Expert Tips on Brewing Belgian-Style Beers

BrewYour Own

THE HOW-TO HOMEBREW BEER MAGAZINE

OCTOBER 2007, VOL.13, NO.6

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Figuring out faults when your homebrew goes bad

10 Keys to Great Extract Beers

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Partial Mash Recipe Round Up

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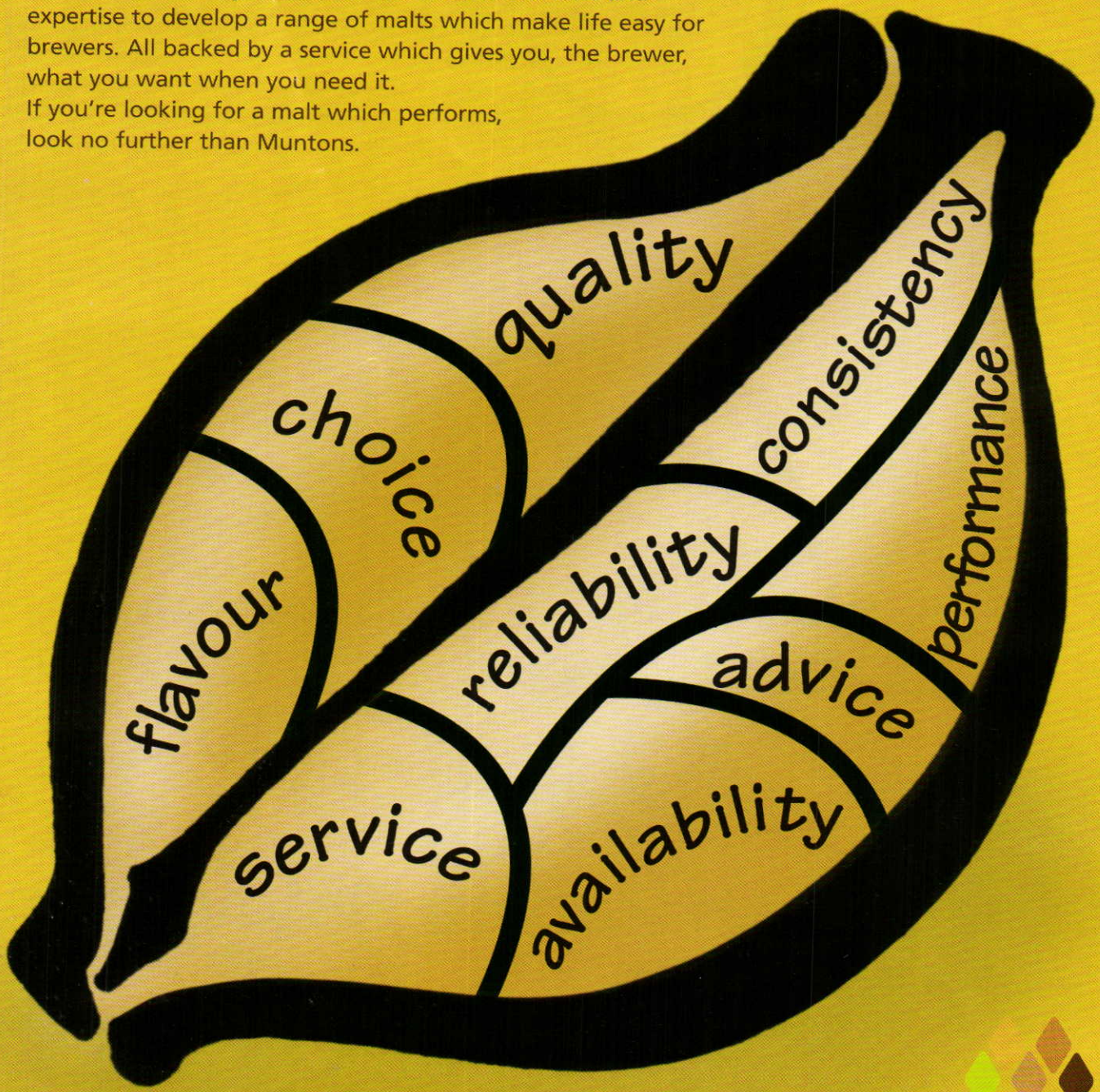

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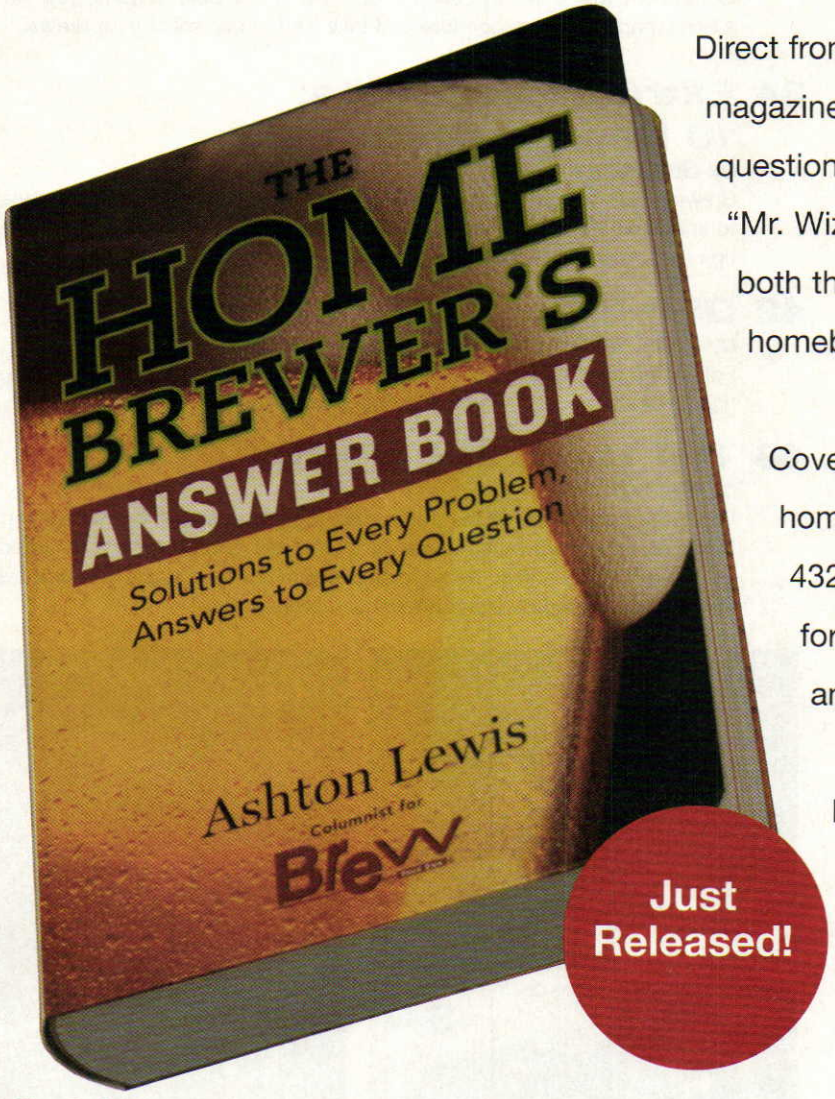

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OCTOBER 2007
Volume 13 Number 6

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THE HOW-TO HOMEBREW BEER MAGAZINE

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Features

Where to find it

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HERE'S TO BEER

RECIPE INDEX

BYO RECIPE STANDARDIZATION

Extract efficiency: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one gallon of water, would yield a wort of 1.024.)

Extract values for malt extract:
liquid malt extract (LME) = 1.033–1.037
dried malt extract (DME) = 1.045

Potential extract for grains:
2-row base malts = 1.037–1.038
wheat malt = 1.037
6-row base malts = 1.035
Munich malt = 1.035
Vienna malt = 1.035
crystal malts = 1.033–1.035
chocolate malts = 1.034
dark roasted grains = 1.024–1.026
flaked maize and rice = 1.037–1.038

Hops:
We calculate IBUs based on 25% hop utilization for a one hour boil of hop pellets at specific gravities less than 1.050.

Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

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Brew Your Own (ISSN 1081-826X) is published monthly except February, April, June and August for $28.00 per year by Battenkill Communications, 5053 Main Street, Suite A, Manchester Center, VT 05255; tel: (802) 362-3981; fax: (802) 362-2377; e-mail: BYO@byo.com. Periodicals postage rate paid at Manchester Center, VT and additional mailing offices. Canada Post International Publications Mail Agreement No. 40025970. Return undeliverable Canadian addresses to Express Messenger International, P.O. Box 25058, London BC, Ontario, Canada N6C6A8. POSTMASTER: Send address changes to *Brew Your Own,* P.O. Box 469121, Escondido, CA 92046-9121. Customer Service: For subscription orders call 1-800-900-7594. For subscription inquiries or address changes, write *Brew Your Own,* P.O. Box 469121, Escondido, CA 92046-9121. Tel: (800) 900-7594. Fax: (760) 738-4805. Foreign and Canadian orders must be payable in U.S. dollars plus postage. The subscription rate to Canada and Mexico is $33; for all other countries the subscription rate is $45.

Volume 13, Number 6: October 2007.

Cover Photo: Charles A. Parker

Hopping Help with Clone

In the current issue, you have clone recipes with extract options ("10 GABF Clones," September 2007). My question is, in reading many posts about extract brewing, many have stated that doing a full boil (5 gallons/19 L) will yield better hop utilization. So, should I be concerned about the amount of hops in the recipe because I'm doing a full boil? Also, should I add all of the dried or liquid extract at the beginning of the boil?

Thomas Gawel
via email

When brewing the clones, follow both the amounts of ingredients and the instructions as closely as possible for best results. (If you have brewed a recipe from BYO before and know that your hop utilization is higher or lower than ours — or, for all-grain brewers, if you know that your extract efficiency differs from ours — certainly make those adjustments. All BYO recipes are formulated with the same assumptions (see page 4), so information you obtain from brewing one can be applied to brewing any other.)

The specific gravity of your wort does affect the utilization of hops boiled in that wort. Basically, the higher gravity the wort, the less bitterness is extracted from the hops. (See page 59 for more information.) If you previously brewed a beer by boiling a "thick" wort on your stovetop and diluting it with water in your fermenter, you would need to make adjustments to your hopping rate if you switched to brewing the beer using a full-wort boil.

In the case of our clones, however, they were formulated from the beginning to be made with a full-wort boil. The recipes that specify this are too bitter to be made without a full-wort boil.

When brewing an extract beer with a full-wort boil, adding all the malt extract at the beginning of the boil is the simplest solution. For stovetop beers, adding a portion of the extract near the end of the boil helps minimize color pickup. In a full-wort boil, however, this shouldn't be a major problem. (See page 34 for more tips on brewing with malt extract.)

pHlustered by Temperature and pH

I enjoyed Chris Bible's article on pH ("The Principles of pH," September 2007). I had never really thought too much about this aspect of my brewing and now I think I might have an avenue to improve some of my beers. I was baffled by one thing, however. At the end of the sidebar on measuring pH, it said that you needed to account for changes in temperature when taking the pH of the

mash, even if the pH meter has automatic temperature correction (ATC).

If automatic temperature correction doesn't correct for differences in temperature, what does it do?

Dennis Novak
Linden, Alabama

Good question. There are two effects of temperature to keep in mind when measuring the pH of a solution. The first is that the actual pH of a solution varies with temperature — as the temperature goes up, more water molecules split into [H+] and [OH-] ions. (Likewise other molecules in the wort will also have a greater degree of dissociation.) So, as the temperature increases, the pH goes down.

The second effect to be aware of is the effect of temperature on a pH electrode. Electrodes for pH meters are calibrated at a single temperature. If a pH reading is taken at a different temperature, the meter will give an erroneous reading.

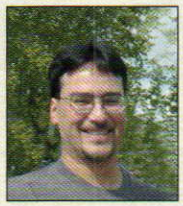
Meters with automatic temperature correction compensate for this second effect, but not the first.

Here's an example to clarify: if you took a mash sample and cooled it down to room temperature, a pH meter with ATC and a meter without it should both read the actual pH of the solution at that temperature. Let's say it was 5.5. Now, if you heat the mash sample back to mash temperatures, the actual pH would drop to around 5.2. If you then measured the pH again with both meters, the meter with ATC should return the actual pH of the mash at that temperature (5.2). The meter without ATC would give a wildly inaccurate reading. And, in both cases, subjecting a pH electrode to mash temperatures would decrease its lifespan.

So, when measuring your mash pH at home, it's

Bob Hansen used to brew at Milwaukee's Water Street Brewery — a brewery that used extracts in their brewhouse. In 2001, he joined Briess Malting and is now the Manager of their Technical Services division. He has given presentations at a variety of brewing conferences.

In this issue, on page 34, he makes the case that you can brew great beer from malt extract and then tells you exactly how to do it. Specifically, he gives ten tips to take your extract brewing to new heights.



John Palmer is the author of the well-known homebrewing text, "How to Brew" (2006, Brewers Publications) and the soon to be released book — co-authored with *Brew Your Own*'s "Style Profile" columnist, Jamil Zainasheff — "Brewing Classic Styles: 80 Winning Recipes Anyone Can Brew" (2007, Brewers Publications).

In this issue, John delivers the twisted tale of the sour sweet stout. Follow the clues and learn how a brew went from promising to pathetic.

Steve Bader got an early start as a brewer in high school, growing wheat, oats, and rye on the family farm in North Dakota. He then moved on to drinking some of Minnesota's finest in college, Cold Spring and North Star (lagers, of course). In 1992, he opened Bader Beer and Wine Supply in Vancouver, Washington. Steve has authored many *Brew Your Own* articles — especially during his stint as the Replicator — and continues to serve on BYO's editorial review board.

best to cool the sample down to prolong the life of your electrode. (If the numbers on your pH meter start "jumping" or it takes forever for them to settle down, this is a good sign that your electrode needs to be replaced. Likewise, if you calibrate your meter in the standard buffer solutions, but shortly thereafter the pH meter reads the pH of these solutions incorrectly, your electrode should be replaced.) When you take the pH of your cooled sample, remember that the pH of the wort was lower when the mash was warmer.

Continuity Error

In the September 2007 issue of Brew Your Own, there is a continuity error in the "Advanced Brewing" column. At the bottom of page 53, there is a subhead that reads, "The bitter truth." On the next page, the running text starts with, "is to produce bittering in beer." The missing words are, "One of the most important roles of boiling." The full text article — without this gap — is available online at: byo.com/departments/1638.html.

Konverted Kölsch

I was reading the July-August 2007 issue of Brew Your Own on summer time brews ("15 Summertime Recipes," by Betsy Parks). I am interested in brewing a good Kölsch recipe in the next week or two. My friends like Schlafly Kölsch out of St. Louis, Missouri. The recipe Kepler's Kölsch sounds good, but I was more interested in a complete grain recipe. Would you have a complete grain recipe and instructions?

Chuck Gnuse
via email

Sure, here's a conversion of the Kepler's Kölsch recipe, with Pilsner malt substituted for the malt extract. This recipe uses a little dab of Vienna malt, which isn't traditional, to add a little bit of malty complexity. If you want a more traditional recipe, just replace the Vienna malt with Pilsner.

Kepler's Kölsch
(5 gallons/19 L, all-grain)

OG = 1.047 FG = 1.009
IBU = 22 SRM = 6 ABV = 4.9%

Ingredients

8.5 lbs. (3.9 kg) Pilsner malt
0.50 lbs. (0.23 kg) Vienna malt
0.50 lbs. (0.23 kg) wheat malt
¼ tsp yeast nutrients (15 mins)
5.5 AAU Tettnang hops (60 mins) (1.2 oz./35 g of 4.5% alpha acids)
0.25 oz. (7.1 g) Hallertau Hersbrücker hops (15 mins)
Wyeast 2565 (Kölsch) or White Labs WLP029 (German Ale/Kölsch) yeast (3 qt./~3 L yeast starter @ SG 1.035)
1 cup corn sugar (for priming)

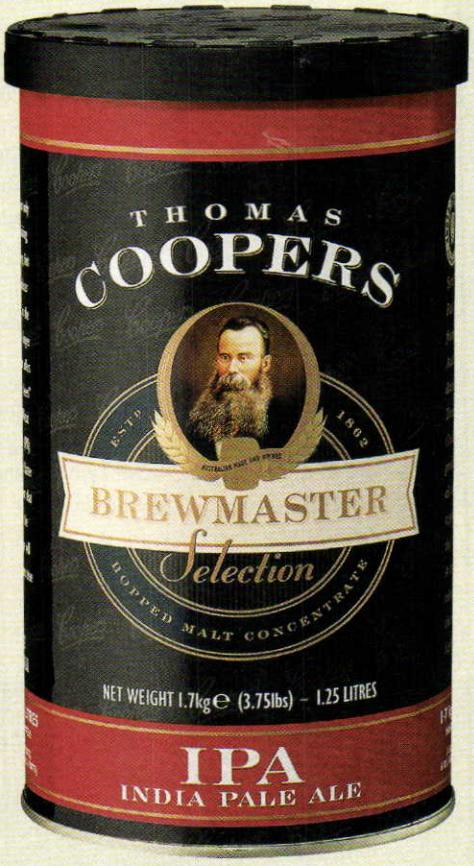
Step by Step

Mash at 152 °F (67 °C) for 60 minutes in 3 gallons (11 L) of water. Raise the mash temperature to 168 °F (76 °C) and hold for five minutes. Recirculate until clear, then run off the wort to the kettle. Collect around 5.5 gallons (21 L) total and add water to make 6.5 gallons (25 L).

Boil the wort for 90 minutes. Cool the wort and transfer to the fermenter. Aerate the wort thoroughly and pitch the yeast from a yeast starter. Ferment at 65 °F (18 °C). Once fermentation stops, rack to the secondary fermenter and cold condition at 40 °F (4.4 °C) for at least three weeks. Serve with 2.4 volumes of carbon dioxide.

FAST, EASY, SIMPLY THE BEST.

Oh yeah, and we threw in an extra helping of Styrian Golding hops!



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reader GADGET The Porta Party

Rex Harris • Box Springs, Georgia

Rex Harris' device keeps his homebrew cool — even when he's away from home!

I built this gadget from a 32-gallon (121 L) plastic trash can. It has a tap tower made from 3" PVC pipe and fittings found at most hardware stores. The underside of the trash can lid has a flange ring the same size as the closet flange on top, and all is bolted together with ¼" hex bolts.

All PVC parts can be found as ordinary fittings and no modifications were made to any of them. There is a ½" hole drilled in the trash can lid under the PVC pipe to allow for passing through of the beverage line to the tap.

A regular 5-gallon (19-L) Corney keg sits in the trash can with ice packed around it. The gas line is inserted through a hole in the top of the trash can and the CO_2 bottle sits on the outside in a Christmas tree stand to keep it upright.

reader RECIPE Don Osborn • St. Paul, Minnesota

Single Hop Beer

Every now and then don't you get the itch to try something new? One way is to try single-hop recipes. It is a great way to get to know a particular hop, especially one that might be new to you.

One recipe I use for experimenting is what I call my Steamin' Wife Lager. It's a California common modeled after Anchor Steam. The "Steamin' Wife" comes from a usually-understanding wife who sometimes does not tolerate the time demands of my hobby (in her words, "obsession").

This is a solid, clean-tasting recipe that allows the hop to shine through and works well for single-hop recipes. This year I made one using Summit hops.

Summit Hop Steamin' Wife Lager

5 gallons (19L) All-Grain

OG = 1.053 FG = 1.012
SRM = 6.5 IBU = 56 ALC = 5.1%

Ingredients

10 lbs. (4.5 kg) American two-row pale malt
0.5 lbs. (0.23 kg) crystal malt (55 °L)
4.43 AAU Summit hops (0.25 oz/7 g at 17.7 % alpha acids) (60 min.)
4.43 AAU Summit hops (0.25 oz/7 g at 17.7 % alpha acids) (45 min.)
4.43 AAU Summit hops (0.25 oz/7 g at 17.7 % alpha acids) (30 min.)
4.43 AAU Summit hops (0.25 oz/7 g at 17.7 % alpha acids) (10 min.)
Wyeast 2112 (California Common) yeast
1 tsp Irish moss (15 min.)

Recipe assumes 70% efficiency

Step by Step

Heat 13 quarts (12.3 L) water to 165 °F (74 °C) and dough in. Mash at 153 °F (67 °C) for 60 minutes.

Mash out with 7 quarts (6.6 L) boiling and hold for 10 minutes.

Collect first runnings.

Batch sparge with 3 gallons (11 L) of 190 °F (88 °C) water (aim for 168 °F/75.5 °C in mash tun).

Collect a little over 6 gallons (23 L) total and begin boil.

Add the hops as directed and boil 60 minutes.

Chill wort, pitch yeast, and ferment around 58–60 °F (14–16 °C) for 10 days or so.

Rack to secondary and lager for a month if you can, then package.

Extract option:

Substitute 7 pounds (3.1 kg) pale liquid malt extract or 5.5 pounds (2.5 kg) of light dry malt extract for the two-row base malt. Steep crystal malt as usual.

Homebrew CALENDAR

October 5

US Air Force Academy Oktoberfest/Homebrew Fest
US Air Force Academy, Colorado

Held at the Academy Officer's Club, the entry fee includes entertainment, German fare and a commemorative glass. Entries for the competition accepted from September 19 through 27. More details are available at: http://users.adelphia.net/~douglas3428/index.html.

October 19-20

Dixie Cup XXIV
Houston, Texas

Celebrating the quest for the Holy Ale, this year's Dixie Cup includes two featured style categories: Gruit Ain't Moot and It's Just Beer. Featured speakers include Steve Grossman of Sierra Nevada and author Randy Mosher. Competition entry deadline is September 28. Late entries will be accepted until October 5. Online registration and info available at www.crunchyfrog.net/dixiecup.

October 20

The Meading of Life
West Chester, Pennsylvania

The third annual mead-only AHA/BJCP sanctioned competition held at the Iron Hill Brewery. All entries must be received by October 13. See www.valhalla-mead.com for addresses and dropoff locations, entry fees and more.

October 27

The Queen of Beer Homebrew Competition
Placerville, California

The 11th annual search for the best woman-produced homebrews, organized by the Hangtown Association of Zymurgy Enthusiasts. Entries will be accepted from September 24 through October 24. "Beer produced by or with the assistance of persons of the male gender is not eligible." More information at: http://www.queenofbeer.hazeclub.org/index.html.

club PROFILE

SODZ • Columbus, Ohio

The Scioto, Olentangy and Darby Zymurgists were formed in Columbus, Ohio in 1995, taking their name from the three rivers that run through the State's capital. Although based in Columbus, SODZ now represents some 50 regular members from all around the central Ohio area. Monthly meeting locations rotate among Central Ohio's better beer bars and breweries.

Special events organized by the club include the annual SODZ British Beerfest Competition, a limited scope competition open only to traditional British beer, mead and cider categories. Other popular events include an Easter Brew, a summer picnic each July, the annual Christmas party, and other club specific and AHA events. The club was recently treated to its second annual tour of the Anheuser Busch facility in Columbus where members enjoyed a VIP tour of the fourth largest AB plant in the U.S.

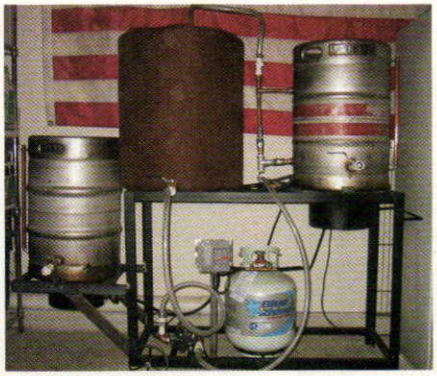
The Scioto, Olentangy and Darby Zymurgists (the SODZ) homebrew club gather at a recent monthy meeting.

Membership has nearly doubled over the past three years and the club has taken a more aggressive attitude in the homebrew community by increasing its participation in competitions and other regional and national events, including a large contingent to Beer & Sweat, a keg only competition held annually in the Cincinnati area.

If you plan to visit the Columbus area, please be sure to drop us a line. For more details and contact information visit us on the Web at www.sodz.org.

homebrew systems that make you DROOL

Ben Meissner • San Antonio, Texas

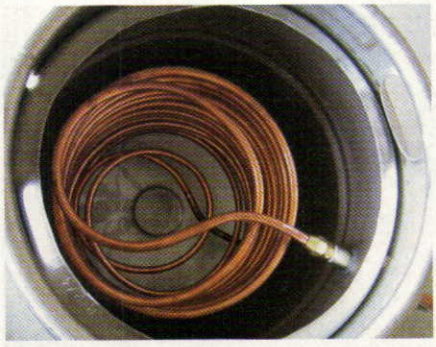


My love for homebrewing began in 2002 after receiving a 5-gallon (19-L) beer kit for Christmas. Ever since that first batch, I knew that brewing beer was something I wanted to master. As my passion for brewing grew, so did my interest in building my own home microbrewery. I was able to complete this whole system for less than $1,000 — but I still have my wish list for future upgrades!

The Sculpture Base

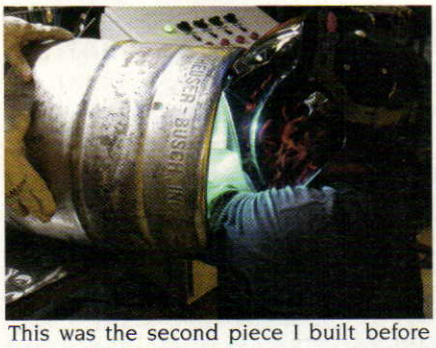
I found most of what I needed for the base of the brew tree at the local sporting goods store in the grill section. The stand I purchased came with two burners and gas lines, so I only needed to add one on top for the HERMS.

The HERMS Tank



I read about the HERMS systems and decided that building my own version was something I could do. Once I had the tap connection out, I was able to cut off the top (using a plasma cutter) and I converted the top to a lid. For the guts, I used 48 feet (9.8 m) of ½" soft copper tubing.

The Mash Tun



This was the second piece I built before the HERMS tank. As a bare minimum, I needed this and the large boiler to brew large batches (15 gallons/57 L). I had my friend Aaron (an expert welder) help.

The Sparge Arm

I built a sparge arm using a small section of leftover ½" soft copper pipe from the HERMS coil. I wanted to be able to set the sparge height so I could use it for the HERMS and sparging the mash. It ended up short, so I extended the arm using the leftover copper pipe. I drilled 25 ⅛" offset holes at the bottom of the arm to make sure it spread over the whole grain bed.

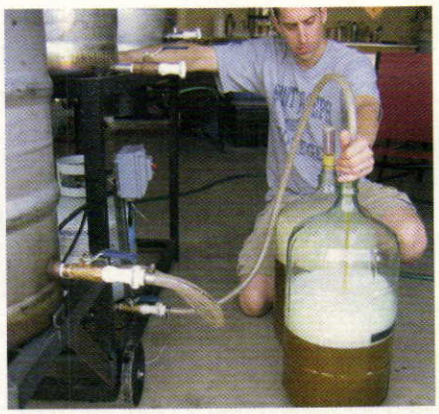
The Wort Chiller

I bought a dual coil wort chiller (⅜" dia. @ 25 ft. /7.6 m per coil) before I decided to build my system. For now, it works well.

The Fermenter

What I really want for fermentation is a 14 gallon (53 L) stainless conical fermenter. But right now, I use multiple glass carboys.

Brewery in Action



It was a blast building my dream system. On brew day I decided I wanted to brew my favorite clone recipe — a Pilsner Urquell clone that has the perfect blend of bitterness and flavor (I think).

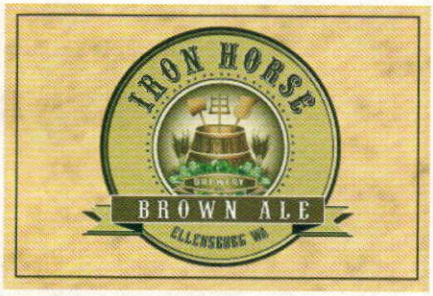
replicator

by **Marc Martin**

Dear Replicator,

As you may know eastern Montana is not exactly a mecca for a wide variety of microbrews. It is not even all that easy to get homebrewing supplies. So, in a quest for good beers a brewing buddy and I decided that we would take our motorcycles and ride west. We traveled for a full week and spent two days touring the many pubs of Seattle. As we headed back east for home we hit rain in Yakima, Washington and decided to get a motel. With Yakima being in the heart of hop country you would think they would have at least one brewpub, but no. We did find an excellent bottle shop and it was there that I found my favorite beer of the trip, Iron Horse Brown Ale. What a great, malty beer! I have not been able to find it anywhere since. I would love to duplicate this beer but don't know where to start. I hope you can help!!

Jim Davis
Great Falls, Montana



Jim, your request was timely. As luck would have it, a few weeks after I received your e-mail my business travels allowed me to visit this brewery in Ellensburg, Washington. You may not have realized it, but when you were in Yakima you were only 33 miles from the brewery.

Just like many of us, Greg Parker had a dream of taking his hobby to serious heights by owning his own brewery. He has now been able to make his dream a reality by exercising a buyout of the Iron Horse Brewery. Formerly owned by a local brewer, Jim Quilter, this small brewery, in an industrial strip of Ellensburg, first opened in December of 2004. Now Greg and his father Gary have big plans for the fledgling brewery including expanded capacity and a new tasting room.

Greg began homebrewing a year and a half ago and developed his skills with five-gallon batches. With no formal training, he started as a brewing apprentice at Iron Horse in January of 2007. He claims that the transition from five gallons to 15 barrels was quite a challenge but he honed his skills by reading lots of brewing books. His favorite authors are Dave Miller, Steven Beaumont, and, of course, Charlie Papazian.

As Greg and I sampled the Iron Horse Brown we discussed its attributes. He reports that when this beer was developed the goal was to combine the best characteristics of the English and American styles. That was definitely achieved as the higher mash temperature, large dose of crystal grains and restraint of hops add to the sweet malt finish common in English styles. The high starting gravity results in the alcohol level needed for American browns.

The overall result is a big brown ale, smooth and malty with a chocolate nose, low bitterness, and a white rocky head. A great request, Jim, for an excellent beer and now you can "Brew Your Own".

For more information about the brewery and their other fine beers visit the Web site www.iron-horse-brewery.com or call 509-933-3134.

Iron Horse Brewery Iron Horse Brown Ale

(5 gallons/ 19 L, extract with grains)

OG = 1.070 FG = 1.022
IBUs = 27 SRM = 20 ABV = 6.2 %

Ingredients

6.6 lbs. (3 kg) Briess light, unhopped, malt extract
1.8 lbs. (0.8 kg) light, dry malt extract
1.5 lbs. (0.68 kg) crystal malt 80 °L
3 oz. (91 g) chocolate malt
½ tsp. Irish moss (15 min.)
½ tsp. yeast nutrient (15 min.)
8 AAU Northern Brewer pellet hops (60 min.) (1.0 oz./ 28g of 8% alpha acids)
1.25 AAU Willamette pellet hops (0.25 oz./ 7g of 5.0% alpha acids)
White Labs WLP 023 (Burton Ale) or Wyeast 1099 (Whitbread Ale) yeast
¾ cup (150 g) of corn sugar for priming (if bottling).

Step by Step

Steep the crushed grain in two gallons (7.6 L) of water at 158 °F (70 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.9 L) of hot water. Add the liquid and dry malt extracts and bring to a boil. While boiling, add the hops as per the hopping schedule. Add yeast nutrient and Irish moss after 45 minutes. Add the wort to two gallons (7.6 L) of cold water in a sanitized fermenter and top off with cold water up to five gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20 °C). Hold at that temperature until fermentation is complete. Transfer to a carboy, avoiding any splashing to prevent aerating the beer. Let the beer condition for one week and then bottle or keg. Allow to carbonate and condition for two additional weeks and enjoy your Iron Horse Brown Ale.

All-grain option:

This is a single step infusion mash. Replace the malt syrup and dry extract with 13.5 pounds (6.1 kg) 2-row pale malt grain and reduce the crystal malt to 1.2 pounds (54 kg). Chocolate malt remains the same. Mix the crushed grain with 3.5 gallons (13 L) of 174 °F (79 °C) water to stabilize at 158 °F (70 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately six gallons (23 L) of wort runoff to boil for 60 minutes. Reduce the 60 minute hop addition to .75 oz. (21 g) to allow for the higher utilization factor of a full wort boil. The remainder is the same as the extract with grain recipe.

BEGINNER'S block

Dried Malt Extract

Choosing and using powdered wort

by Betsy Parks

The first beers many homebrewers make are brewed with malt extract. By eliminating the mashing step needed in all-grain brewing, malt extract allows a brewer to make beer in a comparatively short amount of time. Malt extract is also used in partial mash recipes and for making yeast starters. Homebrewers can choose between liquid malt extract (LME) or dried malt extract (DME). Dried and liquid malt extracts are both forms of concentrated wort, produced by mashing grains just as all-grain worts are. The extracts are then dehydrated until they contain approximately 20% water, for liquid malt extract, or 2% (or less) for dry malt extract. A brewer then adds water to the extract to reconstitute the wort during the brewday.

Why dry?

Brewers choose dry malt extract because it is a powder, which is easier to weigh than liquid malt extract, a thick syrup. And because of the difference in moisture, dry malt extract also has an advantage in storage. If kept tightly sealed away from moisture (and pests) at 50-70 °F (10-21 °C) it can last for more than a year, whereas an open container of liquid malt extact will last for around three months if refrigerated. Many dry malt extracts are also unhopped, which can give a brewer more control because they will choose the level of hop bitterness and the variety of hops. Some homebrewers also keep dry extract around because it is convenient for priming and making yeast starters. Dry malt extract powder is very fine and "clouds" of it can deposit a fine film over your brewing area after it is poured. Quickly wiping down the area (and any affected equipment) with hot water will keep them from acquiring a sticky film.

There are a great number of dry malt extracts to choose from, which will depend on the beer you intend to brew and the recipe you're following. In general, the typical specific gravity of one gallon (3.8 L) of water mixed with one pound (0.45 kg) of dry malt extract will yield a specific gravity right around 1.045. Therefore if your brew is pegged to be a five-gallon (19-L) batch, then three pounds (1.7 kg) of dry malt extract will increase the specific gravity by 0.027 points. Specific gravity is a measure of density, and in brewing it is used to measure how much sugar is dissolved in the wort.

What to do in the brew

To use dry malt extract, dissolve what the recipe calls for in a few quarts or liters of cold water (it may clump in hot water). If you're substituting a dry malt extract for liquid malt extract, account for the moisture difference by dividing the amount of liquid malt extract by 1.25. For example, if a recipe calls for four pounds of liquid malt extract, divide by 1.25 to get 3.2 pounds of dry malt extract. Close and seal the bag once you have the extract you need, and avoid exposing an open bag to the steam coming from a brew kettle or pot of boiling water — the moisture will cause it to instantly clump. Once it is completely absorbed, add the extract to your brew water and stir it well prevent it from collecting on the bottom of the brew pot which could cause scorching.

Bring your wort to a boil, stirring frequently. Dry malt extract can linger near the top of the brewpot, which avoids scorching, but can also make the wort more susceptible to boiling over. If you see signs of a boilover, turn down the heat and stir or spray cold water on the foam. Once the boil reaches hot break, which is when the proteins in the wort coagulate and sink into the pot (they look like floating particles), you can begin to add the hops. Immediately seal up any unused dry malt extract because it is deliquescent, which means it absorbs water from the air, resulting in a firm clump.

byo.com BREW POLL

What is your favorite form of hops for homebrewing?

Pellet Hops: 60%
Whole Leaf Hops: 34%
Hop Plugs: 6%
Hop Oils: 1%

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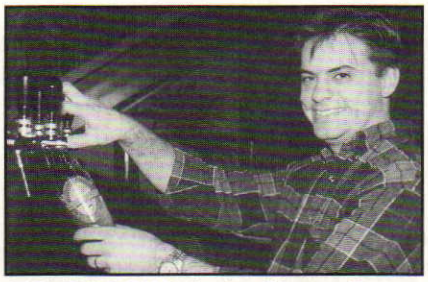
Draft Dispensary

Nitrogenation and dry hopping with a Randall

by Betsy Parks

Is serving beer as simple as pouring it? Not necessarily — especially when it comes to getting it from a keg to a glass. This issue, our Technical Editor (and Master Brewer at Springfield Brewing Company) Ashton Lewis discusses the techniques for serving beer with nitrogen and Andy Tveekrem, Brewmaster at Dogfish Head Craft Brewery talks about dry hopping with the Randall.



ASHTON LEWIS is the Master Brewer at Springfield Brewing Company in Springfield, Missouri, as well as the Technical Editor of *Brew Your Own*. In addition to his technical expertise, Ashton is also *BYO*'s Mr. Wizard, and has answered many hundreds of brewing questions since 1995. His Wizard columns have been collected into a new reference: "The Homebrewer's Answer Book," available online at www.brewyourownstore.com.

There are many beer styles that taste nice using a nitrogen dispense system. I think one of the facts to keep in mind about nitrogenation is that it dampens the flavor profile of the beer. To my palate, the perception of bitterness and hop aroma are reduced and some of the rough edges of beers that are somewhat unbalanced are smoothed out.

In contrast, maltiness is accented. I have used nitrogen dispense for beers from lightly colored golden ales to stouts with various colors and flavors in between. These beers have always been formulated to compensate for the effects that nitrogenation has on flavor.

As with carbonation, temperature affects the solubility of nitrogen in beer. Most beers that are infused with nitrogen or "nitrogenated" are cold during the process. At Springfield Brewing Company we use a blended gas containing 75% nitrogen and 25% carbon dioxide when we nitrogenate certain beers. The 38 °F (4 °C) beer is equilibrated with this gas blend at 26 PSI. One of the things to know about nitrogenated beers, such as Guinness (the brewery who developed this method back in the 1950's), is that the level of carbon dioxide is extremely low and must be low for the beer to pour properly through the special taps used for nitrogenated beer.

By equilibrating the beer with mixed gas with a low carbon dioxide ratio (20–25% is the norm) the carbon dioxide content will be low (about 1.2 volumes or about 2.5 grams/liter of carbon dioxide) compared to normally carbonated beer.

Beer can be carbonated by simply putting the beer in a keg and pressurizing the headspace and allowing the carbon dioxide to move from the headspace into the beer. Although this process takes a couple of days, it is an easy method to carbonate beer.

> "There are three things that are required to serve beer with nitrogen at home: a keg, a supply of mixed gas and a special stout tap. The hardest thing to get is the mixed gas."

Nitrogen, on the other hand, is much less soluble than carbon dioxide and simply pressurizing a keg of beer with mixed gas takes a lot longer to equilibrate. For that reason it is best to bubble the mixed gas through a sintered stone to accelerate the process.

The method we use at Springfield is to first pressurize the headspace of the tank to about 26 PSI with mixed gas, open the gas supply to the sintered "carbonation stone" (in this case it becomes a nitrogenation stone) and then to very slowly bleed gas from the headspace.

The rate at which gas is vented from the headspace equals the rate of gas flowing into the tank as long as the supply pressure and headspace pressure are the same. We use an interval method where we gas for 30 minutes, rest for 30 minutes and then gas for another 30 minutes. We are able to get a 500 gallon (1893 L) tank of beer to the proper condition for dispense after this gassing cycle.

There are three things that are required to serve beer with nitrogen at home: a keg, a supply of mixed gas and a special stout tap. The hardest thing to get is the mixed gas.

When I was in school at UC-Davis, I blended nitrogen and carbon dioxide and used a soda keg as my gas tank. This requires a source of nitrogen and carbon dioxide and is probably not practical at home. The best thing to do is to find a local beverage gas supplier who carries "Guinness gas" and get a small carbon dioxide bottle filled.

I think the best way for homebrewers to start with experimenting with nitrogen is to begin with the classic and that is brewing a dry stout. There is really nothing more exciting than brewing a black ale that when poured has a creamy white head and dancing gas bubbles that take you right back to the first pint of stout you had in an Irish pub.

Once that initial challenge is conquered, the sky is the limit as far as the various beers that will work well with this dispense method.

ANDY TVEEKREM has overseen all plant operations for the Dogfish Head Craft Brewery in Milton, Delaware since 2004. Educated in brewing at the Siebel Institute, he started homebrewing in 1986 and turned professional in 1991 when, "As Hunter Thompson always said, 'When the going gets weird, the weird turn pro.'"

The serving method and presentation of a beer are very important. We drink with our eyes first, so if a beer is flat or too foamy or cloudy when it should be clear, then our impression will be negative before we even taste it.

Certain types of glassware have been found to promote certain characteristics of beer, like the Pilsner flute, which showcases the fine carbonation of that beer style. And of course Guinness has done a fantastic job with nitrogen dispense, to the point where the pour is much like a bit of pub theater.

Randall was invented by Sam Calagione here at Dogfish Head a few years ago as a way to showcase dry-hopping. It simply moves the dry-hop addition from the fermentation tank to the point of dispense. It's great for bars or at festivals because the hops are in a clear housing and people can see the beer flowing through them. It really helps connect people to one of the major ingredients in beer.

If you use a Randall at home, my advice is to be creative and use it as a learning tool. A Randall is ideally suited to home dispense since there is normally a longer contact time with the hops, as opposed to a tavern or a festival where the beer is flowing fast. More contact time yields more flavor.

A Randall is also a great item for experimentation. For example, try taking a pale ale and using different hop varieties in the Randall to see which ones work best with that beer. You don't have to make a whole brew to try out each variety, just empty out the Randall and refill it with the next hop.

It is also fun to use other ingredients than just hops. Slices of fruit can be used, or spices and herbs — just be sure not to clog up the spaces in the filter element.

Up to now, Randall has been our most exotic serving device, but that can change at any time! Currently we are working on Randall version 2.0, which started as a senior engineering project with a group of Bucknell University students. They redesigned the flow chamber to reduce foaming and enhance flavor extraction. We are still doing our design review and working on a production prototype.

Hop Utilization

Halting enzymes, carbonation and taste

"Help Me, Mr. Wizard"

by Ashton Lewis

Upping IBUs

I have been planning on making an extract oatmeal stout, but after entering all my ingredients into a recipe calculator I am concerned with my hop utilization. I boil my wort in about two gallons (8 L) of water and have noticed, through the recipe calculator, that as I add more sugars the hop utilization goes down. I plan on using six pounds of liquid malt extract and a pound or two of honey. If I add just the malt, it shows that I will have around 20 IBUs but if I were to add the honey to the boil that would lower it to about 16 IBUs. I have heard of brewers boiling their hops in plain water and adding the malt and sugars after they have boiled the hops for a while. Could you explain how I would go about getting better hop utilization without buying new equipment?

Adam Boyle
via e-mail

On the surface this may seem like an easy question. Since hop utilization decreases as wort gravity increases it seems logical that one solution to the dilemma faced by extract brewers who boil concentrated wort is to boil the hops separately. This may sound attractive but one downside to this is that the quality of the bitterness and the extraction of plant substances from the hops are reportedly different when hops are boiled in water compared to boiling in wort, and the differences are not for the better.

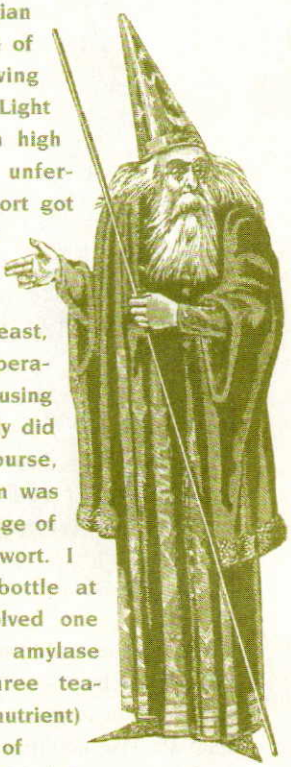
The difference between an expected bitterness of 16 versus 20 indicates a reduction in bitterness by 20%, meaning that one way to combat the issue is to increase the weight of bittering hops added to the boil by 24% (the additional hop addition also has a reduced utilization, so the increase to the recipe needs to be 24%). This will minimally increase the cost, maybe by a buck or so, of your ingredients. If you really want to keep your ingredient efficiency in line with all-grain brewing you still have a couple of other options.

The first option is to boil the hops in wort with a specific gravity in the neighborhood of 1.048, which is similar to the average gravity for a full-volume wort boil. You do not have to dilute all of your extract to this strength, just enough to give a decent ratio of wort to hops. I suggest using at least one gallon of wort per half ounce of hops because the solubility of iso-alpha acids in wort is limited and if the ratio is too low then your hop yield will suffer. You should boil the first hop addition for at least 60 minutes to get the best isomerization and during this time you don't want to evaporate much more than about 10% of the wort volume.

When using malt extracts, the time required to boil the wort is not nearly as critical as with all-grain brewing because the wort has already been boiled during the production of the malt extract. You really only need about 20 minutes to make sure you kill anything that might be in the extract, meaning that you could add your extract to the boiling wort and hops towards the end of the 60 minute boil. If you do this you want to make sure the wort gravity is not excessively high. You could mix the bulk of your extract with water, get it boiling and then add the contents of your hop boil to it to make things flow easily. Remember that hops added late in the boil are primarily for aroma. Since isomerization is not required for extracting aroma this method should not reduce the contribution of late hops as compared to a full-volume wort boil.

In essence this method is nearly identical to the method you proposed, except the hops are being boiled in wort as opposed to water. Another method is to use two kettles to do a full-volume wort boil by splitting the volume into two easier to handle kettles. This will require more equipment (a second kettle) and allows you to easily boil the two pots on your kitchen stove. The beer in question contains a couple of pounds of honey and in this particular example you could hold off on adding the honey to the end of the boil. So you have a few options to address your dilemma without having to risk potential off-flavors associated from boiling hops in water!

Ending enzyme activity



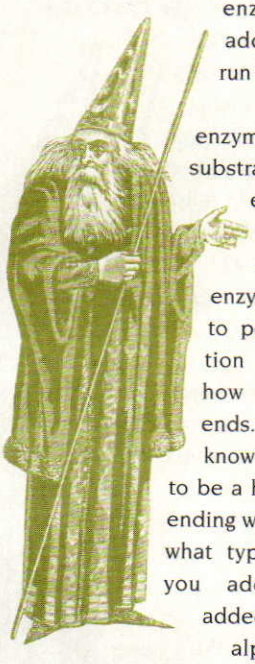
I brewed a Belgian clone with an OG of 1.091. Not knowing Laaglander Extra Light DME had such a high percentage of unfermentables, the wort got down to 1.042 and stopped completely. Adding fresh yeast, keeping the temperatures right and rousing the yeast regularly did nothing, of course, since the problem was the high percentage of starches in the wort. I didn't want to bottle at 1.042 so I dissolved one teaspoon of amylase enzyme (and three teaspoons of yeast nutrient) into about ¾ cup of boiled and cooled-to-lukewarm water and dumped it into the carboy. Within 24 hours, activity and bubbling started back up and a bubble was escaping the airlock every ten seconds or less, so the enzyme must have been doing its work despite being added at fermentation temperatures instead of mashing temperatures.

Is there any way to stop the enzymatic activity when the gravity gets down to a reasonable level? Or will it just keep going until all the starches are broken down? I really don't want to turn this batch into Belgian rocket fuel! Have I created a monster?

Kevin Huddleston
Milton, Wisconsin

I am not sure you have created a monster but you may have a runaway train on your hands! There are only two

ways to stop an enzymatic reaction. You can destroy the enzyme or wait until there is no more substrate for the enzyme to act upon. Enzymes are easily destroyed when heated to the point where the enzyme denatures. If you had a way to pasteurize your beer you could easily halt this reaction. You probably don't have a convenient way to denature the enzyme and by the time this answer is published the enzyme you added will have run its course.



When an enzyme runs out of substrate the action ends and in non-living systems where enzymes are added to perform a function this is often how the reaction ends. It is difficult to know if this is likely to be a happy or tragic ending without knowing what type of amylase you added. If you added a mixture of alpha and beta amylases, the result would most likely be a pretty dry beer with residual sugars that yeast cannot ferment. Adding alpha and beta amylase would be akin to extending your mash profile to produce a dry beer, but even with these beers there are some unfermentable sugars.

If you used the ultimate amylase enzyme in your brew and blasted it with a de-branching enzyme like amyloglucosidase (AMG) you may end up with an extremely dry and high alcohol beer. Some brewers use AMG to brew low calorie and low carbohydrate beers with a lesser alcohol content. A couple of years ago I wrote an article intended as a joke about using Beano® at home to brew light beers and some homebrewers began using it. Beano® contains alpha-galactosidase but achieves a similar outcome as AMG. If you added a tablet or two of this stuff, I predict that the end result may be pretty disappointing for the style of beer you brewed.

There is a solution to your problem that falls into the band-aid category. You could halt fermentation and greatly slow the action of the enzyme you added by cooling the beer down near freezing. This would give you enough time to rack into a keg, carbonate it and drink it before much happens. The worst thing that could happen is that the enzyme activity continues and you have an over-carbonated keg. Or the enzyme produces some sugar from the residuals in the beer but there is no yeast activity, resulting in some added sweetness. I do not suggest using this band-aid fix if you do not have a keg because if there is yeast and enzyme activity still going on you could have a bunch of bottle bombs sitting around.

Carbonate or bottle condition?

Can you lager a beer after fermentation near freezing and then raise the temperature, prime, and bottle condition or has the yeast been dormant too long to make it active again? I have recently read some Kölsch and altbier recipes that are unclear as to the process for carbonating via bottle conditioning.

Stephen Walls
Matthews, North Carolina

This is one of the rare questions with a short and sweet answer. You can certainly lager a beer at near freezing temperatures, warm it up, prime it and bottle condition. Depending on how long you keep the beer cold during lagering there are two problems that you potentially may face.

The first issue has to do with that pesky thing called gravity. During lagering yeast cells settle to the bottom of the lagering vessel and as beer sits undisturbed during lagering the yeast cell concentration in the beer drops. If you have really clear beer you won't have enough yeast present for carbonation.

The other thing that happens during beer aging is that yeast viability declines as yeast cells die and those that do survive have reduced vitality. Simply warming the beer up will not improve yeast health. If the beer has been lagering much longer than about 2–3 weeks you may need to recruit some fresh troops. One million cells per milliliter of beer, or about a tenth of the normal pitching rate for fermentation, is good yeast density for bottle-conditioned beer. The easiest thing to do is use a small amount of dry yeast to fortify your brew with yeast. I wouldn't get too concerned about the yeast strain since the only thing the yeast really does during bottle conditioning is to kick out a little carbon dioxide. If you brew frequently you can of course use liquid yeast if that is more palatable to your brewing style.

A matter of tastes

I have been homebrewing for several years and usually brew beers with a lot of flavor. Some of my friends who prefer wimpier styles of beer want me to brew something for them with less of the "homebrewed" flavor. I am wondering if I comply with their requests if that will make me a sell out? If I do brew something for them do you have any suggestions on a style?

Andrew Scullin
Seattle, Washington

To answer this question you must begin by asking your friends what they mean by "homebrewed" flavor. To me this term has a negative connotation, principally that homebrews in general have flavor profiles that are in some way unrefined. I hate it when I read in the local newspapers about our brewpub touting our house-brewed beers, implying that beers brewed in a small brewery located in a restaurant are somehow different from beers brewed in a larger place. To me it's all about what is in the glass.

Another interpretation of this descriptor is that homebrewed beers, like many craft beers and imports, actually have flavors that make them stand apart from many of the bland beers brewed for the vast majority of beer drinkers who apparently prefer beer without flavor. In that context, the descriptor says more about the preferences of the consumer than it does about your beer.

With that said, you may interpret this to mean that your friends prefer beers that are less hoppy, bitter or malty (or a combination of all three) than your typical lineup of beers. In my opinion, when you respond to requests from your consumer, in your case your friends, you are certainly not selling out by trying to brew a beer to suit their tastes. Some brewers take offense to the notion that some people

have different preferences than the artist and take the attitude that anyone who has a different preference of flavors is in some fashion defective as a beer drinker. If you happen to view brewing in those terms then making your friends happy most certainly would make you a sell-out. On the other hand, a bit of flexibility may simply earn you the feared title of Mr. Nice Guy.

This question hits close to home for me and other craft brewers who do see brewing as an art, but must also remember that a commercial brewery relies on people spending money on our creations to stay in business. I recently came up with a beer to satisfy some of our patrons who just want "a beer" while at the same time challenging myself not to brew something with no flavor that I personally would not want to drink.

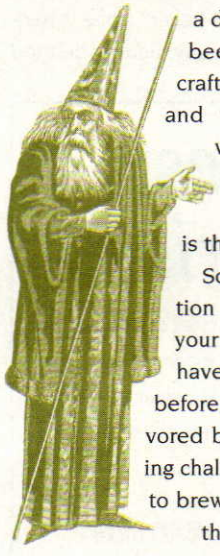
The style I chose to formulate was loosely based on beers brewed by medium-sized domestic breweries that started falling off of the beer map surrounding the great experiment known as Prohibition. Since I was not around during that time period I have no way of knowing what any of these beers tasted like and only know what I have read and been told.

Some beer writers describe the beers brewed before Prohibition in terms that lead one to believe that American beers were radically different 75–100 years ago as compared to today's domestic beers. My personal conclusion is that these beers were certainly different from the typical big domestics we have now, but not radically different. After all, American brewers have used malted barley, hops and adjuncts, such as rice and corn, for at least 150 years as the basis for their beers. Ignoring differences in raw material quality (for example, today's pale malt is most likely lighter in color and flavor than it once was due to advances in malting and kilning), recipes of the past and present have a limited number of combinations that work to yield wort with a narrowly defined original gravity and color range.

You are asking me a question I rarely get and that is my suggestion for a style to brew. My suggestion is to brew a lager with some adjunct and attempt to brew something that may have been in the icebox of the American beer drinker 60 years ago. I have a friend who is fifth generation brewmaster whose family had a brewery that was in operation from the mid 1800's until the mid 1900's who recently gave me some insight on their flagship beer. This beer was probably typical of beers of the period and contained malted barley, some higher kilned specialty malt, corn and hops and was aged on beechwood chips (this was a common practice by many American brewers in the past) and then fined with isinglass prior to filtration. Based on that basic description, one may guess that such beers were not all that different than the modern domestic.

My interpretation of the style was to keep the flavor clean and balanced and to add a bit more hop bitterness and aroma than the typical domestic lager and to use a small amount of special malts for a splash of toastiness and color. At Springfield Brewing Company we called this beer "Old School Lager" since it really does not fit into any neatly defined

style and the name sounds pretty hip! With 20 IBUs and an original gravity of 1.046 (11.5 °Plato) made up using 2-row malted barley, flaked maize (about 30% of the total extract), a bit of Weyermann Cara-Munich® and a pinch of Carafa I®, this beer falls somewhere between a really lightly-flavored pale ale (minus the assertive hop aroma) and a domestic lager. I have been surprised that craft beer aficionados and the person simply wanting "a beer" really like this brew. And high on my list is that I too like it!



So there is my suggestion for a brew to make your friends happy. As I have written many times before, making lighter flavored beers can be a brewing challenge if you are used to brewing big hoppy beers that have enough girth to camouflage imperfections. I have a few tips (many seemingly obvious) that will help brew a nice clean lager:

- Have a good lager yeast strain in sufficient quantities when it comes time to pitch the wort.
- Aerate the wort well before pitching the yeast.
- Keep the fermentation temperature between 50–57 °F (10–14 °C) depending on the strain.
- Get the beer temperature down to as close to 32 °F (0 °C) as possible for at least two weeks prior to bottling.

I like to see primary fermentation of normal gravity lagers last no more than ten days and prefer to see primary tailing off after five to seven days. Long fermentation times usually indicate yeast or wort aeration problems.

Since most homebrewed beers are bottle conditioned I personally do not advocate excessive aging periods prior to bottling unless you plan on adding fresh yeast when it comes time to bottle. After two weeks of cold aging, most of the yeast has settled to the bottom of the fermenter and any remaining aging that is desired will occur in the bottle. Of course this style of beer is also great to put into a keg and serve at a party. If you choose to brew down this route I hope your friends are happy with the beer. Cheers!

Brew Your Own Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard for the last 12 years. A selection of his Wizard columns have been collected in "The Homebrewer's Answer Book," just released, available online at brewyourownstore.com.

Do you have a homebrewing question for Ashton? Send inquiries to *Brew Your Own*, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond personally. Sorry!

Scottish Ales

Malty, biscuity session ales with few esters

by Jamil Zainasheff

The first Scottish ale I ever brewed was a sixty-shilling ale that turned out thin and watery, so I set the keg aside and forgot about it. About a year later I came across the keg and tried what I thought was going to be a stale, thin beer. Instead it had been magically transformed. The head was now fine, thick, and long lasting and the beer seemed to have a lot more body. I entered it in competitions and, sure enough, it placed high every time. This success triggered my interest in Scottish ale and taught me that even small beers can benefit from some period of cold conditioning.

This is a style that can be brewed at a variety of strengths. The BJCP style guide includes 60/-, 70/-, and 80/- Scottish ales. Many years ago the price of a cask of Scottish ale including the tax was given in shillings. This was written as the number of shillings, a slash, and then the number of pence (shillings/pence). When there are no pence, they would write a dash instead (shillings/-). When you see 70/-, read it as "seventy shilling." Today the shilling number is still a relative indication of one beer's strength to another, and in Scotland, when ordering Scottish ale, you ask for a "seventy" or an "eighty." Unfortunately, 60/- is virtually non-existent at pubs in Scotland today. In the U.S., the trend is also toward the higher alcohol versions such as 80/- and more (Odell Brewing Company of Fort Collins, Colorado makes an award-winning 90/-).

Photo by Jim Witmer

Most Scottish ales range in color from very light amber to a deep copper color. They are very clean beers with few apparent esters, except when made as big beers. They have a malt-focused aroma, with bread and toasted malt notes, caramel, and some residual malt sweetness. Most classic examples have just enough hop bitterness to keep the beer from being too sweet. Generally, any hop flavor and aroma is found in trace amounts from the early bittering addition. The body is thinner on the smaller beers and full on the big beers, but they should never be thin and watery or super thick and heavy.

Some beer judges will detect slight peat smoke notes in this style, even when there is no peat malt used. Perhaps it is the combination of roasted malt and malt sweetness or perhaps it is something else in combination with minor oxidation that is perceived as a very slight smoky, earthy, or peat-like note. Contrary to popular belief, there should never be peat smoked malt in Scottish ale. Much confusion was caused a number of years ago when some written descriptions mentioned peat or smoked character in these beers. Brewers took this description to heart and started adding peat smoked malt to Scottish beers and judges started hunting for any suggestion of it. I've heard some people say it is the water or the yeast that provides this peat character, but the water and clean ale yeast I use don't produce peat or smoke character in any of my other beers. Yet many beer judges do comment on peat smoke character in my Scottish ales. I'm not saying that they don't actually have that perception, but I think for many judges, they probably try a little too

(story continued on page 21)

SCOTTISH 70/- ALE by the numbers

OG	1.038–1.040 (8.8–10 °P)
FG	1.010–1.015 (2.6–3.8 °P)
SRM	9–17
IBU	10–25
ABV	3.2–3.9%

RECIPE

Scottish Heavy 70/-
(5 gallons/19 L, all-grain)

This recipe makes a great Scottish 70/- and you can adjust it to make 60/-, 70/- or 80/- beers. When increasing or decreasing the starting gravity of a recipe, the specialty grains remain the same; it is only the base malt and hop bittering that changes.

OG = 1.038 (9.5 °P)
FG = 1.014 (3.5 °P)
IBU = 15 SRM = 15 ABV = 3.2%

Ingredients

5.5 lb. (2.5 kg) British pale ale malt (3 °L)
1.0 lb. (0.45 kg) crystal malt (40 °L)
0.5 lb. (227 g) honey malt (18 °L)
0.5 lb. (227 g) Munich malt (8 °L)
0.25 lb. (113 g) crystal malt (120 °L)
3.0 oz. (85 g) pale chocolate malt (200 °L)
3.15 AAU East Kent Goldings hops (60 mins)
(0.63 oz./18 g of 5% alpha acid)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts (1.4 L) of water to 1 pound (0.45 kg) of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 158 °F (70 °C). Hold the mash at 158 °F (70 °C) for 60 minutes to allow for proper grain hydration and enzymatic conversion. Infuse the mash with near boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 6.5 gallons (25 L) and the gravity is 1.029 (7.4 °P). The total wort boil time is 90 minutes. Add

recipe continued from page 19

the bittering hops with 60 minutes remaining in the boil. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 65 °F (18 °C) and aerate thoroughly. The proper pitch rate is one package of liquid yeast in a 1 liter starter.

Ferment at 65 °F (18 °C) until the yeast drops clear. Fermentation will be slow and steady at this temperature and with healthy yeast, fermentation should be complete in about one week. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Serve at 48 to 52 °F (9 to 11 °C). Allowing the beer to cold condition at 40 °F (4 °C) or lower for several months will improve the beer.

60/- and 80/- options:

To make a 60/- ale, decrease the British pale ale malt to 4.75 lb (2.15 kg) and reduce the hop addition to 0.56 oz (16 g). The post-boil gravity should be 1.034 (8.6 °P).

To make an 80/- ale, increase the British pale ale malt to 8.5 lb (3.85 kg) and increase the hop addition to 0.85 oz (24 g). The post boil gravity should be 1.053 (13 °P). Use two liquid yeast packages or make a 1.5 liter starter using one yeast package.

Scottish Heavy 70/-
(5 gallons/19 L, extract w/ grains)

OG = 1.038 (9.5 °P)
FG = 1.014 (3.5 °P)
IBU = 15 SRM = 15 ABV = 3.2%

Ingredients

3.6 lb. (1.63 kg) English pale ale liquid malt extract (3.5 °L)
1.0 lb. (0.45 kg) crystal malt (40 °L)
0.5 lb. (227 g) honey malt (18 °L)
0.5 lb. (227 g) Munich malt (8 °L)
0.25 lb. (113 g) crystal malt (120 °L)
3.0 oz. (85 g) pale chocolate (200 °L)
3.15 AAU East Kent Goldings hops (60 mins) (0.63 oz./18 g of 5% alpha acid)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast

Step by Step

Mill or coarsely crack the specialty malts. Mix them well and place loosely in a grain bag. Steep the bag in about two gallons (~8 L) of water at roughly 170 °F (77 °C) for about 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags. Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 5.9 gallons (22 L) and a gravity of 1.032 (8.2 °P). Stir thoroughly to help dissolve the extract and bring to a boil.

Once the wort is boiling, add the bittering hops. The total wort boil time is one hour after adding the bittering hops. During that time add the Irish moss or other kettle finings at 15 minutes before shut-down. Chill the wort to 65 °F (18 °C) and aerate thoroughly. The proper pitch rate is one package of liquid yeast in a 1-liter starter. Follow the fermentation and packaging instructions for the all-grain version.

60/- and 80/- options:

To make a 60/- ale, decrease the English pale ale extract to 3.1 lb (1.4 kg) and reduce the hop addition to 0.56 oz (16 g). The post boil gravity should be 1.034 (8.6 °P).

To make an 80/- ale, increase the English pale ale extract to 5.6 lb (2.5 kg) and increase the hop addition to 0.85 oz (24 g). The post boil gravity should be 1.053 (13.1 °P). Use two liquid yeast packages or make a 1.5 liter starter using one yeast package.

Scottish Heavy 70/-, Caramelized
(5 gallons/19 L, all-grain)

This is a more traditional Scottish ale recipe, which relies on some kettle caramelization and an extended boil to increase the level of melanoidins. When making this beer, you will need to boil one gallon of first runnings, reducing it down until it becomes syrupy and the sugars begin to caramelize. This is can be done in a separate pot and then added back to the main wort or done in the main kettle if you don't mind delaying the sparge. You may need to add water to the boil kettle to end up at the correct starting gravity and volume.

OG = 1.038 FG = 1.014
IBU = 15 SRM = 13 ABV = 3.2%

Ingredients

7.5 lb. (3.4 kg) British pale ale malt (3 °L)
3.0 oz. (85 g) black roasted barley (500 °L)
3.15 AAU East Kent Goldings hops (60 mins) (0.63 oz./18 g of 5% alpha acids)
Wyeast 1728 (Scottish Ale) yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain. Hold the mash at 158 °F (70 °C) for 60 minutes. Infuse the mash with near boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Collect 1.0 gallon (3.8 L) of first runnings from the mash. Heat it to boiling, reducing it down until it becomes syrupy and the sugars begin to caramelize. Control the heat carefully to avoid scorching the wort. Once the sugars are adequately caramelized, begin the sparge into the kettle. Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 7.1 gallons (27 L) and the gravity is 1.026 (6.7 °P).

The total wort boil time is 120 minutes. Add the bittering hops with 60 minutes remaining in the boil. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 60 °F (16 °C) and aerate thoroughly. The proper pitch rate is one package of liquid yeast in a 1-liter starter.

Ferment at 60 to 62 °F (16 to 17 °C) until the yeast drops clear. Fermentation will be slow and steady at this temperature and, with healthy yeast, should be complete in about one week. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Serve at 48 to 52 °F (9 to 11 °C). Cold conditioning at 40 °F (4 °C) or lower for several months will improve the beer.

(story continued from page 19)

hard to find peat character in Scottish ales and it is actually more imagination than reality. While the judging of this style continues to improve, every now and then I still hear of judges asking brewers to add peat smoked malt to their beers, which is wrong. Do not add peat malt to any of the beers in this category. If you do, it isn't really a Scottish ale, it's a smoked beer.

The basis for today's Scottish ales is well-modified British pale ale malt. British pale ale malt is kilned slightly darker (2.5 to 3.5 °L) than the average American two-row or pale malt (1.5 to 2.5 °L) and this higher level of kilning brings out the malt's biscuity flavors. A few malt companies (Crisp Malting is one) still produce British pale ale malt from cultivars such as Maris Otter and Golden Promise using a traditional floor malting method. The result is malt with a slightly darker color (3.5 to 4.0 °L) and more flavor than other pale ale malts. It provides a biscuit and bread-like maltiness that is fundamental to these styles. While you can use U.S. domestic two-row malt in a pinch (~1.5 °L), the more highly-kilned domestic pale ale malt (~2.5 °L) is a better choice.

Highly-modified British malts are perfectly suited to single infusion mashes, which is typical for all Scottish beers. Mash around 158 °F (70 °C) for Scottish ales, to produce highly dextrinous wort. Highly dextrinous wort (created through proper mash temperature and a substantial amount of specialty grains) is needed in this style, as it creates a beer with more non-fermentable, complex sugars. It is these polysaccharides which provide enough body to keep the beer from being thin and watery.

If you're brewing with extract, your best choice is an extract made from British pale ale malt. There are some British style malt extracts currently on the market made from 100% Maris Otter malt and they are an excellent choice for Scottish beers. If you can't get it through your local homebrew shop, you can find it online. If you must use domestic two-row malt or extract made from it, you'll need to compensate with some additional specialty malts such as biscuit or Victory, but use restraint.

There are two schools of thought when brewing Scottish ale. One camp brews this style using pale ale malt, a touch of black malt or roasted barley for color, heavy kettle caramelization to develop caramel flavors, and an extended boil to develop additional melanoidins. The other camp, based on an idea I first learned from Ray Daniels, uses specialty malts, such as crystal, honey and Munich to provide the characteristic malty, caramel flavors of Scottish ale instead of a caramelizing step and an extended boil.

In my experience, beers made with heavy kettle caramelization often have a strong toffee note, which many people describe as buttery and a flaw in the beer. While it may not be very traditional, I prefer the specialty grain method.

When using the specialty grain method you're trying to create three characteristics in the beer: a rich, malty flavor of bread and toast, a caramel sweetness, and a slight background roast grain note. For highlighting the malt character, I like Munich and honey malt for approximately

10% of the grist. A bold dose of mid-color crystal malt (~40 °L), as much as 15%, creates an easily recognizable caramel sweetness. A touch of dark crystal malt (~120 °L) adds some interesting background burnt caramel and raisin notes. Many other recipes out there use a dash of highly-kilned grain in the 500 °L or darker color range. I find that a bit much and prefer to use lighter kilned malt, specifically pale chocolate (200 °L). Along with a slight roast note, the pale chocolate lends a deep, dark, toasted bread note to the beer.

Good hop choices are East Kent Goldings or Fuggles. The hop bitterness in this style is quite subdued — just enough to keep the beer from being overly sweet. Hop flavor and aroma should be from very low to none at all. A single addition early in the boil is all that is needed. Target a bitterness to starting gravity (IBU divided by OG) ratio around 0.3 to 0.5.

Scottish ale is traditionally brewed with fairly soft water, which keeps the hop bitterness from being sharp and enhances the soft maltiness of the beer. If you have particularly hard water, you might cut it with distilled water or boil your water to precipitate some of the calcium carbonate. I have moderately hard water, but I only adjust my water for proper mash pH when brewing Scottish ales. If your water tastes good, it will usually make a fine Scottish ale.

Yeast selection for Scottish ales is quite straightforward: pick a clean-fermenting ale yeast with moderate attenuation. Many brewers find White Labs WLP028 (Edinburgh Ale) and Wyeast 1728 (Scottish Ale) yeast satisfactory. However, I prefer White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale). These are both very clean fermenting yeasts, lacking most of the diacetyl and ester production of other yeasts, and with a combination of cool, controlled fermentation, a relatively high mash temperature, and plenty of specialty malts the attenuation is moderate. If you're making a big beer and want it to have a bit more esters, the Edinburgh/Scottish yeast is a good choice.

Ferment around 60 to 62 °F (16 to 17 °C) with the Edinburgh or Scottish yeast or 65 °F (18 °C) with the California Ale or American Ale yeast. A period of cold conditioning, holding the beer for a month or two at near freezing temperatures, helps the beer mature.

Scottish ales require a relatively low level of carbonation. Add just enough to impart a bit of mouthfeel and to drive the aroma out of the glass and up to your nose. Too much carbonation makes the smaller beers seem dry, harsh, and acidic, while gentle carbonation can make them feel creamy and soft. Aim for 1.5 to 2.0 volumes of CO_2 for bottled product. This is about two-thirds of the carbonation of a typical American pale ale, so you'd use two-thirds the amount of priming sugar at bottling time. If you keg or cask condition your beer, aim for 1.0 to 1.5 volumes.

Jamil Zainasheff discusses brewing tips and brewing beer styles as the host of the popular Jamil Show on The Brewing Network, www.thebrewingnetwork.com/jamil.php.

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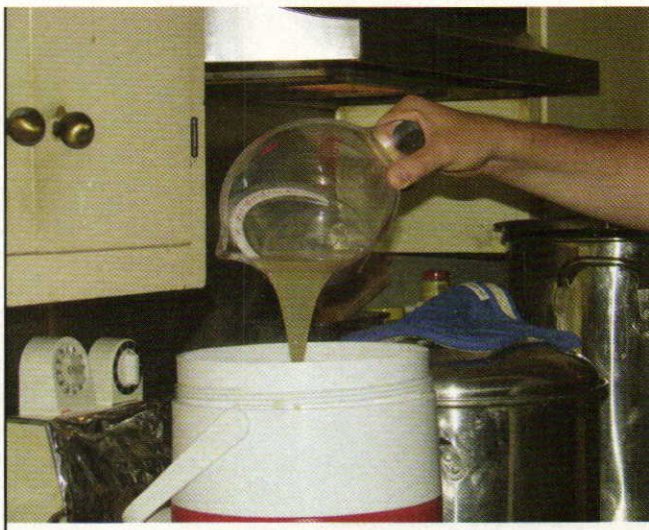
PARTIAL MASH PERMUTATIONS

by **Chris Colby**

In the October 2006 issue of *Brew Your Own*, I introduced a new way to do a partial mash, which I called a countertop partial mash. My method involves mashing 4 pounds (1.8 kg) of grain in a grain bag in an unmodified 2-gallon (7.6 L) beverage cooler. The wort from the first mash is drained and the cooler is refilled with hot water, allowed to rest briefly and the second wort is drained. The first and second wort — along with enough water to make around 3 gallons (11 L) of wort total, and perhaps some dried malt extract — are boiled and the hops are added. At or near the end of the boil, liquid malt extract is stirred into the wort to bring the total amount of carbohydrates to the desired level. The wort is then cooled, diluted to 5 gallons (19 L) and fermented and conditioned as with any other homebrew.

In this article, I present 10 new countertop partial mash recipes, inviting the partial mash brewer to explore some interesting base malts and suggesting some optional extensions of this technique.



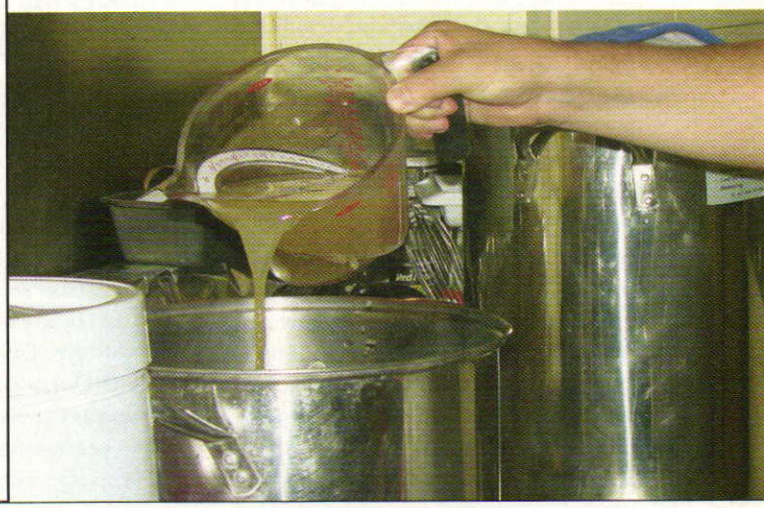
The main benefit of this method is the ability to incorporate a wide variety of base malts into your stovetop recipes that aren't available in malt extract form. In addition, because you boil at least 3.0 gallons (11 L) of wort, you achieve better hop utilization compared to brews in which 2.0 gallons (7.6 L) or less wort is boiled. And finally, by adding roughly half of the "gravity" of the beer as malt extract at the end of the boil, you can brew a lightly-colored beer, if desired.

One problem some brewers have encountered is slow drainage or stuck mashes. In most cases, a little lift and turn of the grain bag will solve this problem. If not, placing a folding strainer basket at the bottom of the cooler may help. Also, moving to a coarser crush will help if this is a consistent problem.

10 countertop partial mash recipes

All you need to brew a countertop partial mash beer is a 2.0-gallon (7.6-L) beverage cooler, a grain bag large enough to hold the grains, a large spoon, a measuring cup (preferably 2 cups (~500 mL) or larger), a brewpot with enough headspace to comfortably boil 3.0 gallons (11 L) of wort and your regular homebrewing gear.

This method was designed to be simple to perform and not require any specialized equipment, yet greatly increase the range of beers a stovetop brewer could successfully brew.



House of Paine (American Pale Ale)

(5 gallons/19 L, partial mash)

OG = 1.048 FG = 1.012

IBU = 45 SRM = 10 ABV = 4.6%

The flavor and aroma of American hops are at the forefront of this beer, supported by a "clean" malt backbone from domestic 2-row malt. Not too many years ago, a beer like this would have been revolutionary. These days, compared to double or imperial IPAs, *its hopping level seems well within* The Age of Reason. *A very tasty session beer for a hophead. 40% of the extract weight of this beer comes from the grains in the partial mash.*

Ingredients

3.25 lbs. (1.5 kg) US 2-row pale malt
0.75 lbs. (0.34 kg) crystal malt (40 °L)
9.0 oz. (0.26 kg) Briess Light dried malt extract
3 lb. 10 oz. (1.6 g) Briess Light liquid malt extract (late addition)
8 AAU Simcoe hops (60 mins) (0.62 oz./17 g of 13% alpha acids)
0.50 oz. (14 g) Cascade hops (20 mins)
0.50 oz. (14 g) Cascade hops (15 mins)
0.50 oz. (14 g) Cascade hops (10 mins)
0.50 oz. (14 g) Amarillo hops (5 mins)
0.50 oz. (14 g) Amarillo hops (0 mins)
1.5 oz. (43 g) Cascade hops (dry hops)
1 tsp. Irish moss (15 mins)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (1.5 qt./~1.5 L yeast starter) or Safale US-05 dried yeast
1 cup corn sugar (for priming)

Step by Step

Here's the basic countertop partial mash method, with a few brewing notes along the way. Heat 5.5 qts. (5.2 L) of water to 163 °F (73 °C) and mash grains at 152 °F (67 °C) for 35 minutes. (In these recipes, the temperature of the strike water is always 11 °F (6 °C) higher than the mash temperature. This should yield a mash temperature close to the target when the grain and cooler are at "room temperature," but take good notes and adjust this temperature in later brews, if needed. Also, don't worry if you miss your mash temperature by a degree or two the first time you try this method.) While the mash is resting, bring 1.0 gallon (3.8 L) of water to a boil in your brewpot, and heat 5.5 qts. (5.2 L) to 180 °F (82 °C) in a separate pot. Recirculate 3 qts. (~ 3L) of wort, then run off the first wort to kettle. Stir in 180 °F (82 °C) water into grains in cooler until water level reaches level of first mash. (The hot water added back to the grain bed should, ideally, heat it to 168 °F (76 °C). This is another value that should be adjusted as you gain experience.) Let sit for 5 minutes, recirculate, then run off second wort to kettle. Add dried malt extract and bring to a boil, adding hops at times indicated. (You should end up with close to 3 gallons (11 L) of pre-boil wort, total. If you are low, add water.) Add liquid malt extract and Irish moss with 15 minutes left in boil. (Keep your boil timer running, even though it may take a few minutes for the wort to return to a boil.) After boil, cool wort, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment at 68 °F (20 °C). Add dry hops in secondary fermenter or keg.

St. Hubbins Ale (British Bitter)

(5 gallons/19 L, partial mash)

OG = 1.038 FG = 1.010

IBU = 30 SRM = 14 ABV = 3.6%

Maris Otter is a type of barley, and several English maltsters make 2-row pale ale malt from it. This malt yields a slightly nutty/biscuity, "English" character, that tastes great in pale ales and bitters. St. Hubbins Ale is full-bodied, given the low starting gravity, with a full caramel flavor. Classic English hops balance the malt and sweetness to make this a very quaffable beer. Perfect with "Cups and Cakes." 50% of the extract weight of this beer comes from the partial mash.

Ingredients

2 lb. 13 oz. (1.3 kg) 2-row pale ale malt (Maris Otter)
1 lb. 3 oz. (0.54 kg) crystal malt (60 °L)
2 lb. 14 oz. (1.3 kg) Muntons Light liquid malt extract (late addition)
1 tsp. Irish moss (15 mins)
5 AAU Kent Goldings hops (60 mins) (1.0 oz./28 g of 5% alpha acids)
0.50 oz. (14 g) First Gold hops (15 mins)
0.50 oz. (14 g) First Gold hops (0 mins)
Wyeast 1028 (London Ale), White Labs WLP013 (London Ale) yeast or Danstar Windsor dried yeast (no yeast starter needed)
0.75 cup corn sugar (for priming)

Step by Step

Heat 5.5 qts. (5.2 L) of water to 167 °F (75 °C) and mash grains at 156 °F (69 °C) for 45 minutes. While mash is resting bring 1.0 gallon (3.8 L) of water to a boil in your brewpot, and heat 5.5 qts. (5.2 L) to 180 °F (82 °C) in a separate pot. Recirculate 3 qts. (~ 3L) of wort, then run off to kettle. Stir in 180 °F (82 °C) water until water level reaches level in first mash. Let sit for 5 minutes, recirculate, then run off second wort to kettle. Bring wort to a boil (no dried malt extract is used in this recipe), adding hops at times indicated. Add liquid malt extract and Irish moss with 15 minutes left in boil. After boil, cool wort, transfer to fermenter and top up to 5.0 gallons (19 L) with water. Aerate, pitch yeast and ferment at 70 °F (21 °C).

Axe of Angus Ale (Scottish 80/-)

(5 gallons/19 L, partial mash)

OG = 1.048 FG = 1.012

IBU = 22 SRM = 15 ABV = 4.6%

A straight-ahead, full-bodied, malty Scottish ale, made with 2-row malt made from Golden Promise barley. There's just a hint of complexity from the crystal and roasted malt. A super good (SG) *beer. 40% of extract weight from grains.*

Ingredients

3 lb. 10 oz. (1.6 kg) 2-row pale ale malt (Golden Promise)
4.0 oz. (0.11 kg) crystal malt (60 °L)
2.0 oz. (56 g) roasted malt (300 °L)
12 oz. (0.34 kg) Muntons Light dried malt extract
3 lb. 5 oz. (1.5 kg) Muntons Light liquid malt extract (late addition)
1 tsp. Irish moss (15 mins)
6 AAU Kent Goldings hops (60 mins) (1.2 oz./34 g of 5% alpha acids)
Wyeast 1728 (Scottish Ale) or White Labs WLP028 (Edinburgh Scottish Ale) yeast (2 qt./2 L yeast starter)
0.75 cup corn sugar (for priming)

Step by Step

You can follow the usual directions to brew this beer, or use the following option to hold the mash temperature steady in the high end of the sachharification range. Heat 5.5 qts. (5.2 L) of water to 167 °F (75 °C) in a 10 qt. (~ 10 L) or larger pot and stir in crushed grains. (Don't put grains in grain bag.) Mash grains at 156 °F (69 °C) for 45 minutes; check the temperature every 5 minutes or so and

add heat — in 15–30 second bursts — to maintain mash temperature in the pot. (Always stir mash when applying direct heat.) While mash is resting, bring 1.0 gallon (3.8 L) of water to a boil in your brewpot, and heat 5.5 qts. (5.2 L) to 170 °F (76 °C) in yet another pot. When mash is complete, heat the whole mash to 168 °F (76 °C), then scoop and pour mash into your grain bag in beverage cooler. Let mash rest for 5 minutes, then recirculate 3 qts. (~ 3 L) of wort and run off first wort to kettle. Stir 170 °F (76 °C) water into grains until water level reaches level in first mash. Let sit for 5 minutes, recirculate, then run off second wort to kettle. Add dried malt extract and bring to a boil, adding hops at times indicated. Add liquid malt extract and Irish moss with 15 minutes left in boil. After boil, cool wort, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment wort at 62 °F (17 °C).

Von Wolfhausen Festbier (Octoberfestbier)

(5 gallons/19 L, partial mash)

OG = 1.054 FG = 1.013

IBU = 18 SRM = 8 ABV = 5.2%

A malty, golden-colored festbier featuring the flavor of Vienna malt. 35% of the extract weight of this beer comes from the grains in the partial mash.

Ingredients

3.75 lbs. (1.7 kg) Vienna malt
0.25 lbs. (0.11 kg) Munich malt (20 °L)
1.0 lb. (0.45 kg) Briess Light dried malt extract
4.0 lbs. (1.8 kg) Weyermann Bavarian Pilsner liquid malt extract (late addition)
3 AAU Hallertau hops (60 mins) (0.75 oz./21 g of 4% alpha acids)
2 AAU Tettnang hops (60 mins) (0.5 oz./14 g of 4% alpha acids)
Wyeast 2206 (Bavarian Lager) or White Labs WLP820 (Octoberfest/Märzen) yeast (4 qt./~4 L yeast starter)
1 cup corn sugar (for priming)

Step by Step

You can mash at 153 °F (67 °C) for 60 minutes using the regular method, or perform a single decoction mash by doing the following: Heat 5.5 qts. (5.2 L) of water to 142 °F (61 °C) and mash grains in cooler at 131 °F (55 °C). Immediately, scoop out

MORE COUNTERTOP PARTIAL MASH recipes

Colby House Porter	Oct. 2006 (and byo.com)
Kluster Kreme (Cream Ale)	Oct. 2006 (and byo.com)
Strauss in the Haus (Vienna Lager)	Oct. 2006 (and byo.com)
Huxley's ESB	Oct. 2006 (byo.com only)
Da Vinci Conundrum (IPA)	Oct. 2006 (byo.com only)
The Schizlitz (American Pilsner)	Jan.-Feb. 2007 (and byo.com)
Rhodan's Back (Flander's Red)	Jan.-Feb. 2007
Copper Ale	Mar.-Apr. 2007
Groom Lake IPA	May-Jun. 2007 (byo.com only)
Kepler's Kölsch	Jul.-Aug. 2007

one-third of the mash into a roughly 8 qt. (~8 L) pot. Heat grains in pot (the decoction), stirring constantly. When decoction reaches 158 °F (70 °C), let rest for 5 minutes; then, continue heating decoction to a boil, stirring constantly. Boil decoction for 30 minutes (keep stirring), then stir decoction back into main mash in cooler. This should establish a combined mash temperature around 153 °F (67 °C). Rest mash for 45 minutes. While mash is resting, bring 1.0 gallon (3.8 L) of water to a boil in your brewpot, and heat 5.5 qts. (5.2 L) to 180 °F (82 °C) in a separate pot. Recirculate 3 qts. (~ 3L) of wort, then run off first wort to kettle. Stir in 180 °F (82 °C) water until water level reaches level in first mash. Let sit for 5 minutes, recirculate, then run off second wort to kettle. Add dried malt extract and bring to a boil, adding hops at times indicated. Add liquid malt extract with 15 minutes left in boil. After boil, cool wort, transfer to fermenter and top up to 5.0 gallons (19 L) with water. Aerate, pitch yeast and ferment at 56 °F (13 °C).

Weimar Weisse (German Hefeweizen)

(5 gallons/19 L, partial mash)

OG = 1.048 FG = 1.012
IBU = 15 SRM = 6 ABV = 4.7%
40% of extract weight from partial mash.

Ingredients

2 lb. 7 oz. (1.1 kg) wheat malt
1 lb. 9 oz. (0.71 g) Pilsner malt
0.5 lbs. (0.23 kg) Briess wheat dried malt extract
3 lb. 10 oz. (1.6 kg) Weyermann Bavarian Hefeweizen liquid malt extract (late addition)
4.0 AAU Perle hops (60 mins) (0.53 oz./15 g of 7.5% alpha acids)
Wyeast 3068 (Weihenstephan Weizen) or White Labs WLP300 (Hefeweizen) yeast (1.5 qt./~1.5 L yeast starter)
1.25 cups corn sugar (for priming)

Step by Step

You can mash at 152 °F (67 °C) for 45 minutes, following the usual method, or try the following step mash to bring out the full phenolic glory of a German wheat beer. Heat 5.5 qts. (5.2 L) of water to 110 °F (43 °C) in a 10 qt. (~ 10 L) pot and stir in crushed grains. Mash grains at 99 °F (37 °C) for 15 minutes, then heat mash to 148 °F (64 °C), stirring constantly. Rest mash at 148 °F (64 °C) for 45 minutes, then heat to 168 °F (76 °C) and transfer mash to grain bag in cooler. While mash is resting bring 1.0 gallon (3.8 L) of water to a boil in your brewpot, and heat 5.5 qts. (5.2 L) to 170 °F (76 °C). Recirculate 3 qts. (~ 3L) of wort, then run off to kettle. Stir in 170 °F (76 °C) water until water level reaches level in first mash. Let sit for 5 minutes, recirculate, then run off second wort to kettle. Add dried malt extract and bring to a boil, adding hops at times indicated. Add liquid malt extract with 15 minutes left in boil. After boil, cool wort, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment at 70 °F (21 °C).

Komodo Stout (Foreign Export Stout)

(5 gallons/19 L, partial mash)

OG = 1.072 FG = 1.016
IBU = 50 SRM = 56 ABV = 7.2%
28% of extract weight from grains.

Ingredients

2.0 lbs. (0.91 kg) English 2-row malt
0.5 lbs. (0.23 kg) crystal malt (40 °L)
0.5 lbs. (0.23 kg) crystal malt (90 °L)
6.0 oz. (0.17 kg) chocolate malt (350 °L)
10 oz. (0.28 kg) roasted malt (500 °L)
2.0 lb. (0.91 kg) Muntons Light dried malt extract
3.0 lbs. (1.4 kg) Muntons Light liquid malt extract (late addition)
14 oz. (0.40 kg) cane sugar (15 mins)
0.25 tsp. yeast nutrients
14.5 AAU Northern Brewer hops (60 mins) (1.8 oz./51 g of 8% alpha acids)
0.5 oz. (14 g) Fuggles hops (15 mins)
Wyeast 1028 (London Ale), White Labs WLP013 (London Ale) yeast (2 qt./~2 L yeast starter) or Danstar Windsor dried yeast
1 cup corn sugar (for priming)

Step by Step

Mash grains at 152 °F (67 °C) for 40 minutes. Add dried malt extract and bring wort to a boil, adding hops at times indicated. Add liquid malt extract and yeast nutrients with 15 minutes left in boil. Cool wort, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment at 68 °F (20 °C).

Two Tusked Narwhal Ale (Barleywine)

(5 gallons/19 L, partial mash)

OG = 1.091 FG = 1.021
IBU = 51 SRM = 11 ABV = 9.0%
31% of extract weight from grains.

Ingredients

2.0 lbs. (0.91 kg) US 2-row pale malt (for mash liquor)
1.0 lbs. (0.45 kg) US 2-row pale malt
2.75 lbs. (1.3 kg) English 2-row malt
0.25 lbs. (0.11 kg) crystal malt (30 °L)
2.0 lbs. (0.91 kg) Briess Light dried malt extract
6.6 lbs. (3.0 kg) Coopers Light liquid malt extract (late addition)
1 tsp. Irish moss (15 mins)
0.25 tsp. yeast nutrients (15 mins)
9 AAU Summit hops (60 mins) (0.5 oz./14 g of 18% alpha acids)
0.5 oz. (14 g) Centennial hops (20 mins)
0.5 oz. (14 g) Centennial hops (10 mins)
0.5 oz. (14 g) Cascade hops (0 mins)
1.0 oz. (28 g) Cascade hops (dry hops)
Wyeast 1968 (London ESB) or White Labs WLP002 (English Ale) yeast (3 qt./~3 L yeast starter)

or Safale S-04 dried yeast
0.75 cup corn sugar (for priming)

Step by Step

For this beer, you'll do two mashes, a small, quick mash to generate your mashing liquor, and the main mash. Heat 5.5 qts. (5.2 L) of water to 163 °F (73 °C) and place 2.0 lbs. (0.91 kg) of pale malt in your cooler in a grain bag. Add roughly half of the 163 °F (73 °C) water to the cooler and mash grains for 10 minutes. Next, add the remaining water to the cooler and run the wort off back into your water pot. Add water so you have 5.5 qts. (5.2 L) again. Put the 4.0 lbs. (1.8 kg) of grains for your main mash in a grain bag and place in cooler. Heat the 5.5 qts. (5.2 L) of dilute wort to 163 °F (73 °C) and mash grains at 152 °F (67 °C) for 60 mins. While mash is resting bring 1.0 gallon (3.8 L) of water to a boil in your brewpot, and heat 5.5 qts. (5.2 L) of water to 180 °F (82 °C). Recirculate 3 qts. (~ 3L) of wort, then run off wort to your kettle. Stir in 180 °F (82 °C) water until water level reaches level in first mash. Let sit for 5 minutes, recirculate, then run off second wort to kettle. Add dried malt extract and bring to a boil, adding hops at times indicated. Add liquid malt extract and Irish moss with 15 minutes left in boil. After boil, cool wort, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment at 66 °F (19 °C). Add dry hops in keg or in secondary fermenter.

Castaway Blonde Ale (Honey Ginger Blonde Ale)

(5 gallons/19 L, partial mash)

OG = 1.044 FG = 1.008
IBU = 20 SRM = 7 ABV = 4.7%
43% of extract weight from grains.

Ingredients

3 lb. 10 oz. (1.6 kg) US 2-row pale malt
6.0 oz. (0.17 kg) crystal malt (20 °L)
4.0 oz. (0.11 kg) Briess Light dried malt extract
2 lb. 2 oz. (0.96 kg) Alexanders Pale liquid malt extract (late addition)
1 lb. 6 oz. (0.62 kg) orange blossom honey (0 mins)
0.25 tsp. grated fresh ginger (10 mins)
1 tsp. Irish moss (15 mins)
0.25 tsp. yeast nutrients (15 mins)

2.5 AAU Mt. Hood hops (60 mins)
(0.41 oz./12 g of 6% alpha acids)
2.5 AAU Cascade hops (60 mins)
(0.5 oz./14 g of 5% alpha acids)
0.25 oz. (7 g) Saaz hops (5 mins)
0.25 oz. (7 g) Saaz hops (2 mins)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (2 qt./~2 L starter for liquid yeasts) or Safale US-05 or Danstar Nottingham dried yeast
1 ⅛ cup corn sugar (for priming)

Step by Step

Mash at 150 °F (66 °C) for 50 minutes. Add dried malt extract and bring wort to a boil, adding hops at times indicated. Add liquid malt extract, Irish moss and yeast nutrients with 15 minutes left in boil. Add ginger with 10 minutes remaining in boil and honey at the very end of the boil. Cool wort, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment at 68 °F (20 °C).

Beelzeboss
(Unique Style)
(5 gallons/19 L, partial mash)

OG = 1.051 FG = 1.005
IBU = 13 SRM = 3 ABV = 5.9%

Inspired by "devilish" Belgian beers such as Duvel, Lucifer and Satan, Beelzeboss is a witbier-like beverage brewed with Mountain Dew soda as the brewing liquor. This beer finishes very dry — almost like Mountain Dew Champagne — with a crisp, tart finish. Fermentation may be sluggish, so don't rush to rack this beer to secondary. 40% of extract weight from grains.

Ingredients

2.0 lbs. (0.91 kg) Pilsner malt
1.0 lbs. (0.45 kg) wheat malt
10 oz. (0.28 kg) flaked wheat
6.0 oz. (0.17 kg) flaked oats
40 12-oz. (355-mL) cans of Mt. Dew
5 valencia oranges (zest only) (15 mins)
1 tsp. Irish moss (15 mins)
0.75 tsp. yeast nutrients (15 mins)
4 AAU Styrian Goldings hops (45 mins)
Wyeast 3944 (Belgian Wit) or White Labs WLP410 (Belgian Wit II) yeast (1 qt./~1 L starter)
2 pkg. Safale US-05 dried yeast
1.25 cup corn sugar (for priming)

Step by Step

Pour liquid from 24 cans of Mt. Dew into

your fermenter. Mash grains (with water) at 155 °F (68 °C) for 40 minutes. While mash is resting bring 1.0 gallon (3.8 L) of water to a boil in your brewpot, and heat soda from remaining 16 cans of Mt. Dew to 180 °F (82 °C). Recirculate 3 qts. (~ 3L) of wort, then run off wort to kettle. Stir in hot Mt. Dew until liquid level reaches level in first mash. Add remaining Mt. Dew to kettle. Let sit for 5 minutes, recirculate, then run off second wort to kettle. Bring wort to a boil, adding hops, zest, yeast nutrients and Irish moss at times indicated. After boil, cool wort, transfer to fermenter. Aerate, pitch liquid and dried yeast and ferment at 72 °F (22 °C).

High Castle Malt Liquor (Malt Liquor)

(5 gallons/19 L, partial mash)

OG = 1.060 FG = 1.009

IBU = 13 SRM = 6 ABV = 6.6%

It's hard to imagine now, but when malt liquor was introduced, it was pitched as an upscale drink. Early advertising compared the brew to Champagne and it was packaged in 8.0 oz. (~240 mL) cans to compensate for its higher alcoholic strength. Perhaps in some alternate universe, the beer remained upscale. If so, here's a recipe to produce a well-made version of the style. 32% of extract weight from grains.

Ingredients

1 lb. 11 oz. (0.77 kg) US 6-row pale malt
1 lb. 2 oz. (0.51 kg) German Pilsner malt
1 lb. 3 oz. (0.54 kg) flaked maize
1 lb. 3 oz. (0.54 kg) cane sugar (15 mins)
1 lb. 4 oz. (0.57 kg) Coopers Light dried malt extract
2 lb. 14 oz. (1.3 kg) Coopers Light liquid malt extract (late addition)
1 tsp. Irish moss (15 mins)
0.5 tsp. yeast nutrients
3.5 AAU Cluster hops (60 mins) (0.5 oz./14 g of 7% alpha acids)
Wyeast 2007 (Pilsen Lager), White Labs WLP840 (American Lager), Wyeast 2035 (American Lager) or White Labs WLP940 (Mexican Lager) yeast (3 qt./~3 L yeast starter)
1 cup corn sugar (for priming)

Step by Step

This beer is brewed with a couple little twists to enhance its dry character. Heat 5.5 qts. (5.2 L) of water in a 10-qt. (~10-L) pot to 151 °F (66 °C), stir in grains and mash at 140 °F (60 °C) for 15 minutes, then heat mash to 148 °F (64 °C) and hold for 30 minutes. Finally, heat mash to 168 °F (76 °C) and transfer to grain bag in cooler. While mashing, bring 1.0 gallon (3.8 L) of water to 148 °F (64 °C) in your brewpot, and heat 5.5 qts. (5.2 L) of water to 170 °F (77 °C). Stir dried malt extract into brewpot. Recirculate 3 qts. (~ 3L) of wort, then run off first wort to kettle. Hold wort in kettle at 148 °F (64 °C). Stir in 170 °F (77 °C) water until water level reaches level in first mash. Let sit for 5 minutes, recirculate, then run off second wort. Bring wort to a boil, adding hops, sugar, yeast nutrients and Irish moss at times indicated. Add liquid malt extract at end of boil. Let wort sit (covered) for 15 minutes, then cool, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment at 54 °F (12 °C).

EXTRACT

EXCEL

"Some of the best beers in the world are brewed from extracts." says Don Gortemiller, Brewmaster for Pacific Coast Brewing in Oakland, California. And he's got the medals to prove it. Ten Great American Beer Festival (GABF) medals hang on the walls of his extract-based brewpub, along with many other professional brewing accolades. "People are always impressed with the quality of our beers," agrees George Bluvas, Director of Brewing Operations for Waterstreet Brewery in Milwaukee. Waterstreet has won three GABF medals for their extract-brewed beers. They operate both an extract and an all-grain brewpub and serve beers from each at ten of their company restaurants. "We've hosted both the CBC (Craft Brewers Conference) and MBAA (Master Brewers Association of the Americas) in Milwaukee and have had some of the best palates in the industry into our brewpubs. I've challenged them to tell me which beers on the sample platter are extract and which are all-grain. Invariably they get it wrong", he said, adding, "several of our lightest beers are brewed with extract."

When extract brewing, you usually have a short, roughly four-hour, brew day. Extract brewing also requires less equipment and space than all-grain brewing. Although all-grain brewing can be fun, not every brewer has the time or space

TEN KEYS TO GREAT EXTRACT BEER

by **Bob Hansen**

L E N C E

available to them. (And even if they do, many all-grain brewers have an extract beer or two in their portfolios — brews that can be knocked out quickly, when needed, but can still be counted on to taste great.) As I sampled the award-winning Blue Whale Pale Ale at Pacific Coast recently, I wondered to myself, "Why do extract beers get a bad rap?"

Extract beers are sometimes maligned for being simple, too dark and having a distinct flavor that sets them apart and makes them inferior to all-grain brewed beers. Many all-grain brewers — especially less experienced ones or people that have never tried extract brewing — look down on it as a lesser art. Some have tried without success brewing with extract and decided the process was to blame. While it is true that extract brewing poses an additional set of challenges, especially when trying to produce unique, award-winning beers, savvy brewers have learned to overcome these challenges and many experienced brewers return to the simplicity of extract brewing — at least occasionally — after refining their brewing skills brewing all-grain beers.

Brewing Competitions

The results of brewing competitions tell the real story. In these contests, competition is fierce and minor technical deficiencies will knock any beer out of contention. Yet brewers continue to win medals in the largest commercial (GABF, etc.) and recreational (National Homebrew Competition) brewing events with beers produced from extract.

Additionally, malt extract is used in several award-winning commercial beers as a means of boosting gravity.

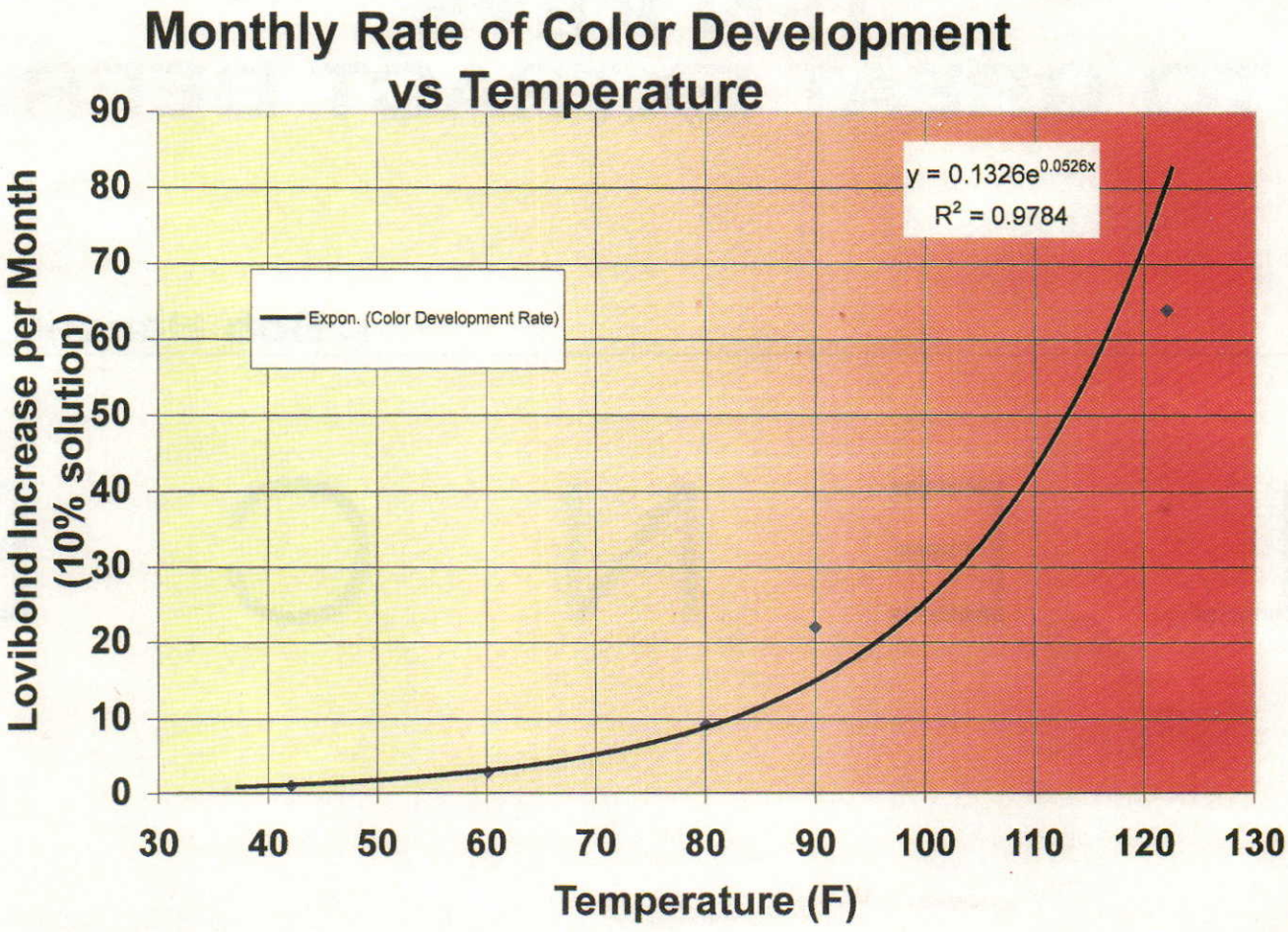
Extract brewed beers capture a good share of recreational contests such as the Dixie Cup and the National Homebrew Competition, with some estimates of medal-winning beers involving some form of extract running about 10–20%.

"Our extract brewing customers regularly win individual categories and even best of show," says Scott Birdwell, proprietor of DeFalco's Home Wine and Beer Supplies in Houston.

Granted, in commercial contests, the percentage of extract winners each year is smaller. However, this may not have anything to do with quality. One of the main reasons extract beers do not win more professional medals is that there aren't that many extract breweries out there entering contests. For brewhouses bigger than seven or eight barrels, all-grain systems produce beer at a lower cost and are the standard. Smaller breweries with extract systems oftentimes don't enter large brewing contests because they can't justify the entry fees. "We haven't entered in a few years," says Gortemiller.

So, what are the secrets to making award-winning extract beers?

Though extract brewing simplifies the brewing process, it doesn't necessarily make brewing award-winning beers any easier. Differences in extract brewing have to do specifically with the preparation and handling of the ingredients and production of the wort. All the other important aspects of brewing such as good recipe



formulation, proper pitching rates, fermentation temperatures and cleanliness are the same as with all-grain brewing or any other brewing method. It goes without saying that you must have a high level of brewing competence regardless of your method of wort production.

Making the Grade

As the main ingredient, the type and quality of malt extract used is critical to producing a high quality beer. Brewing grade malt extract is a necessity. Food grade extracts, made from feed grade or distillers malt without concern for color, flavor or quality, are made for bakers and vinegar makers. With the growth of craft and homebrewing, the incidence of food grade extract being sold to brewers has become rare. Nonetheless extracts should always be purchased from known brewing vendors, especially when buying in bulk. When in doubt, inquire about the manufacturer of the extract to be sure you are not using an extract made for other purposes like pretzel makers.

Ten Keys to Great Extract Beers

1. **Use a good, light malt extract as your base**
2. **Use fresh LME or DME**
3. **Store your extract properly**
4. **Dissolve malt extract with distilled water**
5. **Boil your full volume of wort**
6. **Limit your boil time to the length required to get adequate hop bitterness**
7. **Chill your wort quickly with a wort chiller**
8. **Know which styles are best suited to extract brewing**
9. **Steep specialty grains or perform a partial mash**
10. **Just brew it — don't believe the hype**

1. Start With A Good Base

Almost universally, award-winning brewers recommend using extracts as a base and customizing them with specialty grains using partial mashes, mini mashes or steeping to achieve targets. "We build all our beers from scratch", says Gortemiller, "using the palest of base extracts, that way we have the most options to work with." This gives brewers the full flexibility to control recipes and brew a broad range of beer styles.

Some brewers who have experience working with extracts may use "specialty" extracts. These extracts may use some specialty grains, but are not fully formulated. They may choose an amber extract to which they add additional specialty malts to build on the flavors already present. Blends of various specialty extracts can also be used, but in order to achieve flexibility, this really requires an intimate knowledge and availability of a lot of extracts. There are several sources of information on the characteristics of various extracts, including the guide to extracts in the October 2006 issue of *BYO* ("Ultimate Extract Chart," p. 30) and databases such as the one that comes with the ProMash software.

2. Freshness Counts

All the brewers interviewed agreed that buying fresh, quality extract was the single most important step to producing award-winning beers. This is because liquid extracts develop darker colors and off flavors if stored too long or at elevated temperatures. This gives rise to beers which are too dark (a common extract beer defect) and an off flavor known as "extract twang." Extract twang is a very real phenomenon. These off flavors associated with heat damaged or aged extract manifest themselves and are perceived in different ways. Extract that is heat damaged will often smell and taste like molasses instead of having a strong malt flavor and aroma. In beers, it is most commonly associated with a strange, almost licorice or anise flavor or appears as strangely sweet or spicy flavor, especially as an aftertaste. Like other brewing defects, once you learn to taste this, it is unmistakable. Unlike some other brewing defects (diacetyl, skunkiness, etc.) it is never appropriate, accepted in certain styles or really pleasant. Luckily for homebrewers, extract twang is completely avoidable.

3. Storing Conditions Count

The flavors and colors actually develop from the Maillard reactions that can occur at moderate temperatures because of the concentrated nature of malt extract. Liquid malt extracts are at a concentration that places them at the maximum possible range for color development. "From a color and flavor development point of view, it couldn't be worse." explains Brad Rush, Quality Manager for Briess Malt and Ingredients. "Unfortunately extracts need to be at this concentration to be microbially shelf stable." As conditions in a concentrated extract are not like the normal brewing or malting process, these flavors

are not at all like normal brewing flavors, leading to the distinct twang.

Along with flavors, colors are generated at the same time via the same reactions. The rates of color and flavor development increase exponentially with temperature. The chart on page 36 shows rate of color development for liquid extracts stored at different temperatures. A very light extract (13–20 degrees Lovibond at 80% solids) can literally double in color with a month's storage at 90 °F (32 °C). At higher temperatures (120 ° F/49 °C) they can double in color in a week. This would mean that a light colored 1.040 beer that would normally be 2–3 degrees Lovibond would be 4–6 degrees Lovibond and approaching an amber in color.

Brewers can avoid any quality issues associated with aging simply by making sure they are purchasing fresh extract that has been stored properly. "We store it cool, use it pretty quickly and in extreme cases have stored it in the beer cooler," says Bluvas. Check the package of extract to see if the manufacturing date is listed. If not, ask your supplier to find out. Reject any extract that is older than 18 months or that you think may have been exposed to higher temperatures. After receiving your extract, store it in a cool area, ideally below 70 °F (21 °C), where the development of color or flavor is minimal.

Another way to avoid quality issues with aged extract is to use dried extracts. In dry extracts, the moisture level is very low and the water is completely bound up. The available water (water activity) is so low that very little can happen chemically because of the immobility of all the reactants. Color development in dry extracts is virtually nonexistent even at elevated temperatures. Not until temperatures of above 150 °F (66 °C) does it become a concern. Dry extracts are often claimed to be lighter than their liquid counterparts because of this. This is untrue as the liquid and dry extracts that are manufactured from the same wort and at the time of manufacture will have the

same color. The dry extracts, however do not develop color. None of the professional brewers we talked to used dry extracts, citing cost and handling issues for hundreds of pounds of powder. But plenty of homebrewers swear by them. "I recommend people buy fresh or use dry," says Birdwell. Homebrewers can be reasonably sure that the beers they brew from them will be the correct color and be free of extract twang.

4. Distilled Water

What about water for extract brewing? It is important to realize that when extract is made, first normal wort is prepared and then the water is evaporated or distilled off. All the salts in the original wort remain in the extract. To recreate the original wort you would need to add back distilled water to the brew. Adding back normal or tap water is like adding brewing salts to your beer. If you have highly mineralized water, and so does your extract manufacturer, you will get a double dose of a lot of minerals. This may not be a bad thing, but should be accounted for.

One subtle defect common in many extract beers can be the increased perception of flavor and fullness from the increased minerals and generally higher finished product pH — due to the additional buffering of all those minerals. If you are brewing a stout this might not be a problem, though you may be able to reduce the brewing salts you are adding. It might be considered critical though for truly light styles of beer or those traditionally brewed with soft water. None of the commercial extract breweries interviewed for this story used distilled water, though they were all in locations that had fairly soft water. For several homebrewers, it's mandatory. "It makes sense for brewing very light styles", says Jamil Zainasheff, past Ninkasi award winner and *Brew Your Own*'s "Style Profile" columnist.

5. Pump up the Volume — Bigger is Better

Boiling high gravity worts leads to increased color development, as the reaction rate increases significantly with concentration. Though brewing a reduced volume and diluting in the fermenter works, it is at the cost of increased color and flavor development. This only exacerbates two

of the weaknesses inherent in extract brewing. All of the breweries we talked to do full-kettle boils. Some of the homebrewers we talked to would occasionally do high gravity brews or other methods such as the "Texas Two- Step", though most admitted they went to full kettle brews when they were "going for the gold."

6. To Boil or Not to Boil . . .

Brewing grade malt extracts have normally already gone through a kettle boil with hot break removal and extensive volatilization during evaporation. Excessive boiling is never a good thing in brewing. Award-winning brewers typically boil their extract worts for 45 minutes, just long enough to get good extraction from the hops and guarantee resterilization of the wort. For high-gravity worts, often the extract is added in stages, with half added for the last ten minutes only, to reduce color development. This is especially the case when using extract to supplement beers with large mini mashes and sometimes 60 minute boils. In the case of extract supplements to large mini mashes, sometimes 60 minute boils were employed, but for straight extract or extract with steeped grain brews, there is no reason for excessively cooking the wort. One reason to brew with malt extract is to save time.

7. Chill Out

For light-colored beers, the main source of color can actually be the additional color developed during the brewing process, especially at temperatures above 160 °F (71 °C). This can make more color than the grain itself in very light beers. Color develops just as fast when sitting at boiling temperatures as when boiling. When trying to keep a beer light — especially a concern with extracts — an immersion wort chiller quickly reduces the wort temperature down to 160 °F (71 °C) where its color development rate is almost negligible.

8. Know Your Limitations

Certain styles lend themselves to extract brewing more than others. Wheat beers are easier to make from extract and produce a beer indistinguishable from all-grain brews. "English and Belgian styles are well suited to extract brewing," says Gortemiller. "Other styles require more adjustment." Very light beers and German lagers are two types that can be difficult to do. Very light beers are sensitive to the color issues mentioned.

9. Steep or Mini Mash

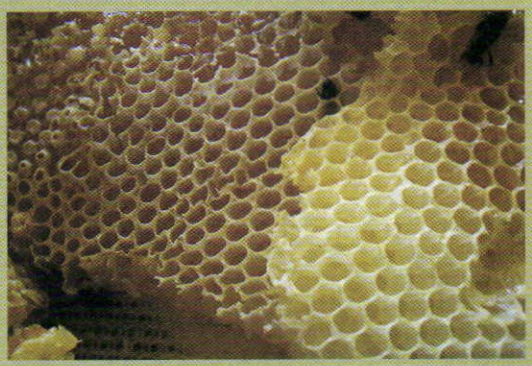
To successfully pull these light beers and German lager styles off, many brewers use increased amounts of mini mashed base malts as a portion of their brewing sugars or use light adjuncts such as honey rice or corn syrups. German lagers such as light bocks and Märzens can be difficult as most base extracts lack the rich malty character of these beers. There are some Munich specialty malt extracts on the market that can be helpful. Alternatively, by planning in advance and mini mashing larger amounts of high dried malts, these styles can be very successfully produced. At some point the extract and all-grain brewing mesh together. If the amount of grain mashed becomes too high, the efficiencies of and reasons for choosing extract brewing can be lost. When brewing high-gravity beers, though, this intertwining of the two methods brings renewed efficiencies. Several award-winning brewers of bigger styles regularly use extract to simplify their brewing method and shorten their brewing day. (And of course, most all-grain brewers use malt extract for preparing yeast starters.)

10. Don't Believe the Hype

"I think there is some level of intimidation for extract brewers entering their beers in contests," says Gary Glass, Director of the American Homebrewers Association. "And there's a certain level of snobbishness among many all-grain brewers," agrees Birdwell. This may cause people to believe that award-winning beers cannot be brewed from extracts. "At the end of the day, the beer is judged on its own merits," said Zainasheff, "and I don't distinguish between the two brewing processes when creating or appreciating beer." Bluvas summarizes, "We brew the same beers styles at our extract and all-grain breweries and we've learned to work with both brewing processes so that our customers find them indistinguishable."

Bob Hansen works for Briess Malting in Chilton, Wisconsin. This is his first article for Brew Your Own.

RECIPE



Honey of a Kölsch

(5 gallons/19 L, partial mash)

OG = 1.042 FG = 1.008
IBU = 15 SRM = 4 ABV = 4.5%

This is a modified version of a recipe from Water Street Brewery in Milwaukee, Wisconsin that won the only medal in the category at the GABF in 1996 and a silver at the 2007 NABA. The honey helps to keep the color light and increase attenuation. With fresh liquid or dry extract it produces a very light and drinkable beer that is a slight twist on a traditional style, in only a few hours.

Ingredients

4.0 lbs. (1.8 kg) Briess CBW® Pilsen liquid malt extract or
3.2 lbs (1.5 kg) Briess CBW® Pilsen dried malt extract
1.25 lbs. (0.57 kg) light clover honey
0.50 lbs. (0.23 kg) Briess Carapils®
3.25 AAU Hallertau hops (45 mins) (0.5 oz./14 g of 6.5% alpha acids)
0.50 oz. (14 g) Cascade/Saaz hops (50/50 Blend) (10 mins)
0.50 oz. (14 g) Cascade/Saaz hops (50/50 Blend) (0 mins)
1 tsp. Irish moss (15 mins)
Wyeast 2565 (Kölsch) or White Labs WLP029 (Kölsch) yeast (1.5 qt./~1.5 L yeast starter)
1 cup honey or 1 cup Briess CBW® Pilsen dried malt extract (for priming)

Step by Step

Steep Carapils malt in 5.0 gallons (19 L) of distilled water at 160–170 °F (71–77 °C) for 20 minutes. Remove grains. Add extract and bring to a boil. Boil for 30 minutes. Add honey and Irish moss with 15 minutes left in boil. (Keep your boil timer running, even though it may take a few minutes for the wort to return to a boil.) Remove from heat. After boil, cool wort, transfer to fermenter and top up to 5 gallons (19 L) with water. Aerate, pitch yeast and ferment at 65 °F (18 °C). Condition beer at 35–45 F (5 °C) for 3–4 weeks.

Photo by Les Jorgensen

BSI:

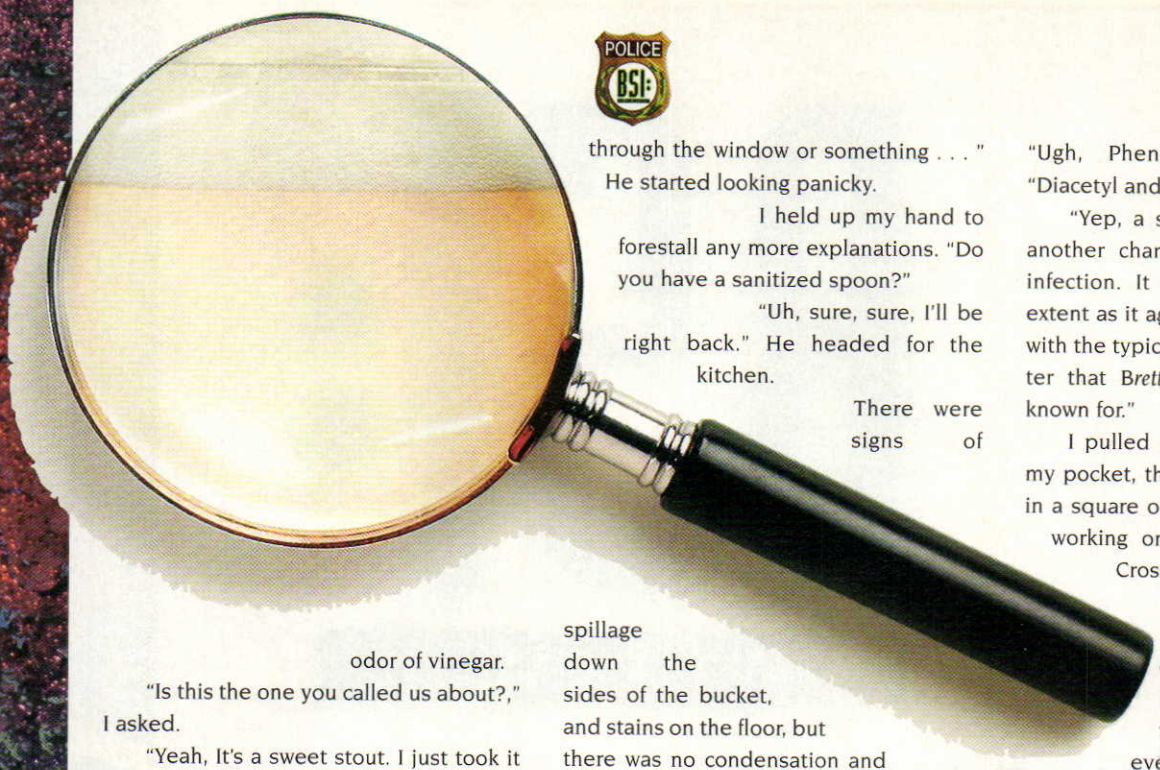
BREW SCENE INVESTIGATION

by **John Palmer**

The first thing I noticed was the musty smell, like a locker room. We had been called to a residence early on a Sunday morning where the owner, a Mr. Crossley, had apparently received the shock of his life. He had immediately called us — not merely because we were the best, but because a guy like him doesn't have many options. If he had been thinking clearly, he probably wouldn't have called us at all, and saved himself a world of hurt. But he had panicked, and now we were there.

A single flickering shoplight lit the garage. Looking around, I could see a bunch of stacked cardboard boxes mostly blocking the single window, some firewood, a workbench and a kegerator. The workbench was against the wall and had a propane burner, pot, a cylindrical beverage cooler and various other items stacked on it. I realized I was looking at a makeshift brewery.

The subject was in the back corner of the garage, by the workbench, and next to some plastic bins marked "2-Row." I was appalled; what was it doing here? I couldn't see any movement at first, but then I heard a faint click and saw a bubble move in the neck — definitely still alive. But why was it here? The garage was warm, even on a Sunday morning it was easily 75 °F. I bent down and sniffed cautiously. Besides the musty smell that pervaded the garage, I could smell the faint sweet



odor of vinegar.

"Is this the one you called us about?," I asked.

"Yeah, It's a sweet stout. I just took it out this morning to keg it and it seems to have started fermenting again." I glanced at my partner, Steve, to see if he was ready. He nodded. Crossley stood to the side, apparently afraid to watch. I sighed, reached down and lifted the lid. "Dear God!," my partner gasped, "That's sick!"

Nodding, I looked closer and felt a chill go down my spine. The surface of the fermentation looked like kräusen, with white patches dotting the surface. But it was too shiny and wet, like something out of the "Alien" movies. This was definitely not a normal fermentation. It looked like bubbles were building up under a gelatinous layer covering most of the surface. This beer was definitely sick. I waved my hand over the fermenter, drawing the odors toward my nose. The beer smelled sick too: sweet, buttered popcorn, vinegar and plastic.

I looked up at Crossley and said, "When did this happen?"

"I dunno, last night I guess. It was fine yesterday." His story didn't make sense, beer contaminations take weeks to develop to this stage. He looked nervous.

"When did you brew this?," I asked.

"A couple weeks ago."

"Why is it sitting out here instead of in the fridge?"

"Like I said, I was going to rack it to a keg today."

"Has this ever happened before?"

"N-n-no! I mean, why would it? I keep the place clean, ask anyone! Maybe someone else was in here, climbed in through the window or something . . . " He started looking panicky.

I held up my hand to forestall any more explanations. "Do you have a sanitized spoon?"

"Uh, sure, sure, I'll be right back." He headed for the kitchen.

There were signs of spillage down the sides of the bucket, and stains on the floor, but there was no condensation and the bucket was warm. The odor seemed to come from the stains too. I stood up and gestured to Steve to have a look. "What do you think?"

Steve took a couple of cautious sniffs and then pulled out a flashlight to get a better look. He looked at it for a few seconds, then asked, "*Acetobacter*?"

"Possibly," I said, "it smells like it, but that pellicle is thick and white enough that it's probably *Brettanomyces*. An *Acetobacter* pellicle is thinner, more like a film."

Steve looked back in the bucket and said, "There's bubbles under the pellicle."

"Yeah, I noticed that," I said. "That's another reason I suspect *Brett*, since it produces CO_2 and *Acetobacter* doesn't produce much at all."

Steve nodded, then said, "It could be *Lactobacillus* though, that would explain the vinegar smell and the CO_2."

"True, but *Brett* will also produce acid if there is oxygen present . . . Do you smell anything else?"

"I'm not sure, it's just so funky . . ."

"Yeah, we'll know more in a minute."

Crossley came back with the spoon. I handed it to Steve.

He poked the spoon through the pellicle to get a sample of beer. "It's ropy," he said. Gelatinous strands hung briefly from the spoon before falling back into the beer. "Yeah, I'm not surprised," I said.

"That ropiness or 'sickness' is a sign of a *Pediococcus* infection. What do you taste?" He sighed, muttered something about illegitimacy, took a sip, and made a face.

"Ugh, Phenolic," he said, wincing. "Diacetyl and phenolic."

"Yep, a strong phenolic character is another characteristic of a young *Brett* infection. It will be reduced to some extent as it ages, but mostly it will merge with the typical leathery, barnyard character that *Brettanomyces* fermentations are known for."

I pulled a notepad and pencil from my pocket, thought a moment, and filled in a square on a Sudoku puzzle I'd been working on. "Did you oak this beer Crossley?"

"No."

"Hmmm, maybe it came from the woodpile . . ." *Brettanomyces* is not that easy to catch. *Pediococcus* is. It's everywhere and most restaurants that don't clean their keg lines regularly have *Pedio* infections in them. *Lactobacillus* is fairly common too, but *Brettanomyces* is associated with wood, although once it gets into your equipment it is very hard to get rid of, and will often contaminate subsequent batches.

Steve attempted to hand me the spoon, but I turned toward the kegerator. The diacetyl most likely meant *Pediococcus*, and if Crossley had *Pediococcus* in his fermenter, then it was probably in the concrete floor and throughout the brewery. I was betting it was in the kegerator too. *Pediococcus* also produces lactic acid, but it does it without producing CO_2, like *Lactobacillus* and *Brettanomyces* do. It tends to be a more sour character, than either *Lacto* or *Brett*, too.

The kegerator had a single tap coming out of it, and the drip tray was stained with old beer. Inside were a couple of empty six packs and two Corney kegs. One was connected to the faucet, the other had a cobra picnic tap on it. I shook them. The keg that was online was nearly empty but the other was about half full. Both wer cold, at serving temp, not fermentation. I could see where beer had spilled around the liquid-out poppet, and there were more beer stains on the walls. It smelled musty too.

"What are these?" I asked Crossley.

"That's my pale ale on tap," he said, "and a double IPA in the other keg."

Time to test my hunch. I took a collapsible plastic cup from my pocket, and

drew a pint from the cobra tap. Sniffed it; strong herbal hop aroma, alcohol. Tasted it; hoppy, bitter, clean, not bad, not bad at all . . . I knocked the rest of it back and poured a pint from the faucet. There was a burp, and a small green chunk of something was floating in my cup. A hop? . . . I didn't think so. I raised the cup to my lips but didn't drink it. It smelled like old butter and leather. *Pedio* and *Brett* again. I opened the side door and tossed the swill outside. Strange, one good and one bad. Why not have the good one on tap? "Do you drink your own beer regularly Crossley?"

"Yeah, everyday, mostly, why wouldn't I?"

"You tell me. When was the last time you drank from this?"

Crossley grunted and looked at floor. "I've been working a lot. I have a regular job now . . . But my roommates drink my beer all the time."

"Really, do you have many roommates?" I didn't wait for an answer as I gestured for Steve to look outside.

A minute later Steve was back with a grin on his face. "Barrels of empty bottles, Chief." I raised an eyebrow, but he shook his head and said, "No, all micros."

"Recent?"

"Some, yeah."

My turn to grunt — those fast food burritos just don't sit well.

I turned back towards the bucket. "How is the acidity?," I asked Steve. "Is it sharp like vinegar or just sour and tart?"

"Hmmm, just tart. Here, I'll get you some."

"No, that's okay. Close it up."

Let's see, I thought, definitely *Pediococcus* and *Brettanomyces*, probably not *Acetobacter* from the sound of it. No sign of fruit flies or bees in here, although there had been a dead squirrel by the front door. Where were these contaminations coming from? That was the question. There was the woodpile and the dirty concrete floor . . . Looking around, I noticed a bottle of iodophor sitting on the edge of the workbench. I took a closer look at the sanitizer in the airlock; it looked fresh. A-ha! I bet it had run dry and he had just refilled it this morning before we arrived. I turned to ask Crossley about this, but at that moment the kitchen door opened and Charlie looked in.

POLICE BSI:

"Chief? You gotta see this . . ." He had hung back to check out the rest of the house while Crossley led Steve and I to the scene of the crime. I thought he meant the bottle of Lagunitas Maximus he was drinking from, but he beckoned us back inside and led us to the living room.

A large jacketed stainless steel fermenter stood in the middle of the room with an extension cord connecting it to the wall socket. It was the self-cooling type, a 12-gallon technical marvel that seemed grossly out of place here.

"A-ha! Care to explain this?! Are you two-timing now?"

"It's not mine!," he interjected, "We just borrowed it, I mean, my roommate borrowed it . . .," he mumbled.

Borrowed, riiiight . . . Smirking, I started to reach for the lid, but Charlie stopped me. "I tasted it, Chief, it's clean." Hmmm, maybe it wasn't his after all. And it did explain that other keg . . . I let my hand drop and turned back to Crossley, fixing him with a steely glare.

"Alright Crossley, I'll take your word for it, but I want to know what you were doing out there in the garage."

"I was getting more dogfood, and just happened to see it . . ."

"Not today, dammit, last week, last month! I want to know what you thought you were doing when you brewed that poor bastard! That's supposed to be a sweet stout, but it's not so sweet anymore, is it! The kegs are cold, but the fermenter is warm — and the airlock looks recently filled! What's up with that!?"

He sagged down onto the couch and looked at the ceiling. "It was my own recipe, I was going to surprise the other guys in the club, you know? Blow their minds with a really outstanding batch. It was going so well . . ."

"Did you have it in the fridge?," Steve asked.

"Yeah. I . . ."

"Why did you take it out?," Charlie asked gently.

"I had it in there for about a week at 65 °F (18 °C), and it seemed like it was done. We were having a party, so I took it out and put the Cornies back in."

"When was this?"

"Last, uhhh, okay maybe a couple weeks ago. I don't remember . . ."

"Hold on," I said, "Start at the begin-

ning. What was your recipe?" He told me and it sounded good, like something I might make. "How did you brew it?"

"It was a single temperature infusion mash in a 10-gallon (38-L) Gott cooler. Batch sparge, one hour boil."

"Did you boil it in the garage?"

"Yeah."

"How'd you chill it?"

"Immersion chiller"

"Any chance your chiller was leaking?"

"I dunno, why?"

"Because if you are using your garden hose, there is probably bacteria in there that can get into the wort. You should use dedicated hoses for chilling, preferably the white potable water hoses that are used for RVs — just in case."

"How about your fermenter? Did you clean it well after the previous batch?"

"Yes, I scrubbed it out and soaked it with iodophor."

"What was the previous batch? How did it turn out?"

"It was a Belgian Tripel, but I had to dump it . . ."

"Did you use a starter?"

"Yeah"

"What did you use for sanitizer?"

"Uh, iodophor"

"Do you crush your grain in the garage?" asked Charlie.

"No, I crush it outside to avoid *Lactobacillus* contamination. Hey look, I asked you guys here to help me fix my beer, I didn't expect the Spanish Inquisition!"

I laughed derisively, explaining "Nobody ever does. Okay Crossley, here's how I see it. You talk a good game but you're a slacker. Your brewery is contaminated with *Brettanomyces* and *Pediococcus*; you have *Pediococcus* growing in your kegerator and you wonder why the batch went bad! This is two in a row! Constant vigilance!" I said, smacking my hands together for emphasis.

"So what now, what do I have to do?" he whined.

"I'm going to give it to you straight Crossley, you've got a lot of cleaning to do — every glass and stainless vessel in your brewery needs to be cleaned 'til it shines, understand? Scratched plastic and soft stuff like tubing has got to go. Sanitize everything, preferably with a different sanitizer than the one you've been using — it never hurts to keep the "bugs" on their toes. And finally, you gotta clean every stain, spot or spill in your fridge, on your floor or at your workbench; all of them are just reservoirs for contaminants."

"What about the sweet stout?"

"Weeeeell, you're lucky Crossley, at one time we would have said there was no hope for this batch either, but these days, we put you on probation, and let it sit for a few months. It may improve with age. You may even be able to drink it someday. Or, you may be able to blend it with another beer and make a good sour beer. Meanwhile, case closed."

John Palmer is the author of "How to Brew" (2006, Brewers Publications). This article is a work of fiction, any resemblance to actual events, locations, or people seemed like a good idea at the time. Only friends were abused during the writing of this article. Their names have not been changed, however, because doing so would have required some effort.

Profiling the Perps

CHARACTERISTIC	PEDIOCOCCUS	LACTOBACILLUS	ACETOBACTER	BRETTANOMYCES
TYPE:				
Aerobic		x	X	X
Anaerobic	X	X		X
Produces CO2		X		X
Produces Acid	X	X	X	X
SLIME:				
Opaque, white pellicle			X	
Thin film, translucent pellicle		X		
Ropy	X			
AROMAS:				
Diacetyl	X	x		
Phenolic				X
Musty/Earthy				X
Vinegar like		x	XX	x
FLAVORS:				
Diacetyl	X	x		
Phenolic				X
Musty/Earthy				X
Sour/Acidic	X	X	XX	x

X=Major, x= Minor
In the presence of oxygen

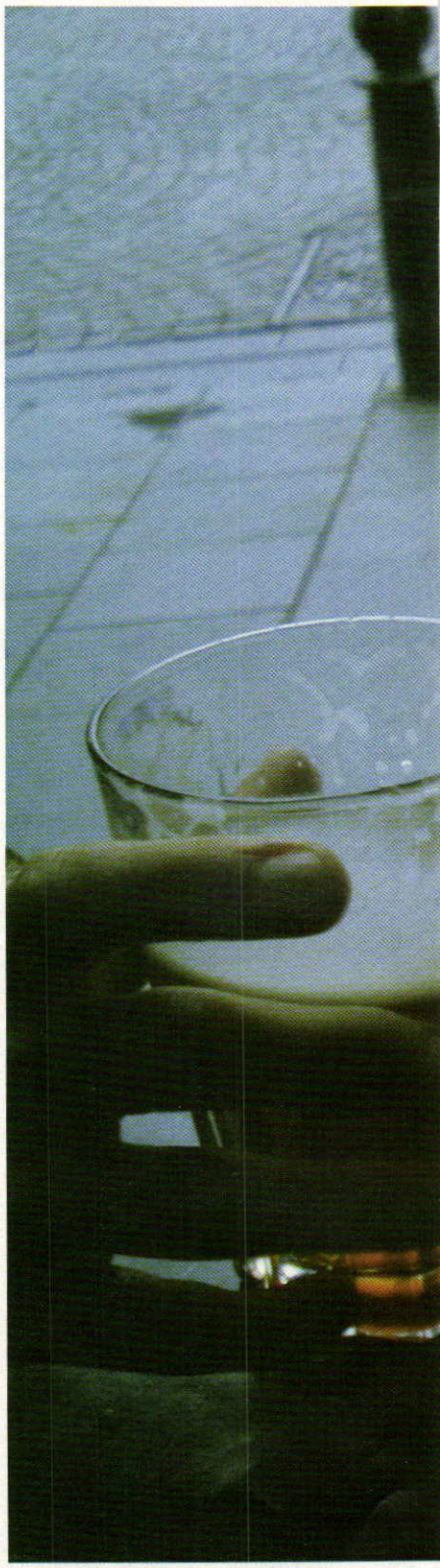
Experimental, maverick, artistic — there are many words often used to describe Belgian-style beers. And these days as interest in Belgian brewing grows in the U.S., the home of North American craft beer, these descriptions are often extended to the new-world brewers of Belgian-style beers. But how do they do it? We asked eight U.S. brewers, known for their Belgian-style beers, to share some insight.

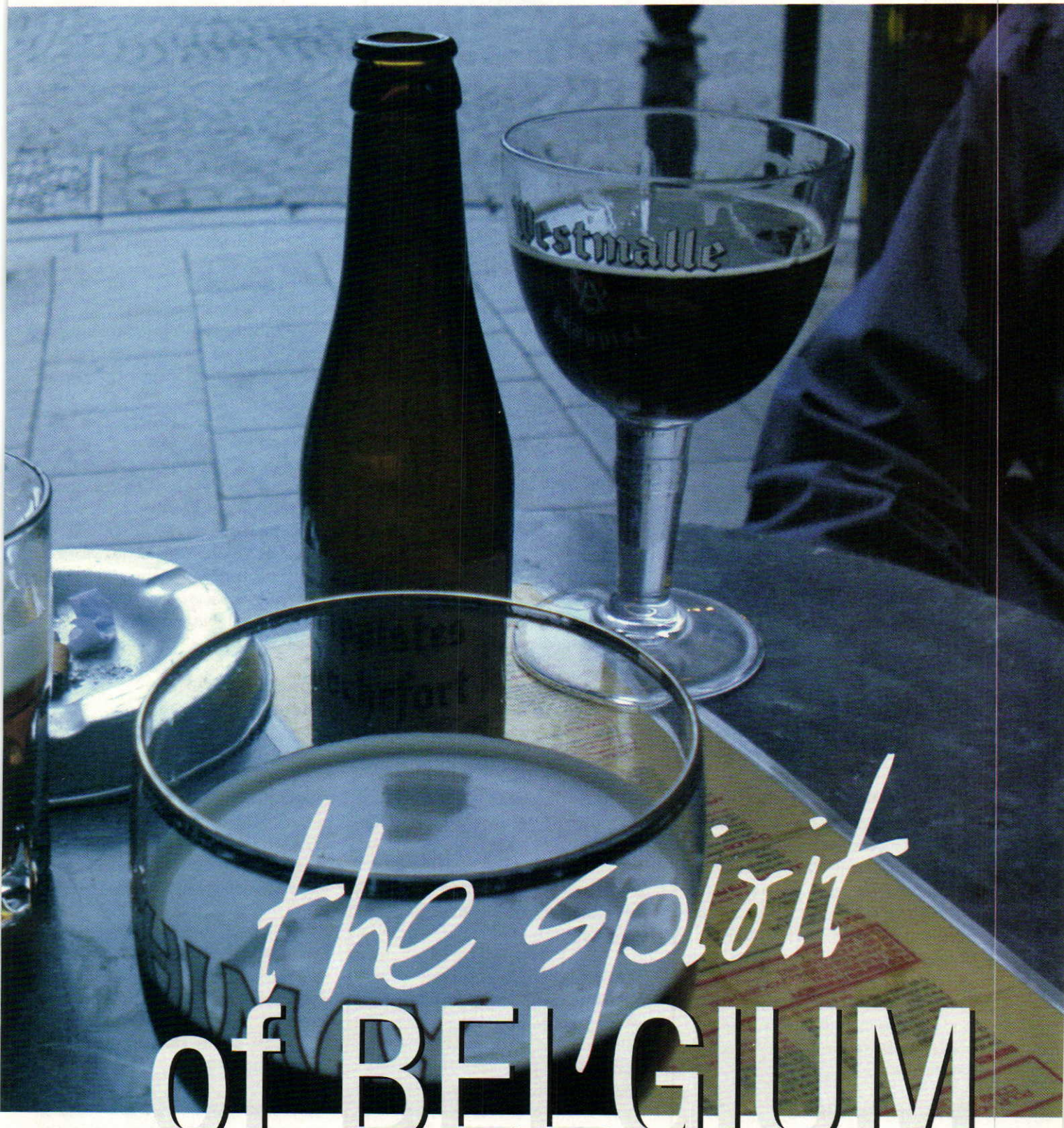
Tomme Arthur • Port Brewing & Lost Abbey
Vinnie Cilurzo • Russian River Brewing Co.
Randy Thiel • Brewery Ommegang
Rob Tod & Jason Perkins • Allagash Brewing Co.
Peter Bouckaert • New Belgium Brewing Co.
Steven Pauwels • Boulevard Brewing Co.
Mark Ruedrich • North Coast Brewing Co.

How have you (and other North American brewers) expanded upon the range of "Belgian" beers and have you heard any feedback on your beers from brewers in Belgium?

Tomme Arthur, Port Brewing and The Lost Abbey
I believe that American brewers are very much at the forefront of inspiring a world of drinkers. One of the biggest challenges that brewers with as much history as the Belgians have behind them is that they often can't focus on innovation. American brewers are not bound by much at this very moment. As such, there are incredible liberties and chances being taken.

Vinnie Cilurzo, Russian River Brewing Co.
Some American craft brewers have done things differently, but I can't say that too many have expanded upon traditional Belgian style beers as compared to





the spirit of BELGIUM

the Belgians themselves. I hop my Belgian-style beers more than what you'd probably see in Belgium, and in that way I've put my own signature on the beers. But, keep in mind that when it comes to brewing Belgian-style beers commercially and at home, often less is more. I think American craft brewers have expanded on our barrel-aged beers when compared to actual Belgian brewers. In 2006 when I was in Belgium with Sam Calagione, Rob Tod, Tomme Arthur and Adam Avery, we each took two beers to pour at different events and our beers were very well received. Of course in some cases the Belgians (both brewers and beer enthusiasts) didn't like some of the beers. But, overall it was an eye opener to many of them of the high quality being brewed by the American craft brewers.

Peter Bouckaert,
New Belgium Brewing Co.

Of course I had feedback from my Belgian colleagues, sometimes more than I'm hoping for. As long as we call it Belgian we will have feedback. The problem is that most "Belgian" beer claims really are not Belgian, they are American. We just got into the habit of calling funky, sour or high alcohol beers Belgian. That is not what Belgian beer is; this is what American brewing thinks Belgian is. I think Fat Tire is our best "Belgian" beer. Yes we have expanded upon the range of beers. The U.S. brewing world has evolved so far that it should stop referring to the old world.

Randy Thiel,
Brewery Ommegang

As typical Americans, we grasp onto a concept and run with it. Pizza is a great example of a concept that currently does not resemble its origins, but is taken to a new level by zealous American enthusiasts. At Brewery Ommegang, I've tried to remain as traditional in flavor profiles as possible, especially with regards to flavor balance and digestibility. Although the ingredients may not always be authentic, the spirit certainly is.

Steven Pauwels,
Boulevard Brewing Co.

I recently had a visit from Belgian brewers and they were more interested in American pale ale, IPA's and stouts.

American brewers now think more outside of the box than Belgian brewers do. Belgian brewers follow tradition more than innovation and are currently inspired by craft brewers. We started brewing a saison about five years ago and started making a version with *Brettanomyces*. Because of capacity constraints we couldn't put this beer on the market, but took it to festivals. At the Belgium Comes to Cooperstown event this year, there were already copies from some highly respected brewers.

Rob Tod,
Allagash Brewing Co.

I've spoken to Belgian brewers who said that it's great that U.S. beer drinkers are so open to experimentation. I think that the nature of this country's experimental brewing dovetails the two very nicely, especially for Belgian-style brewers, because these styles are experimental by nature. For example, techniques like barrel aging, spontaneous fermentation and ingredients like sugars and spices are now being used by U.S. brewers in new, non-traditional ways.

What malts lend themselves particularly well to Belgian-inspired beers?

Tomme Arthur, Port
Brewing and The Lost Abbey

We tend to use quite a bit of imported malt (some of it Belgian) as well as German and English malts. The secret to a great Belgian-style beer is to find the best yeasts possible and complement them without being too overbearing. If I had to pick one or two malts, I would say that Special B from Dingemans is fantastic. I also love to keep a healthy stash of Gambrinus Honey Malt on hand. It has amazing potential.

Vinnie Cilurzo,
Russian River Brewing Co.

I actually like to use more North American malts in our Belgian style brews as well as a few European malts. We use the North American malts because they are more neutral which lets the yeast and fermentation character shine through more. Also, I like the idea of using mostly malts and hops that are grown closer to home; after all, I am an American brewer, not Belgian.

Randy Thiel,
Brewery Ommegang

For a white beer, a very low color Pilsner malt accentuates the heavenly pallor of the beer. Pale malts are much too dark for this style.

Steven Pauwels,
Boulevard Brewing Co.

First think about what characteristics are important in the beer you want to brew and then decide on what malt you want to use. Most maltsters offer a wide variety of different specialty malts that can do the job. However, we use almost 100% Belgian specialty malt, but use one pale malt for all our brands.

Jason Perkins,
Allagash Brewing Co.

We use a wide variety of mostly domestic malts — mostly for freshness. However, we also use some Belgian Pilsner malts. We also mostly avoid using excessive amounts of caramel malts in order to produce a dryer result with the exception of Special B, which if used correctly can be beneficial in Belgian-style brewing.

Should a homebrewer do anything different in the brewhouse when brewing a Belgian or Belgian-inspired beer compared to an English-style ale or German-style lager?

Tomme Arthur, Port
Brewing and The Lost Abbey

We are currently mashing the majority of our Belgian-style beers with a very traditional one step infusion mash.

Vinnie Cilurzo,
Russian River Brewing Co.

In the kettle, we don't use as much hops, but the kettle hop addition schedule is almost the same when comparing a hoppy Russian River beer to one of our Belgian-style beers. Where we really differentiate our Belgian styles is in the fermentation temperature schedule.

Peter Bouckaert,
New Belgium Brewing Co.

Ingredients and their origin and brewing process are all inter related tools. It's like asking what water to use to make a Pilsner. Should it be soft water, because that is what the original Pilsners brewers did? I made Pilsners with maximum levels of calcium, mainly because my brewery was not equipped like the original pilsner brewers. Brewing is always a compromise, although my approach can be different than your approach, we both are right. Also, the Belgian Reinheitsgebot states that you should only use knowledge, creativity and experience. Those are the only ingredients that I'm using. I use them in various concentrations, depending on the beer I want to make.

Mark Ruedrich,
North Coast Brewing Co.

As the bitterness levels in PranQster, Brother Thelonious and Le Merle are low to moderate, we achieve the dryness we're after on balance by using a much cooler mash bed. We also employ a couple different sugars to brew these beers.

Randy Thiel,
Brewery Ommegang

A brewer should do whatever is practical in the brewhouse with a focus on the end-result rather than the traditions of a production process.

Steven Pauwels,
Boulevard Brewing Co.

Modern brewhouses are designed to brew German-style lagers in a very energy efficient way. When we started using our new state-of-the-art brewhouse, we had to make several adjustments to the initial setup. The Belgian, English and German way of brewing is different. The English use overmodified pale malt for single step infusion, Germans only use 100% malt and need decoction mashes to get high fermentation degree while the Belgian brewers use adjuncts.

Jason Perkins,
Allagash Brewing Co.

The ingredient additions of hops, candi sugar and spices are the major differentiations for brewing these styles of beer. We also boil longer than most of our non-Belgian-style brews, which may be inefficient but produces nice, deep colors and can add more caramel complexity.

How does fermentation temperature play a role when you brew these beers?

Tomme Arthur, Port Brewing and The Lost Abbey

This along with oxygen levels in wort are

my two biggest challenges. Most brewers don't realize that there are a myriad of flavors in Belgian-style beers created by yeast growth and development in the early phases. In each brewery, it is the responsibility of the brewer to determine which range of temperatures best serves each yeast strain and then they must then look at oxygen levels as well in terms of growth and flavor gain.

Vinnie Cilurzo,
Russian River Brewing Co.

Fermentation temperature is the most important component in our Belgian style brews. We have two different Belgian yeasts going all the time. The yeast we use for Damnation is very fruity so we hold back the temperature initially then let the tank free rise after a few days of fermentation. Belgian yeast also reacts very strongly to the shape of the fermenting tank.

Randy Thiel,
Brewery Ommegang

The Ommegang yeast ferments at 77 °F (25 °C). We maintain a tight control over the fermentation temperature, and it does not vary by more than 1 °F (0.5 °C) from the target temperature.

Steven Pauwels,
Boulevard Brewing Co.

Fermentation temperature helps control the ester and higher alcohol formation. Know your yeast to make the right decision. For some yeasts we only cool the first day to two days, other yeasts make better beer when the fermentation starts at a lower temperature and there is no cooling at all.

Jason Perkins,
Allagash Brewing Co.

Temperature plays a big role because Belgian styles are so yeast-strain dependent. It's good to use trial and error to get to know yeast strains and how temperature affects them because it makes dramatic differences in the beer.

Most beers from Belgium are not very hoppy. Do you think Belgian-inspired beers can be hoppy or is there something about them that does't pair well with hops?

Vinnie Cilurzo,
Russian River Brewing Co.

Most Belgian beers are not that hoppy, but they are dry. That is where I think many American craft brewers and homebrewers can improve their Belgian style beers. Dryness can replace bitterness. There are now a few Belgian-style IPA's coming out of Belgium which often carry a metallic character from the hops they use. We just brewed a 100% Bravo hop beer for an experiment where I used a Belgian yeast. It was our first Belgian style IPA and it turned out great.

Mark Ruedrich,
North Coast Brewing Co.

I think the biggest challenge in brewing a hoppy Belgian-style ale would be to find synergy between the esters produced by whichever of the many different Belgian yeast strains you chose to use and the fruity/spicy aromatics in the hops.

Randy Thiel,
Bewery Ommegang

More and more Belgian beers are showing an accent on hop character. I think it's a natural fit for an estery, well-attenuated beer! Surprisingly, the resiny North American hops are as good a match as the noble European varieties.

Steven Pauwels,
Boulevard Brewing Co.

Belgian beers were very hoppy 30 to 40 years ago, but decreased in bitterness to follow the trend for less bitter beers. The fruity characteristics of Belgian yeast strains can blend very well with American hops. For some beers, a noble hop is more suitable.

Jason Perkins,
Allagash Brewing Co.

I agree that many Belgian styles don't do well with hoppiness, so brewers should be careful with amounts and selections. I have, however, noticed beers coming out of Belgium that are hoppy. I think that thanks to American-style experimentation with hops that we have come full circle in that some Belgian brewers are now using more hops.

Do you use a house cultured yeast or a commercial strain in your beers?

Tomme Arthur, Port
Brewing and The Lost Abbey

We use both. I have a cultured strain that we use in many of our Abbey-style beers. We also make a Biere De Garde, a saison and a blond ale with yeasts from the commercial providers. I use as many different yeasts as possible, enabling us to build all kinds of unique beers.

Vinnie Cilurzo,
Russian River Brewing Co.

We use both commercial strains and house cultures. The coolest thing we have going is our house wild yeast culture we use in several of our barrel-aged ales. Also, we use a wine yeast strain to do all of our bottle conditioning.

Peter Bouckaert,
New Belgium Brewing Co.

We have multiple yeast strains year round, some of them purchased, some of them "mutated" internally, some with a hazy past.

Mark Ruedrich,
North Coast Brewing Co.

We use four different strains, alone or in combination, which we have gathered over the years from different sources. We maintain all our yeast cultures in our lab.

Steven Pauwels,
Boulevard Brewing Co.

We use house-cultured yeasts for the most part, even though we currently are running a project to compare lambic blends from two different suppliers. Handling multiple strains in a production brewery can be very challenging. We use two Belgian strains. We are process-oriented brewers trying to make a wide variety of beers with the same yeast.

Betsy Parks is the Assistant Editor of Brew Your Own *magazine. This is her second feature article for the magazine.*

Web extra:

Check out bonus Q+A with these brewers at:

byo.com/feature/1637.html

Specialty Malts

Crushing, steeping, mashing — and brewing

by Jon Stika

When I began brewing back in 1992, I felt fortunate to find either a packet of dry yeast or a can of malt extract that had not celebrated a birthday, much less to hope to find one of a specific kind. Specialty malts were even more difficult to find. But today we homebrewers live in malt heaven, with suppliers offering varieties of malt numbering in the dozens. In this column, I will cover the basic types of specialty malt available and how you can incorporate them.

First a little background. All malt begins as raw grain. The grain is steeped in water, and then allowed to rest until it sprouts and the interior of the kernel begins a transformation that will allow it to convert starch to sugar. At this early stage the grain is referred to as green malt. The maltster can then take the green malt down a myriad of paths to produce anything from standard pale base malt to dark crystal malt and everything inbetween. Most specialty malts are made from barley, but malt made from wheat and rye are also major ingredients in many beers.

Green malt is then processed further to produce malt that you will have to mash to complete the conversion to sugar, or malt that will already be converted to sugar without the need for mashing. Most green malt takes the former route and is carefully dried, then kilned (gently roasted) into a malt with a healthy complement of amylase enzymes giving the malt its diastatic power. This diastatic power allows this malt to convert itself from starch to sugar when mashed. Examples of these malts include pale, Vienna, and Munich malt made from barley, along with standard wheat and rye malt.

Alternatively, green malt can be carefully stewed in its own juices rather than dried so the enzymes complete conversion of starch to sugar (saccharification) within the kernel to produce crystal malts such as caramel and cara-pils.

Both pale and caramel or crystal malts can then be roasted at higher temperatures to produce many different final products. This additional roasting caramelizes the malt via the Maillard reaction; where free amino nitrogen and sugars combine to produce all those roasty-toasty flavors we love. To add to this malted and roasted diversity, there are also many varieties of barley, wheat, and rye. Roasting reduces any malt's diastatic power, so malt that is roasted to a dark color may not be able to convert starch to sugar in a mash.

> ". . .homebrewers live in malt heaven, with suppliers offering varieties of malt numbering in the dozens."

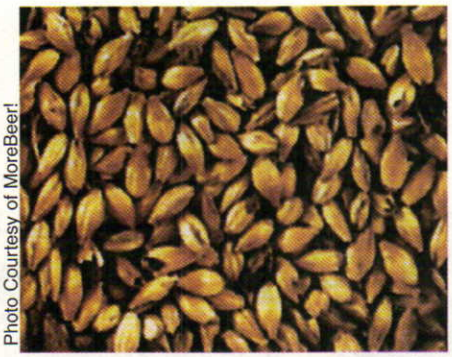


Photo Courtesy of MoreBeer!

Specialty malts are categorized by their roasted color, which is measured by a scale of degrees Lovibond.

Now that you know some of the basic types of malt, let's look at how to get them into the beer. As a general rule of thumb, most beer recipes typically consist of 80 to 90% base malt (malt that still contains the amylase enzymes for saccharification of it, and additional specialty malts). This leaves the remaining 10 to 20% of the malt bill to be made up of specialty malt or other adjuncts (such as flaked or roasted grains or other sugars). If you are just beginning to experiment with specialty malts, it is a good idea to limit them to around 10% of the total malt bill. This way you will learn how each kind of specialty malt will affect the flavor and color of your beer without overwhelming a batch with any one or a combination of malts.

In order to include specialty malt in a batch of brew the first step is to crush the malt properly. The goal in crushing malt is to get each kernel of malt cracked open without excessively pulverizing it. Malt that is crushed too fine can lead to astringent flavors, poor extraction, or a stuck (clogged) mash. Malt that is not crushed fine enough may not give up all of its contents to the wort and result in a low rate of sugar extraction.

Malt should be crushed so each kernel is broken into four to six pieces without creating an excess amount of flour or tiny husk fragments (in the case of barley malt). Wheat or rye malt has no husk, but must also be crushed before use. Though it is possible to crush your malt with almost anything, a rolling pin, coffee grinder, flour mill, or blender, a malt mill equipped with specially designed rollers will achieve the most reliable results. If you have your own malt mill, it is best to crush the malt just prior to use and to do so in an area other than where your beer will ferment. This is to avoid contamination by bacteria or fungi floating around in the malt dust created during crushing.

I crush my malt out in my workshop with a single roller mill and ferment my beer in the basement to keep the two processes separate. There are many good malt mills on the market now, depending on the size and type you prefer. If you do not have your own malt mill it is best to have the malt supplier crush the malt for you when you purchase it.

Crushed or uncrushed malt should be stored in a dry, cool place. When storing malt, keeping it dry is more important than keeping it cool. Malt stored in the freezer can end up smelling or tasting like a freezer and should be avoided. Airtight plastic containers that do not have any

residual flavors (from storing things like pickles) are the best way to prevent malt from picking up stray flavors or moisture. It is best to use specialty malts within a year of purchase to get the most flavors from them.

Next you'll need to determine if the specialty malts you are going to use can simply be steeped or require mashing. Crystal malts and any dark-roasted malt may be steeped to extract their goodness. However, if you plan to use any base malt such as pale, Pils, Vienna, Munich, wheat or rye that have not been darkly roasted, you will need to conduct either a partial or full-scale mash to complete the conversion of starch to sugar. If you are not sure if your malt should be steeped or mashed, conduct at least a partial mash to be sure you get the desired results from your malt.

If you are using liquid or dry malt extract as the backbone of your beer recipe and plan to use specialty malts that do not require mashing for conversion (such as caramel or crystal malt), then steeping is the easiest way to go. To steep your crushed malt, place it in a nylon or muslin grain bag (available from most homebrew suppliers) and put it in enough 130–170 °F (54.5–76.5 °C) brewing water to completely immerse the malt. Leave the bag of malt in the water for 15 to 20 minutes, stirring the water with the bag every few minutes.

"Crystal malts and any dark-roasted malt may be steeped to extract their goodness."

After steeping, lift the bag out of the water with a sieve, then ladle about a quart of the water over the bag to strain the malt a bit more, allowing the liquid to run back into the steeping pot. Straining the malt with an excessive amount of water, with water hotter than 170 °F (76.5 °C), or squeezing the last liquid from the bag can lead to excessive extraction of tannins from the malt that can cause astringency in beer. Once the steeping is complete, dissolve the malt extract into the steeping water and continue on with the rest of your brewing process.

If you plan to use malt extract as the basis for you beer but wish to use some specialty malt along with base malts, then a partial mash is the way to go. A partial mash can be conducted with the same equipment used for steeping, but with more attention paid to temperature, water volume and time. To conduct a partial mash, heat 1.5 quarts (1.65 L) of water to between 150 and 158 °F (65.5 and 70 °C) for every pound (.45 kg) of specialty malts (and any other flaked or roasted grains) in the recipe. It is important to be precise with water volume and temperature as the mash thickness and temperature will be critical to success.

Place all of the crushed malt (and any other grains) in a grain bag and immerse it

in the water and place the lid on your vessel to retain heat. Let the grain sit in the water for 45 to 60 minutes, monitoring the temperature every 10 minutes or so. If you have the water and grain bag in a pot that can be heated, you can apply heat in short 15 to 45 second bursts to boost the temperature if needed. If you increase the temperature a little too much, don't panic, just add a little cold water to bring it back in range. If you have the water and grain bag in a vessel that cannot be directly heated, then keep some boiling water on the stove in case you need to add a small amount of it to adjust the temperature upward to keep the mash in the desired temperature range.

While your mash is resting, heat the same volume of water as you used for the partial mash to 168 °F (75.5 °C). At the end of the mash time, lift the bag of malt out of the mash water and place it in a sieve over the mash vessel and slowly pour the 168 °F (75.5 °C) rinse (sparge) water over the grain bag to rinse the rest of the sugars out of the mashed malt. Once the partial mash process is complete, the remaining malt extract called for in the recipe can be dissolved into the partial mash water and you can continue your brewing process.

> ". . . specialty malts will open a new world of colors, flavors and styles of beer you can brew."

If you plan to brew an all-grain batch of beer, include the properly crushed specialty malt(s) with the base malt and mash and sparge according to the recipe. The enzymes from the base malt should convert the starch in the specialty malt(s) to sugar, and the sparge water will carry the sugar, flavor and color compounds of the specialty malt into the wort.

Be aware that Munich malt does not usually possess the diastatic power to convert other specialty malts and should be limited to less than half of the malt bill. Also, both wheat and rye malt have a high diastatic power but do not have a husk like barley malt to serve as a filter in the mash. Wheat or rye malt may be mashed successfully in a grain bag when employing a partial mash, but will require either a base (barley) malt or rice hulls to provide a proper filter in a full scale mash.

Learning to use specialty malts will open a new world of colors, flavors, and styles of beer you can brew. Knowing how to include each type of specialty malt will take you as a brewer, to the next level.

Jon Stika writes the "Techniques" column in every issue of Brew Your Own.

Web extra:

Check out BYO's online Grains and Adjuncts Chart at:
byo.com/referenceguide/grains/

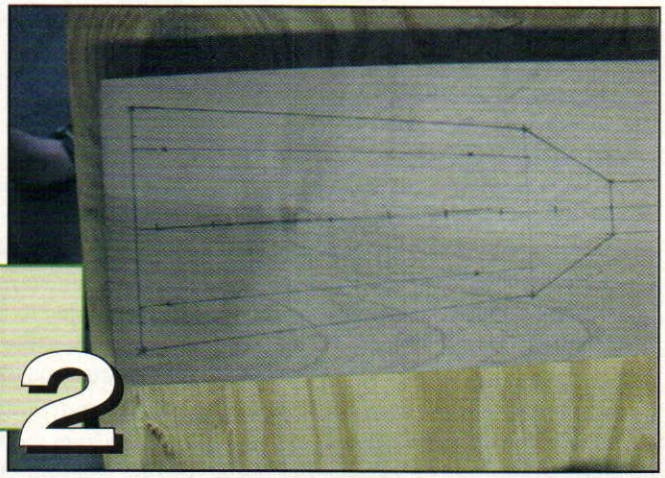
Make a Mash Paddle

A woodworking project for homebrewers

Story and photos by Forrest Whitesides

If you are an all-grain brewer, or if you do larger partial-mash batches, a mash paddle (or some equivalent) is a critical piece of brewing equipment to ensure that any "dough balls" (dry spots in the mash) are busted apart, that the mash temp is evenly distributed throughout the mash tun, and to generally just keep things stirred up.

Commercially available mash paddles are made from a variety of materials, including plastic, metal and wood. While plastic and metal both have their advantages, there's nothing quite like the look and feel of wood for a mash paddle, in my opinion. And while you can buy some very nice wooden mash paddles, you can make your own for about $20 worth of wood and materials, assuming you have a few basic tools in your garage or work area. And you don't need to be a master craftsman to get the job done. I'm a rank novice when it comes to woodworking, and if I pulled it off, you can too.

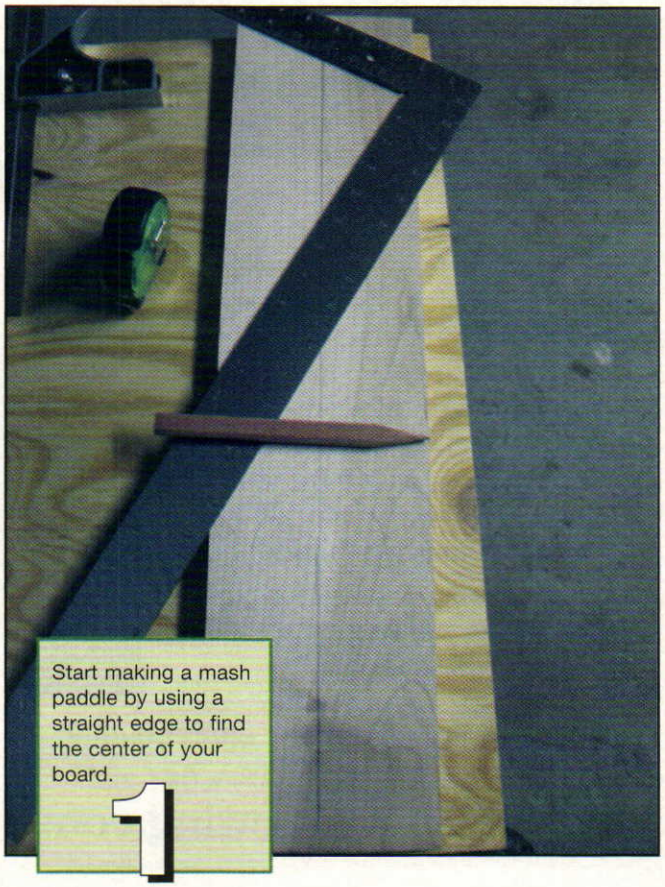


Next, use the straight edge to mark the basic shape of the paddle.

2

Wood selection

Selecting the proper wood is a critical step in the process. You want to use a wood that has a relatively tight, closed grain, as these woods are generally less permeable by liquids and will impart little in the way of flavors from resins in the wood. Some good choices include maple, poplar, white oak (but not red oak) and cherry, although any wood with a tight grain and low resin content will probably make a good paddle. As pictured in this project, I chose a 1-inch by 6-inch piece of maple that I picked up at a major home center for about $4 per linear foot.



Start making a mash paddle by using a straight edge to find the center of your board.

1

The tools you'll need

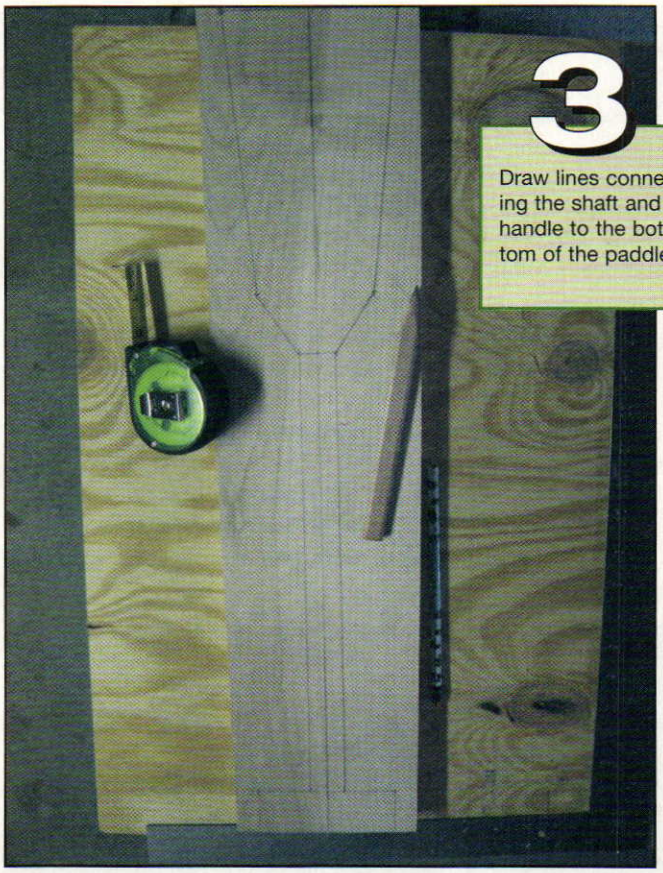
Like most woodworking projects, you can do it with a few simple tools or with some nicer, more expensive tools. On the minimal end of the spectrum, you'll need a decent jig saw, a hand drill, and a sanding block with sandpaper. On the more fancy side, you can use a router or scroll saw, a drill press, and a palm or orbital sander. Additionally, an assortment of files and rasps come in handy for shaping and smoothing. Other common tools are also helpful, such as a framing square, clamps, a tape measure, and torpedo level.

I made two mash paddles, one using a jig saw and the other with a scroll saw as the primary cutting tool. In my relatively inexperienced hands, the scroll saw made much cleaner, neater cuts with a higher degree of precision. However, with the jig saw, I was able to make a perfectly suitable mash paddle . . . it just wasn't nearly as easy (or pretty). But as usual, good tools make work much easier.

A word about design

The shape and style of your paddle is a very personal thing, so I won't spend a lot of time trying to dictate design. There are a few basic functional elements to the overall design, however, that should be considered.

First, the paddle should have at least a few holes or slots cut into it to help break up solid balls of grain and to facilitate easier



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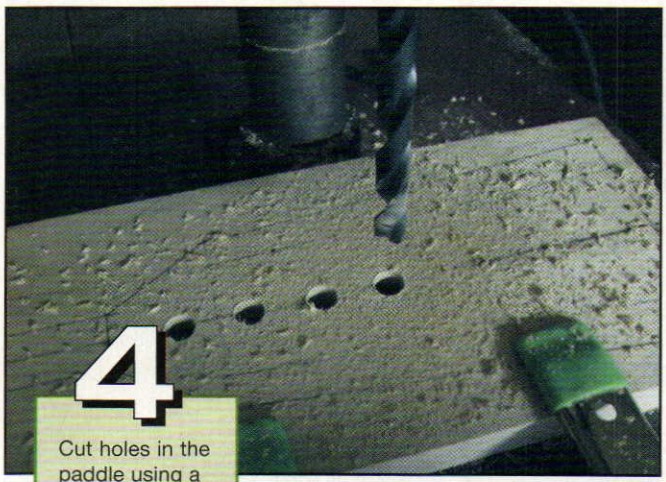
Draw lines connecting the shaft and handle to the bottom of the paddle.



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Cut holes in the paddle using a hand drill or drill press.

stirring. Some paddles have many smaller holes, some have just a few larger slots, and still others have a combination of the two — it doesn't much matter what you decide to do, so long as there are some cutouts in the paddle.

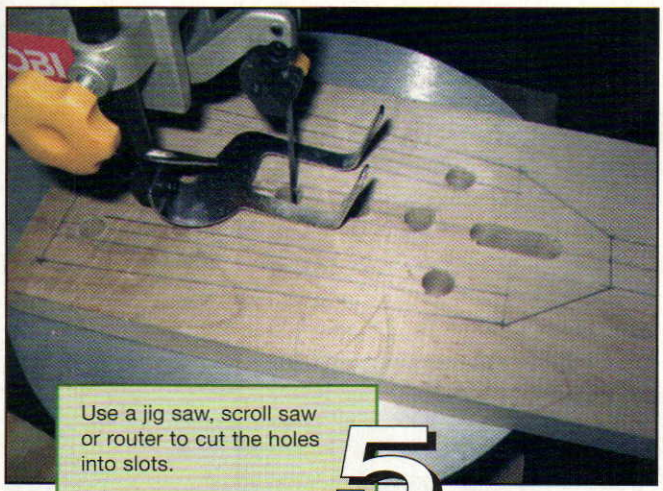
Second, you want to make sure that the shaft and handle part of the paddle are wide enough and thick enough to withstand the force exerted as you stir a thick mash. Therefore, for every 12 inches (30.5 cm) of total paddle length, you will want about a half-inch (1.3 cm) of shaft width, generally speaking.

Make your marks

If you've got a great eye for design and a steady hand, go ahead and sketch out your paddle on the wood. For the rest of us, we'll be using measuring tools and a straight edge to mark the wood. There are many ways to approach measuring and marking the project, but I'm going to stick to the method I used. If you're an experienced woodworker, you probably already have your own sound method to do this. If you're not, like me, then read on for a crash course in quick-and-dirty project plotting.

I realized quickly that my piece of wood wasn't square on any edge, and since I don't have a jointer, I decided to just draw a center line down the wood and work outward from the middle. To find the center, measure the width of the board, divide that measurement by two, and then use the new figure to mark the board at the halfway-across point. Start at one end of the board and make several halfway marks all the way down. Line up a straight edge on these marks and draw a heavy line down the center (see Figure 1). This method isn't the prettiest in the world, but it works.

I decided to make my paddle four inches wide at the bottom (the business end of the paddle), and then become more streamlined as it approached the handle. So I made a mark two inches on both sides of the center line (for a total width of four inches) at the bottom of the board. Then further up the board (about seven inches/18 cm from the bottom) I made two more marks 1.5 inches (3.8 cm) on either side of the center line. To add one more contour, add two more marks about 1.5 inches (3.8 cm) further up and just half an inch (1.3 cm) on either side of the line. These last two marks also serve as the starting points for drawing the shaft and handle of the paddle Using a straight edge, draw lines between the marks on each side to complete the basic shape of the bottom half of the paddle (see Figure 2). Then draw lines connecting



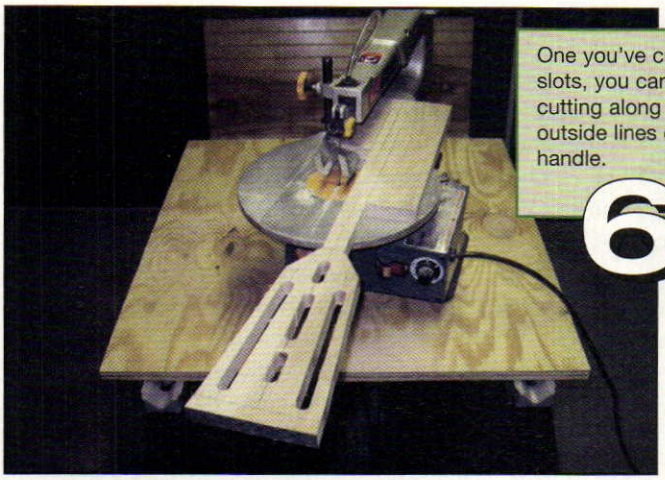
Use a jig saw, scroll saw or router to cut the holes into slots.

5

the shaft and handle to the bottom of the paddle (Figure 3). The shape of the handle itself is personal. I went with a "T" shape out of sheer expediency. Note: These measurements are just the ones that I used and work well assuming a total paddle length of approximately 24 inches. Feel free to experiment.

The final cuts

Now it's time to put some holes in your paddle. Trust me, it's



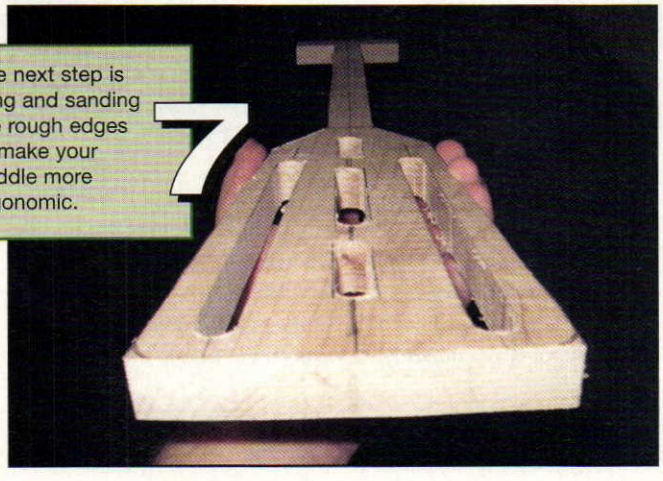
One you've cut out the slots, you can begin cutting along the outside lines of the handle.

6

much easier to mark, drill and/or cut the holes before you cut out the paddle itself. Here's where you can let your creativity run wild. I opted for two long slots along the sides and three shorter slots down the center of the paddle. To keep things symmetric, use that trusty old center line as the base from which to measure and mark the positions of your holes.

Use a hand drill or drill press to put holes in the paddle (Figure 4). I used a 7/16-inch bit for my holes. To make slots instead of simple holes, drill a hole on either end of where you want the slot to be and then cut out the space between with a jig saw, scroll saw or router (Figure 5). As an alternative, you can simply drill several holes very close together to form a slot, although this method will likely require a lot of sanding and filing to get a smooth hole.

Using your saw of choice, cut along the outside lines (Figure 6). Your paddle could be used at this point, but sanding or filing will go a long way to make it more ergonomic and attractive (Figure 7). You can use various files and rasps (Figure 8) to smooth the edges of the wood and to even out the slots and holes. A palm sander or sanding block will smooth out the finish and make your paddle comfortable to hold and handle.



The next step is filing and sanding the rough edges to make your paddle more ergonomic.

7

To finish, or not to finish?

If you used a closed-grain wood like any of those listed at the beginning of the column, there is no need to apply any sort of finish to your paddle. After use, rinse it off with warm water and let it air dry before putting it away. If you really want a finish on your paddle, you can use a light coat of cutting board oil as it is food grade. I do not believe that this is necessary, however, and some homebrewers believe that even small amounts of this oil can be imparted during mashing and have a detrimental impact on head retention in the finished beer.

Now that you've completed the project, take your completed paddle (Figure 9) and get to mashing!

This was Forrest Whitesides' first woodworking project for Brew Your Own. *He has been homebrewing since* 1995 *and writes the "Projects" column in every issue. He also admits to a strong penchant for all Belgian-style brews.*

Choose a variety of files and rasps to smooth the edges of your paddle.

8

A completed mash paddle, ready for action.

9

The Bitter Truth

Factors affecting hop bitterness in beer

by Bill Pierce

The small cones of the tall, climbing vine *Humulus lupulus* — the hop plant — were the last major ingredient innovation in brewing, not coming into wide use for bittering and flavoring beer until the end of the Middle Ages. Brewers found that hops were superior in terms of their flavor and preserving qualities, and they gradually replaced the mixtures of various other plants and herbs used prior to that time. Hops provide a pleasant bittering that helps balance the sweetness of malt and also offer brewers a rich and diverse palette of flavors and aromas that contribute an almost infinite diversity to the beers they brew.

The heart of the hops

For brewing, most of the desirable compounds of hops are contained in the lupulin glands, which can be observed on fresh whole hops as numerous tiny yellow dots at the base of the cones near the stem. Enclosed therein are the resins and essential oils that provide the qualities we seek in our beer. Almost all of the bittering comes from soft resins containing three alpha acids: humulone, cohumulone and adhumulone. Together these typically account for between 2 and 18 percent of the total dry weight of the cones, and the alpha acid content is listed in the specifications provided by hop producers for each lot of a specific variety. This figure indicates their contribution to the bittering level of a beer.

Hop varieties with high alpha acid levels tend to be lower in the essential oils that are the primary components of hop flavor and aroma. For reasons of convenience and economy, high alpha varieties usually are favored for bittering additions, while lower alpha hops are better known for their flavor and aroma properties. Even so, all bittering hops are not quite the same and there can be differences in the character of the bittering from each variety. Not everyone agrees, but varieties that are lower in cohumulone compared to the other alpha acids are believed by many people to be somewhat smoother and less harsh. The cohumulone percentage of the total alpha acids is published for each variety, and can be useful when formulating recipes. Cohumulone is also slightly more soluble than the other alpha acids during boiling.

The hop resins are somewhat unstable and prone to oxidation, and the alpha acid level of hops decreases over time. This loss is decreased at lower temperatures, and when hops are packaged in oxygen-barrier bags from which most of the air has been removed. The storage stability also varies with the variety of hops. Some varieties will lose more than 50 percent of alpha acids if stored for a year at room temperature; the loss is less than 15 percent if stored at 0 °F (-18 °C).

Different forms of hops vary with regards to their storage potential and performance in the brewhouse. Whole hops are simply hop cones that have been picked and dried. Whole hops are only lightly processed and this appeals to some brewers. When boiled, whole hops float on top of the wort and it is easy to siphon clear wort out from underneath them after the boil. However, their lupulin glands are exposed and will oxidize faster than pellet or plug hops when exposed to oxygen. Under optimal storage conditions, though, the difference is minimal.

Whole hops, or cone hops, are sometimes erroneously called leaf hops, although the leaves of the hop plant are not used in brewing.

Pellet hops are just whole hops that have been finely milled and extruded through a die. Pellets are widely used by homebrewers and commercial brewers because they are more compact and have better storage characteristics when storage conditions are not optimal. Pellet hops also show about 10% better hop utilization than whole hops. In the kettle, pellets sink to the bottom of the vessel. (They also sink when used as dry hops.)

The kind of pellets homebrewers are familiar with are T-90 pellets. These pellets contain everything that whole hops contain — both lupulin gland material and vegetative matter. As such, the alpha acid rating of these pellet hops will be the same as (or very close to) alpha acid rating of the whole hops they were made from.

T-45 pellets are hop pellets made such that about half of the vegetative matter is removed, thus roughly doubling the alpha acid percentage of the pellet. Brewers wishing to brew highly bitter beer, but minimize the amount of vegeta-

Photos Courtesy of Midwest Supplies

Whole hops, hop plugs and pellet hops — the three most common forms of hops available to homebrewers.

tive matter in their kettle should consider T-45 pellets. Unfortunately, they are not commonly available to homebrewers.

Hop plugs are made from whole hops, cut into small pieces and pressed into half-ounce (14 g) disks. As with T-90 hop pellets, they contain all the material of the whole hops. Unlike hop pellets, the material in hop plugs will float once the plug breaks apart in the kettle.

Commercial brewers also have access to hop extracts, isomerized hop extracts and hop oil extracts, and some homebrew shops sell these repackaged into homebrew-friendly sizes.

Although many homebrewers grow their own hops, measuring the alpha acid level in them requires laboratory analysis and equipment beyond that found in a typical homebrewery. However, hop producers, larger breweries and some independent laboratories routinely measure the alpha acid level of hops and the corresponding bittering in beer. For a fee, it is possible to send samples to these labs for precise analysis.

Rearranging the room

As they exist in the lupulin glands of hop cones, alpha acids are not particularly bitter. To become bitter, they must first be isomerized, that is, the configuration of the alpha acid molecule is changed, although its chemical formula stays the same. Only these iso-alpha acids are soluble in wort and beer. Isomerization requires time and both the high temperature and physical agitation of boiling. The reason bittering hops are added early in the boil is to enable a greater percentage of the acids to be isomerized.

The percentage of the total alpha acids that are isomerized is known as the hop utilization, and it depends on a number of factors. Among these are the length of time the hops are boiled, the temperature (dependent upon the altitude) and vigor of the boil, the size and geometry of the boiling kettle, the specific gravity of the wort, the wort acidity, the form of hops being used (pellets or whole cones) and even the yeast used for fermentation. Hop utilization is far less than 100 percent. Even commercial breweries achieve less than 50 percent utilization; for homebrewers it varies from 0 percent for "dry hops" that are not boiled but added post-fermentation, to perhaps 40 percent for bittering hops boiled vigorously for 60 minutes or longer.

During the boil, about 50% of the alpha acids are isomerized, but losses during the brewing process mean that the net utilization is lower. Some bittering compounds stick to coagulated protein and other material. Some of this material will stick to the sides of the kettle and bitterness will be lost because of this. Likewise, if the kettle "foam" is skimmed, some bitterness is lost. Some brewers purposely skim this material believing that it contains a harsher, less pleasing bitter character. In addition, bitterness decreases during fermentation and different yeast strains are thought to remove bitterness in different amounts.

Boiling time is the major factor influencing hop utilization. If you plot hop utilization vs. boil time, you get a curve

rather than a straight line. Longer boil times always lead to higher utilization rates, but the rate of increase in hop utilization slows as boil time is extended. Experiments indicate that at 45 minutes the extent of isomerization is about 90 percent of that which occurs at 60 minutes.

Because the vast majority of the alpha acid isomerization occurs during the first 60 minutes, there is normally little reason to boil hops for longer than that time. Moreover, some brewers believe that boiling hops for longer than 60 minutes can result in undesirable reactions and harsh flavors.

It's different when you're bigger

At least two additional factors are of notable significance. The first is the specific gravity of the wort. Higher gravity worts exhibit poorer hop utilization; for example a specific gravity of 1.080 will have utilization of approximately 70 percent of that which occurs at a gravity of 1.040; at 1.100 it drops to 58 percent. This is important when brewing high gravity beers, and is also of particular consequence to those who boil concentrated wort that is later diluted by the addition of water to the fermenter.

The other issue is the level of bittering itself. Iso-alpha acids have more limited solubility as they become more concentrated, which should be taken into account when calculating the utilization for more bitter styles. For example, at 50 IBUs (more about measuring bittering in a moment) the utilization will be approximately 87 percent of what it would be at 15 IBUs; at 80 IBUs it's 80 percent. If you brew high gravity beers, concentrated worts or bitter styles, you will need to increase the amount of hops accordingly in order to achieve the desired bittering.

Hop utilization is an empirical measurement and varies for each brewing system. While formulas exist for estimating the utilization, and brewing software takes this into account, it is extremely likely that each brewer will have to make adjustments for his or her system. After several batches of the same recipe you should be able to establish an average utilization value that is reasonably accurate for your brewing equipment and procedures.

How bitter is it?

Bitterness is a relative matter of perception for the human palate, that is, what one person regards as pleasantly bitter may be extremely so to another, but it can be determined quantitatively.

The measure of bitterness in beer is the International Bittering Unit (IBU), which is defined as a milligram of iso-alpha acid per liter of beer. (A milligram per liter can also be expressed as a part per million). Using IBUs to describe bittering provides brewers and knowledgeable beer drinkers with a frame of reference, and it also enables brewers to calculate the amount of hops to achieve a predicted or desired level of bittering.

Modern beer styles range from as little as 7–8 IBUs (most people cannot detect less than about 5) to as much as nearly 100, which is roughly the upper

limit of both iso-alpha acid solubility in wort (it depends on the specific gravity, among other things) and the point at which the human palate is overloaded by bittering. It is also difficult for the taste buds to detect a difference of less than 4–5 IBUs between beers, especially at higher levels.

Bittering by the numbers

For homebrewers with brewing software such as ProMash, BeerTools, BeerSmith or StrangeBrew, calculating your estimated IBUs is as easy as typing in a few values. If, however, you'd like to calculate your IBUs by hand, the formula for calculating bittering is as follows:

IBUs = Weight of hops in grams * Alpha acid percentage of hops * Utilization factor in percent * 0.1 / Volume of beer in the fermenter in liters

or, in U.S. units:

IBUs = Weight of hops in ounces * Alpha acid percentage of hops * Utilization factor in percent * 0.7489 / Volume of beer in the fermenter in U.S. gallons

(The factor of 0.7489 accounts for the percentages and the conversion of ounces and gallons to milligrams and liters.)

The IBU contribution of each hop addition is calculated separately and then added together to determine the total bittering. The alpha acid percentage should be supplied when you bought your hops and you can weigh each hop charge with a kitchen scale with a resolution of ¼ oz. (7 G) or less.

To determine the utilization factor, you can consult a generic table or graph of hop utilization — or you can try to take every possible variable into consideration. If you look through the homebrewing literature, you can find adjustments to hop utilization based on losses of alpha acids during storage, bagged vs. unbagged hops, effects of wort density, effects of wort pH and a variety of other possible influences.

Value of the values

The multitude of variables that can be used in estimating hop utilization might lead you to conclude it's neither possible nor worth the effort to attempt to calculate IBUs to a reasonable degree of accuracy. There are more than ample opportunities for errors in measurement and the failure to consider one factor or another. Far more important than the absolute numbers is being able to use the information from your IBU calculations, combined with your own brewing experience (and beer sampling) to consistently achieve desired results with regards to bittering.

If you continue experimenting with your brewing system, recipe formulations and IBU calculation methods, you will eventually establish methods of estimating bitterness you can trust and which are practical and useful in your brewing. And that's the bitter truth.

Bill Pierce wishes to thank authors Ray Daniels and John Palmer for their contributions to the understanding of hops.

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In Memoriam

Marlon Lang

Adoptive father of homebrewers

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The homebrewing community mourns the loss of a truly great man. Marlon Lang, contributor and member of the *Brew Your Own* editorial review board, passed at his home in Baton Rouge, Louisiana on the morning of Friday, July 13, 2007. Marlon was sixty-four. He is survived by his two children, Paul and Anne, and his wife Carolyn.

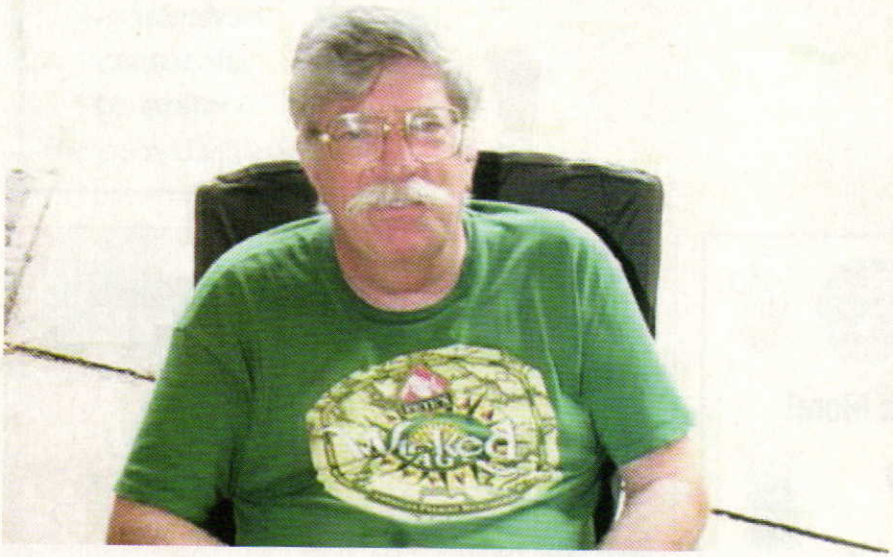
A long time member of the Redstick Brewmasters Homebrew Club, Marlon was a prolific and technical brewer who specialized in Belgian and hoppy beers. Any brewer who wondered if their beer tasted hoppy enough could take it to Marlon hoping to receive the coveted moniker of a "Lang Beer." He took special joy in learning the technical sides of brewing and sharing that knowledge and his experienced opinions on various online resources, especially the "Brews and Views Bulletin Board" on the Homebrew Digest at http://www.hbd.org.

Weekends were a special place at Marlon's home, known as "Party Central," where homebrewers from his club would sit on the patio and drink homebrew, craft-brew and talk of all things homebrewing with occasional left turns into NASCAR and other subjects — good friends, good beer, good conversation. These perpetual weekend rendezvous are as missed as the man who made them special.

One of the more unique aspects of Marlon's style was his affinity for adoption. Marlon accepted many homebrewers into his life and each person selected knew the moniker of "Adopted Son" was something special. When you were adopted by Marlon, you were referred to as "Son," praised for your accomplishments (in brewing and in life) and felt like part of his family. Marlon's ability to befriend and inspire was a gift of his charismatic personality that few people possess.

Marlon became a fixture at the Dixie Cup, an annual competition in Houston. Each year he would make the trip west from Baton Rouge at exactly fifty-five miles per hour. Any faster, he would say, and gas would be wasted. Besides, he'd add, he'd get there just the same as those nuts traveling faster. He would come to the competition to work, either judging or stewarding, and would leave with cases of anonymous "mystery beer." If you have wondered where that third bottle went for entries that did not go to the best-of-show round, there is a good possibility Marlon and those lucky enough to enjoy "Party Central" sampled it. At the competition he was good for a funny story and brewing-related news from the Pacific Northwest, which he visited often, touring many of the area breweries.

> When you were adopted by Marlon, you were referred to as "Son," praised for your accomplishments (in brewing and in life) and felt like part of his family.



Marlon Lang frequently contributed to *Brew Your Own* as an author and also proof-read stories for accuracy as a member of our editorial review board.

Marlon's dedication to the hobby, his outlook on life and his love of friends, beer, family and country made him a special person who stood out, even in a crowd of often-unique homebrewing characters. He was respected, loved and honored — and now missed immensely. Though there are many good brewers and competent mentors, there was, and will only ever be one Marlon.

Godspeed, Dad. From all of your proud adopted sons.

Among his many contributions to *BYO*, Marlon wrote about brewing with holy water for "Last Call" in October 2004.

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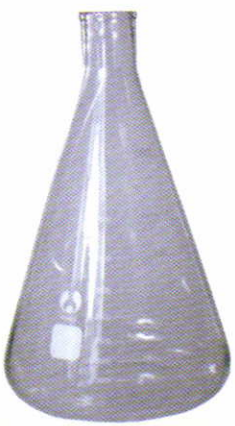

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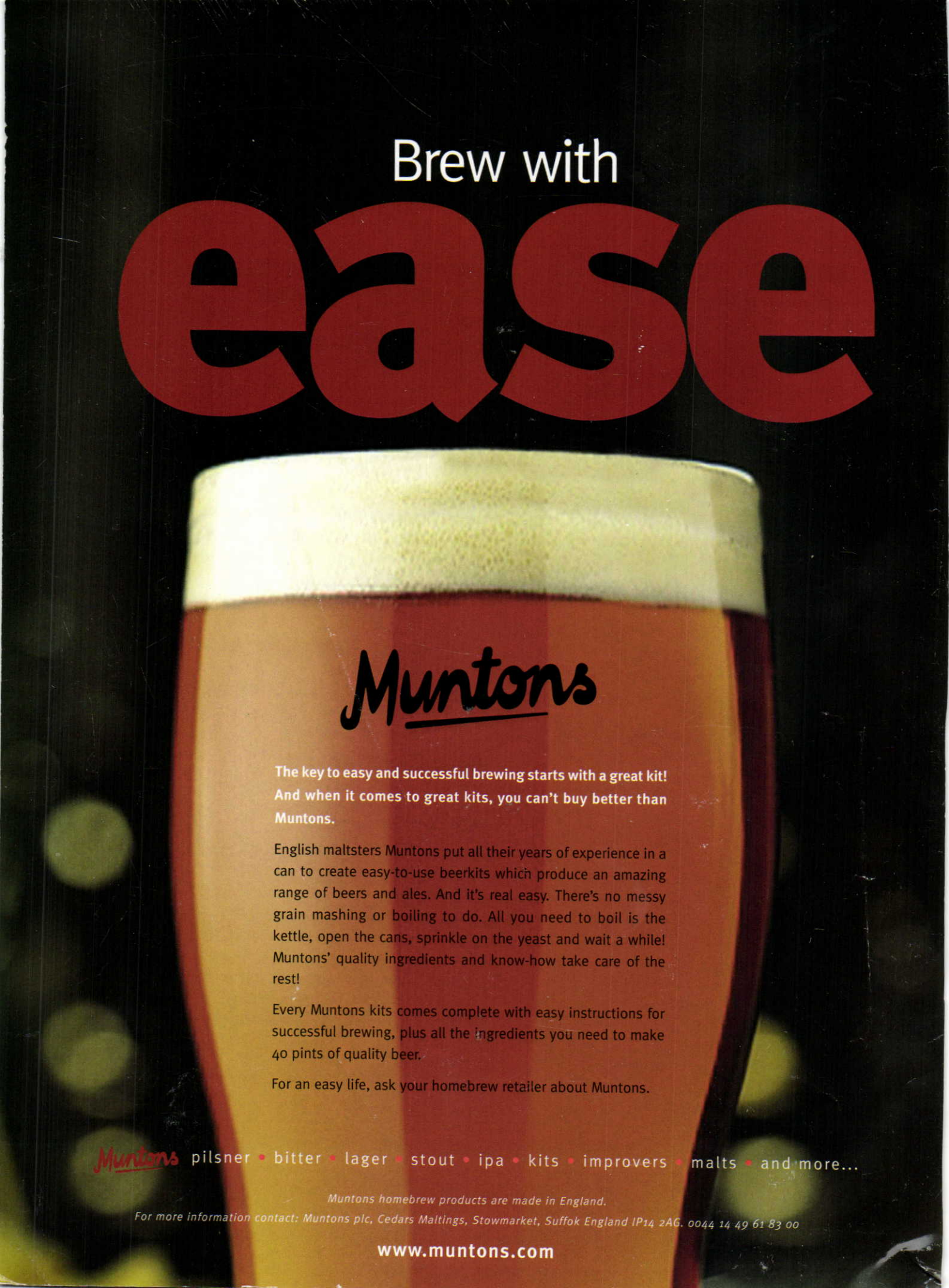
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