy weight cotton cloth; or d) on some other suitable surface.

D. Ensure that water does not puddle underneath the grainbed as any submerged grains are at risk of drowning. Also ensure that the grainbed is not exposed to direct sunlight which would quickly dry out the grain and render it inviable.

E. Cover the grain with a damp piece of light-to-medium weight cotton cloth and allow the barley to "breath" for 8-12 hours (depending on schedule) at room temperature or a bit below.

F. Stir the barley a few times during this period and sprinkle it with water, as needed, to keep the grainbed moist. Keep the cotton cloth that covers the grainbed moist, as well.

G. After 8-12 hours of breathing, return barley to the plastic bucket and steep it for another three hours.

H. Thoroughly drain the barley as before and do a "bite-test": bite down into a few grains, one-by-one, and they should "bite" approximately like a piece of chewing gum. The grains should be somewhat solid but pliable, and they should yield to the teeth. If they are harder than chewing gum, another eight hour air-out phase followed by another three hour steeping phase may be required. The bite-test will take a bit of practice and experience to get the hang of, but once mastered, it can be a rather effective gauge of the grains' moisture content.

IV. Germinate the Barley

A. Spread the barley out 3-8 cm (1-3 inches) deep, as before. Cover the grain with moist cotton cloth and store the grain at room temperature or below, out of direct sunlight.

B. Shift the barley around several times per day, performing the bite-test each time the grain is stirred to test its moisture content.
   1. If the grains start to get a bit harder than chewing gum, sprinkle the grainbed with water and stir it around to distribute the water evenly. Dampen the cotton cloth that covers the grainbed, as well.
   2. If the grains start to get a bit soft, remove the cotton cloth that covers the grainbed and allow the grain to dry out a bit.

C. Rootlets should begin to appear after a day or two.

D. After 2-3 days of germination, begin peeling off the husks from a few grains to examine the acrospires, which will be hidden inside the husk. Some acrospires will branch away from the grain and be easily visible. Others, though, will be wedged into the grain along the non-creased side. Those acrospires will be harder to see, but they should be visible in good light.

E. When the majority of the acrospires are about 3/4 of the length of the grains, it is time to start the drying process.

V. Dry the Malted Barley

A. First (and best) Option: Sun Drying – works on some combination of: a) warmer; b) sunnier; c) windier or d) less humid days.
1. At around 9:00 in the morning, spread the barley out in the sunshine not more than 8 cm deep on a sheet of medium or heavy-weight cotton cloth, a clean patch of concrete, or other suitable surface and cover the grain with a frame constructed from four pieces of "1X4" lumber with a piece of window-screen stapled to one side. This will protect the grain from insects, birds, etc. (Note, the window-screen does not specifically need to be "food safe" since it will not contact the grain.)

2. Shift the grain around a few times during the day.

3. At around 4:00-6:00 in the evening, gather the grain, and bring it indoors. If possible, spread the grain out indoors, ideally someplace where there is a bit of breeze blowing, and shift the grain around a couple times during the evening and night.

4. Move the grain back out into the sunshine the next morning, shift the grain around periodically during the day, bring the grain in at night, etc., until the grain is crispy when bitten.

B. Second Option: Fan Drying – works when sun-drying is not an option.

1. Fan Drying Option 1 - Spread grain out as thinly as possible on a piece of food safe mesh and place a box fan in such a way that the breeze passes directly through the grain.

2. Fan Drying Option 2 - Spread the grain out on a suitable surface and place a box fan in such a way that the breeze blows across the surface of the grain.

3. Fan-dry the grain until it is crunchy when bitten.

4. Depending on the ambient humidity, fan-drying will probably not dry the grain to the point where it is crispy, but it should get it to the point where the grain is stable enough to store until the first good sunny day arrives. Then the grain can be moved out into the sunshine and dried until it is fully crispy.

VI. Remove Rootlets

A. Break Rootlets Loose from Grain

1. Option 1: Place the grain in a sturdy cotton bag and knead the bag until the roots have broken loose from the grain.

2. Option 2: Place the grain in a stainless pot or tank and stir vigorously, either by hand or by mechanical means.

3. Note: If rootlets do not easily break loose, the grain may need further drying.

B. Sift the grain through a cross-breeze to blow rootlets away from grain. If there is no natural breeze, use a fan or a stream of air from an air compressor. Wear a good pair of safety goggles when doing this because any rootlet that makes its way into an open eye will tend to glue itself there and be a real nuisance until it is eventually washed away by the tearing process. Rootlets will probably not cause permanent eye damage, but they will definitely be a bother for awhile.

VII. Cure/Kiln the Malted Barley

A. Curing/kilning does so much for the flavor profile of the finished malt, but beyond that, it also serves another very important purpose, in that it kills any bugs and bug eggs that survive up through the germination and drying process. This is absolutely crucial if the malt is to be stored long-term, since a colony of bugs can completely devour a grain store in a matter of months. Malt that goes quickly from the kiln to an airtight container – sealed drum, tied plastic bag, etc. – can oftentimes be stored for years with minimal degradation.

B. Methods of Curing/Kilning

1. Option 1: Primitive Method (works for non-enzymatic malts but iffy for enzymatic malts)
a. Place the grain in a skillet, put the skillet on a stove burner set to a low-heat, and start stirring.
b. Taste the grain periodically and take it off the stove when it reaches the desired degree of curing/kilning.

2. Option 2: More Advanced Method (works for both enzymatic and non-enzymatic malts)
   a. Spread grain in baking trays and kiln/cure it in the oven using the chart below to determine oven temperatures.
   b. Stir the grain every 15-20 minutes to ensure consistency.
   c. After curing/kilning, allow darker malts to air-out and mellow in a canvas sack for a week or two before brewing with them.

3. Option 3: Semi-Professional Method (works for both enzymatic and non-enzymatic malts)
   a. Fabricate a drum roaster consisting of: A) a canister that rotates horizontally on its axis with two or more fins inside the canister that prevent the grain from simply sliding around the inside of the canister; B) a burner or electric heating element below the canister; C) a housing that covers the canister / burner and conserves the heat; and D) a thermometer that monitors the ambient temperature inside the housing.
   b. Cure/kiln using the chart below as a starting point.
   c. After curing/kilning, allow darker malts to air-out and mellow in a canvas sack for a week or two before brewing with them.

4. Option 4: Crystallize / Caramelize the Malted Barley
   a. "Mash" unmilled base malt – or "green malt" that has been dried well enough to remove the roots – in a mash tun at 67 °C (153 °F) for two hours. Note: For light crystal malt, skip the next steps and go straight to drying.
   b. For darker crystal malts, remove grain from the mash tun and steam it in a "Dutch oven" type setup placed in an oven at 150-200 °C (302-392 °F) for another two hours, stirring every 15 minutes.
   c. Remove grain from Dutch oven, spread it out on baking trays, and kiln at 100-140 °C (212-302 °F), stirring every 15 minutes. Note: steaming and kilning at lower temperatures will result in lighter crystal malts in the 20-40L range, while steaming and kilning at higher temperatures will result in darker crystal malts in the 60-80L range.
   d. When satisfied with color of the crystal/caramel malt, finish drying in the sun or using a fan, as before.
<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time</th>
<th>Malt Type</th>
<th>Diastatic Power</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-90 °C</td>
<td>2 hours</td>
<td>Pale Malt (fully enzymatic)</td>
<td>160 °Lintner</td>
<td>1 °Lovibond</td>
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<tr>
<td>90-100 °C</td>
<td>2 hours</td>
<td>Base Malt (fully enzymatic)</td>
<td>150 °Lintner</td>
<td>3 °Lovibond</td>
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<td>100-115 °C</td>
<td>2 hours</td>
<td>Light Gold Malt (moderately enzymatic)</td>
<td>110 °Lintner</td>
<td>10 °Lovibond</td>
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<td>115-130 °C</td>
<td>1-2 hours</td>
<td>Dark Gold Malt (moderately enzymatic)</td>
<td>50 °Lintner</td>
<td>15 °Lovibond</td>
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<tr>
<td>130-145 °C</td>
<td>1-2 hours</td>
<td>Light Amber Malt (non-enzymatic)</td>
<td>0 °Lintner</td>
<td>30 °Lovibond</td>
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<tr>
<td>145-160 °C</td>
<td>1-2 hours</td>
<td>Dark Amber Malt (non-enzymatic)</td>
<td>0 °Lintner</td>
<td>40 °Lovibond</td>
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<tr>
<td>160-175 °C</td>
<td>1-2 hours</td>
<td>Light Brown Malt (non-enzymatic)</td>
<td>0 °Lintner</td>
<td>60 °Lovibond</td>
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<tr>
<td>175-190 °C</td>
<td>1-2 hours</td>
<td>Dark Brown Malt (non-enzymatic)</td>
<td>0 °Lintner</td>
<td>100 °Lovibond</td>
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<tr>
<td>190-205 °C</td>
<td>1-2 hours</td>
<td>Black Malt (non-enzymatic)</td>
<td>0 °Lintner</td>
<td>150 °Lovibond</td>
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</table>
Addendum: Photos and More
(They say a picture is worth a thousand words, so hopefully a few of these will fill in some gaps.)

I start out with 6-row barley grown by my friend Saul, a local farmer who is also my partner in malting and brewing. Obviously, 2-row barley will work nicely, too. It is just that 6-row is what seems to grow the best where I am. In this photo, I am removing chaff, a few dead bugs, and anything else out of the ordinary.
Here I am steeping the barley. It will swell about 30 percent in volume during this step, so have some extra space in your bucket, starting off.
This is my germination setup. It is basically a frame of 1x4 lumber with cotton canvas stretched tight on one side and stapled in place. I put the germinating grain on top of that piece of cotton canvas and lay a second piece of cotton canvas over the top of the grain to keep the moisture in. It is something like a damp, canvas “cot and sleeping bag”, if you want to think of it that way.
This is a closer look at the germinating barley. You cannot really tell by the photo, but this barley is ready to dry.
This is a close-up of a single barley corn with the acrospire approximately 75 percent of the length of the grain. On some barley corns, you will have a little shorter acrospire, and on others, a little longer. But 75 percent of the length of the grain is a good goal for the average.
This is my drying setup. I started with a 1x4 lumber frame, to which I attached some spindly wooden legs. Then I stapled one piece of food-safe polypropylene mesh to the bottom side of the box and another piece of the same mesh to the top side of the box, except that it is only stapled on two adjacent sides.
Here is another view of my drying setup, this time with a couple pieces of angle-iron holding down the two unstapled sides of the mesh and three bricks holding those two angle-irons in place. I am relying predominantly on sun-drying, but I have found it helpful to use a fan at times. Usually I will use it to kick-start the drying process for the first few hours, at least long enough to dry out the roots. Then, if it is sunny outside, I will cut off the fan and rely purely on sunshine. Of course, sometimes you have an unexpected cloudy/rainy spell, and that is where the fan really saves the day. Fan-drying will halt germination in a matter of hours and then dry the grain down to where it is stable and storable in a day or two.
This is what the barley looks like after it has dried out again. You can still see a few dried roots attached, but I can remove those later, after the grain is cured/kilned. It is important to dry the grain down to the point where it is crispy when bitten before moving on to the curing/kilning process. Otherwise, all of the enzymes will be destroyed when the temperature of the grain goes from around 50 °C up to 100 °C. Also, grain that is too damp will likely mold in a stagnant oven.
This is how I am curing/kilning. I am making a batch of base malt, so the alarm on my thermometer is set to go off when the temperature inside the oven reaches 105 °C.
Here is a look at the grain inside my oven, along with the probe for my thermometer. You really want to use a good thermometer because oven thermostats are notoriously unreliable.
One way or another, you want to stir the grain around a bit, about every 15-20 minutes, to get a consistent curing/kilning.
These are some of my finished malts. As you can see, my gold and amber malts do not look much different from my base malt. But looks can be deceiving. My base malt is around 3 °Lovibond, color-wise, and it tastes about like fresh-baked bread. My gold malt is around 15 °Lovibond, color-wise, and it tastes more like Grape-Nuts cereal. And my amber malt is around 50 °Lovibond, color-wise, and it tastes a lot like Wheat Chex cereal. The brown malt that you see here is about 150 °Lovibond, color-wise, and it tastes somewhere between over-toasted bread and roasted coffee. And finally, you cannot tell from the picture, but the 40L caramel malt that you see here has a much more glazed appearance when you see it in good light... and a wonderful caramel taste! Yum!

Buccaneer Bob wishes to thank everyone who helped to make the documentation of this process possible. The author makes no claims to any rights regarding this document, so feel free to distribute, print, publish, etc., in any way you see fit.