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All Grain Instructions

See All-Grain Kits

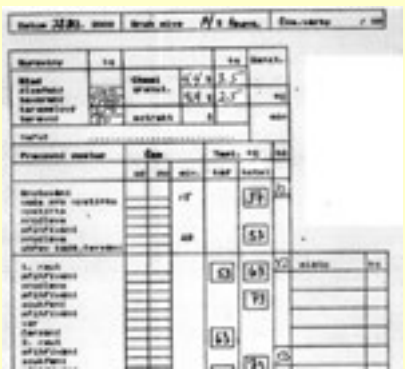
Infusion Instructions and General Details

Brewing with Budvar Undermodified Malt

Traditional 2-vessel Double Decoction

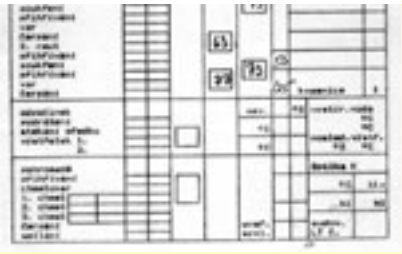
For a more complete description, see my article 'Double Dipping' in February, 2001 of Brew-Your-Own.

Open 'squares'--fermenters--at Hostan brewery in Moravia. the thick lacy head is quite remarkable. Square in background is being filled. Open square fermenters are still common at may breweries. Older ones like these are lined with fiberglass while newer ones are stainless steel.



Brewlog from the day I spent brewing in Moravia. February 28, 2000.

I returned to Moravia in March, 2000 and spent 4 days travelling with a Czech brewmaster. I spent 14 hours brewing at a Moravian brewery. I had the opportunity to clarify all the issues remaining from my previous trip regarding Czech brewing.



HereÕs the details of traditional double decoction Czech brewing.

Dough-in at 37C (98F). Rest for 10-15 minutes. *Decoction is a very thin mash*. 2-2.5 quarts of water per lb of malt. This is at least 50% more water than single infusion mash.

Raise (at 0.5-1C/minute by direct heat) mash to 50-53C (122-127F) for 15 minute rest.

Pull first decoction. Amount will depend on system but 40-50% of mash is good estimate. You want thick portion of mash which will be at the bottom for decoction. In thick ale mash, there is little distinction between thickness of bottom and top. However, in a thin decoction, the grain sinks to the bottom.

Calculating Strike Water Temperature Note this equation applies to single infusion mash as well. TW=[TD(2.08xM + 0.4) - 0.4xTG]/(2.08xM) where TW is the strike water temperature in F, TD is the dough-in temperature in F, TG is the grist temperature in F, M is the water/grist ratio in quarts/lb.	**Determining Decoction Volume** Units are quarts and degrees C. Decoction volume=(temperature increase)x (total mash volume)/(90-unboiled mash termperature)

Determining Decoction Volume Units are quarts and C. Decoction volume = (temperature increase) x (total mash volume)/(90 - unboiled mash temperature)

Raise decoction to 63-65C (145-149F) and rest for 10-15 minutes. Then raise decoction to 73-74C (163-165F) for 10-15 minute rest. Then bring decoction to boil for 20 minutes.

Add decoction back to main mash (note the main mash has been at 50-53C (122-127F) during the first decoction processing). Entire mash should now be at 63-65C (145-149F). Rest for 10-15 minutes.

Pull second decoction. Second decoction will be larger than first, on the order of 50-60% of mash. Again, you want thick (bottom) portion.

Raise decoction to 73-74C (163-165F) for 10-15 minute rest. Then bring to boil for 20 minutes.

Add decoction back to bring entire mash to 77-78C (171-172F) for 30 minute rest.

Now you're ready to lauter. You will find the top thin portion is extremely clear--much of the break material typically found in kettle is in lauter tun due to boils during decoction. The top portion is so clear you need not lauter it. The first wort can actually come off the top via a siphon hose. This will be as much as 40% of the total kettle volume. Gravity of first wort will be quite low, ~14-15P for a 12P pilsner.

Recirculate until clear which should be in a minute for decoction. Then lauter. You will not need to add any sparge water for some time because of thin mash, unless lauter gets stuck which often happens with decoction. If lauter slows too much, add 80C (176F) sparge water and stir gently, then begin lauter again. You need much less sparge water for decoction because of thin mash.

Boil 1.5 hours.

3 hop additions. First is shortly before boil begins. Second about 10 minutes into boil and last 20 minutes before end of boil. Hop additions are all of nearly equal amounts. Czech Saaz hops for all. 3-5 oz total in 5 gallons.

Cool wort and pitch yeast. [It is best to remove the hops prior to cooling or shortly after cooling the wort. Breweries do this with a whirlpool.]

If you have concentrated yeast slurry (3+ oz for 5 gallons) then pitch at 8C (46F) and ferment 1 day for every degree Plato ('Czech rule'). For example, 12 days for 12P (1.048) pilsner. High krausen in 48-60 hours. Temperature may rise to 11C but not higher. Rack to secondary and lager at 0-3C (32-37F).

Brewing Dark Czech Lager (click here to see dark lager that I brewed in Moravia)
There are a few differences from the double decoction procedure when brewing dark lagers.

- All rests are 5-10 minutes longer.
- Black malt is not boiled--it is added during last rest only

You must use either decoction or multiple-temperature step mash when using Budvar malt. Or you may substitute the well-modified Moravian malt and do a single temperature infusion mash.

Infusion Instructions

Making beer from grain is not at all difficult but it does add a couple of hours. You need a little more equipment, namely a lauter-tun and large pot. The most important thing is not to worry and just have at it.

Mashing Procedure
These simplified and brief instructions presume you have made beer from extract and are comfortable with such terms as pH, lauter-tun, etc. You should have a book such as *The New Complete Joy of Homebrewing* as well. There are many different types of mashing equipment (Phil's lauter-tun, 3-level systems, picnic coolers, pots, etc.), so be flexible in adjusting your procedure to fit your equipment. The notes below on strike water, pH, and flow rate are applicable to all systems however.

1. Bring strike water to ~170°F and add grist (crushed grain) slowly while breaking up dough balls. Adjust mash temperature to ~154°F using either cold or hot water or heat. You may check pH at this point although it is rarely necessary to adjust pH.
2. Cover mash and let stand for ~45 minutes. Conversion will be complete within this period and likely sooner which you can confirm with the iodine-starch test. Details are given in most homebrewing texts. (Iodophor works just as well as tincture of iodine by the way.)
3. During the mash bring your sparge water to ~175°F. Sparge at a reasonable rate which you can determine for your particular system from information below. Catch the first ~1/2 gallon and return to mash because it will have a fair amount of husk material.
4. Sparge until you have about ~6 gallons (the boil will evaporate ~1 gallon) or until the pH rises above ~5.8, whichever comes sooner. You will likely find that pH is rarely a problem here as well, particularly if you add a few drops of acid to your sparge water.
5. Process is the same as making beer from extract from this point on.

Strike water

- about 1-1.25 quarts/lb of grain
- 165°F will mash in at ~150° F (equation here)
- pH of mash should be 5.3-5.6 at 70°F which is the same as 5.0-5.3 at 160°F

Mash Temperature

- 147-158°F for single temperature mash

Sparge water

- about 1-1.25 quarts/lb of grain
- ~170°F
- pH of sparge water in and of itself is unimportant: runoff pH should be in same range

pH of Wort and Beer

- The pH of German beers has risen over the past 20 years due to modern malts (from ~4.4 to ~4.55). Beer with lower pH have the following enhancements.
  - More pleasing hop bitterness
  - Rounder, fuller, softer malt flavor
  - More 'spritzy' or refreshing flavor (This is related to 'liveliness' which also involves carbonation.)
  - Better foam, finer bubbles
  - Better resistant to protein haze
  - More resistant to bacterial growth

as mash initially and not rise over 5.8-6.0

Lautering Rate

- ~1 quart/square foot-minute.
- For 5 gallon pail, ~1 pint/ minute or about 45 minutes for 6 gallons.

Keys to high yields

1. Mix grist with strike water thoroughly; avoid dough balls.
2. proper pH
3. mash out (raise mash to 170° F before lautering)
4. lauter with hot 170-175°F water
5. slow lauter

pH of Mash

- Mash pH should be 5.3-5.6 at 70F. The lower part of this range is most desirable in that resulting beers have the following attributes.
- Shorter mash program when using modern malts (Undermodified malts benefit even more with respect to nitrogen content of wort and FAN levels of beer.)
- Improved extract yield
- Lighter colored beer (important for pilsners only)

It's generally easier to measure pH of the mash by taking a couple of tablespoons and letting it cool to room temperature. The pH will change with the temperature--pH

  - More complete fermentation
  - More rapid yeast growth and fermentation
  - Better hot and cold break
  - More resistant to oxidation
  - The only disadvantages of the lower pH are slightly lower hop utilization and longer boil-off time for DMS.
- ***Unfortunately, mash acidification to pH 5.3-5.4 has virtually no effect on the pH of the final beer. To achieve the lower beer pH it is necessary to acidify the wort itself of pH 5.1-5.2.***

Terminology:

Single Infusion means hot water is mixed with the grist only once. This is often used to mean single temperature mash. Most English and Amercan brewpub and microbrewers do a single infusion/ single temperature mash. Most German brewers (~80%) do a single infusion, multiple temperature mash. Many Czech brewers also do multiple temperature mashes but raise the temperature with decoctions (multiple infusions). All malts available to brewers in America except Budvar are amenable to single infusion single temperature mashes although multiple temp mashes may be employed.

5.0 at 150F will be pH 5.3 at 70F.

	Mash Temperature	
	@150 F	cooled to 70 F
pH	5.0-5.3	5.3-5.6

- pH of water is not very important. Salt composition is important. It may well take more acid to properly adjust water of pH 7 than water of pH 9.
- IT IS IMPORTANT TO KNOW THE pH of the mash, not the water. It's okay to lower pH of strike and sparge water before adding to grain. But, it is still important to measure pH of the mash and runoff
- Acid should not be added to great excess to strike or sparge water because it may cause calcium to precipitate.

- Mash pH should be 5.3-5.6 at 70°F. The lower part of this range is most desirable in that resulting beers have the following attributes.
  - Shorter mash program when using modern malts (Undermodified malts, not available in US, benefit even more with respect to nitrogen content of wort and FAN levels of beer.)
  - Improved extract yield.
  - Lighter colored beer

Modern Malts and Protein Rests

Modern malts are defined by two characteristics; 1)moderate to high degree of modification and 2) uniform modification between barleycorns as well as within each corn with respect to protein, starch, and glucans. All malts, excet Budvar, from Europe and America, available to US microbrewers and homebrewers for at least the past 13 years meet these criteria.

All modern malts except Budvar, regardless of their origin, can be used in a single infusion mash with good results. For example, several breweries are now using Moravian well-modified malt to make excellent ales. However, decoction and multiple step mashes can still be employed to produce wonderful and unique flavors with modern malts. However, these mashing schemes may produce beers with poor head formation and retention if a 'protein rest' in the temperature range of 120- 135°F is included. If you experience problems with head formation, either shorten the protein rest or simply pass over the protein rest. For example, a common mash schedule in Germany called "hochkurz maischverfahren" ("high-short mashing scheme") involves dough-in at a 'high' temperature, ~140°F, and taking the first decoction here to bring the mash to saccharification (~156°F). It is possible to take another decoction at this temperature to jump to mashout (~170°F).

(important for pilsner only).

- pH of water is not very important. Salt composition is important. It may well take more acid to properly adjust water of pH 7 than water of pH 9. IT IS IMPORTANT TO KNOW THE pH of the mash, not the water.
- It's okay to lower pH of strike and sparge water before adding to grain. But, it is still important to measure pH of the mash and runoff.
- Phosphoric acid is a better choice than lactic acid primarily because phosphoric, an inorganic acid, is more stable than lactic, an organic acid. Neither should be added to great excess to strike or sparge water because they precipitate out calcium ions.

Modern malts also produce beer of higher pH which has some detrimental effects as noted on the previous page. It's very easy to adjust pH of both the mash and wort to enhance the beer.