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THE HOW-TO HOMEBREW BEER MAGAZINE

SEPTEMBER 2008, VOL.14, NO.5

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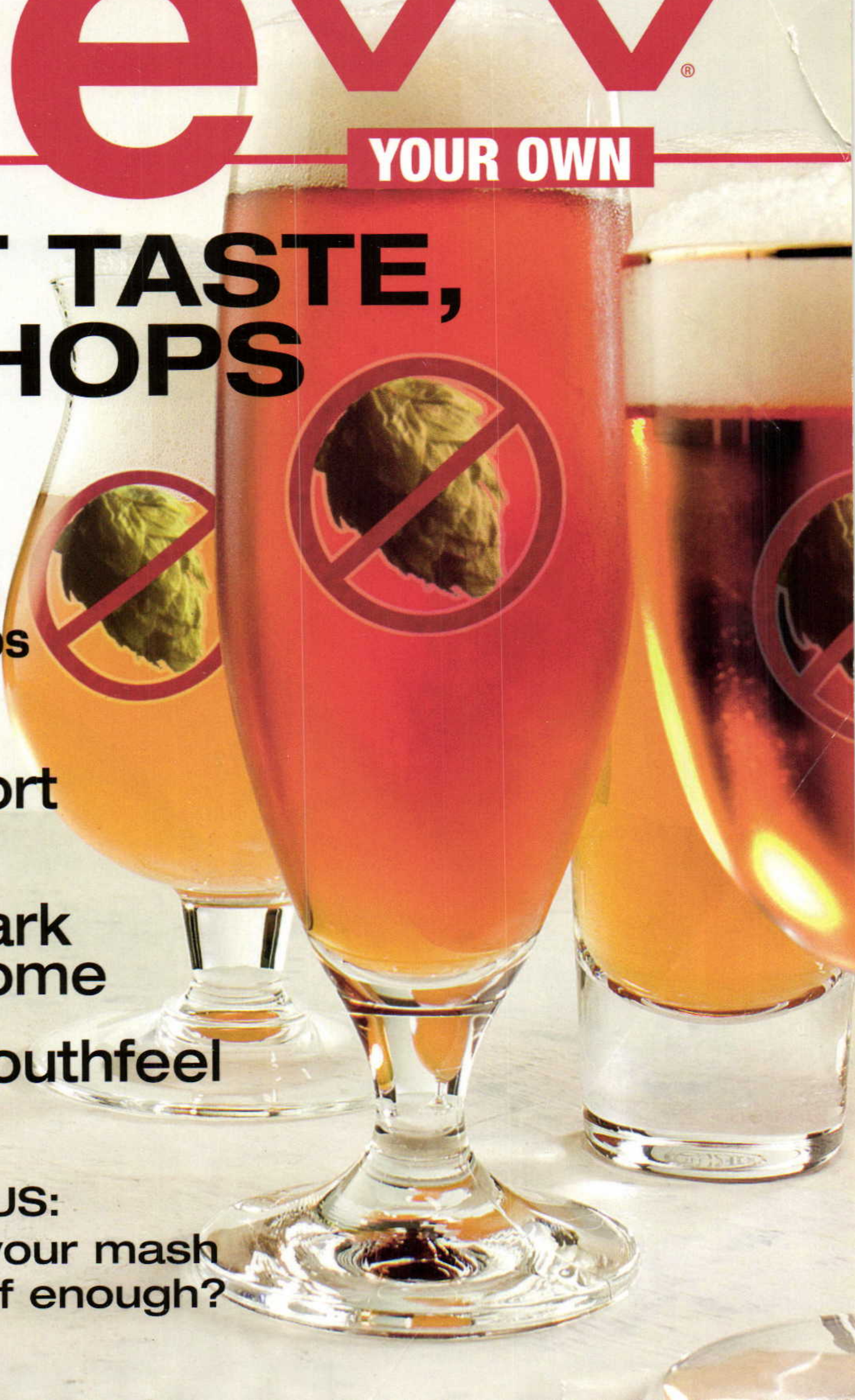

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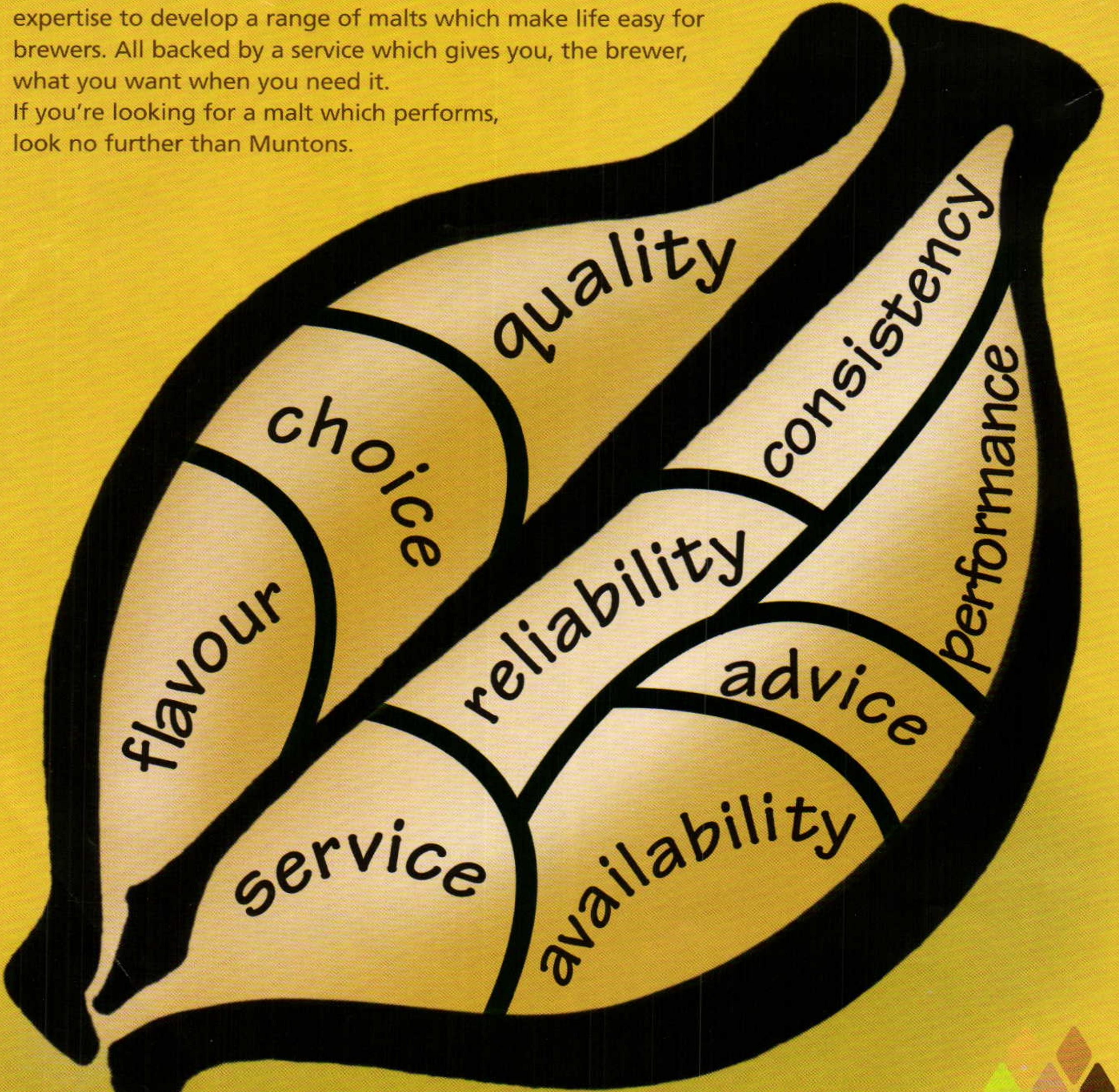

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SEPTEMBER 2008
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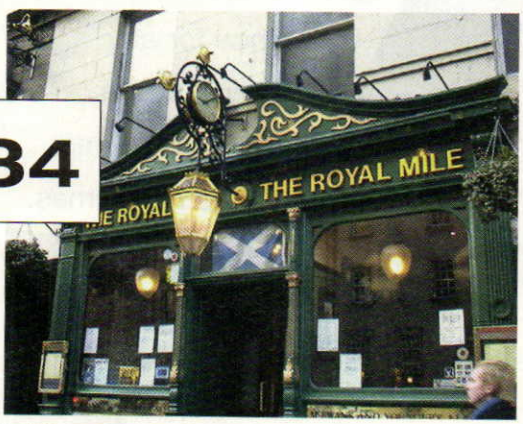

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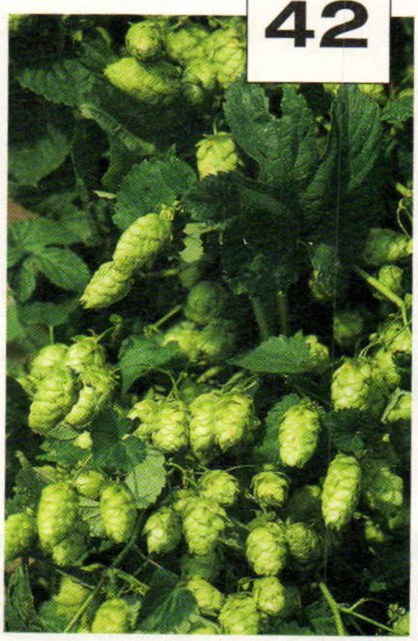

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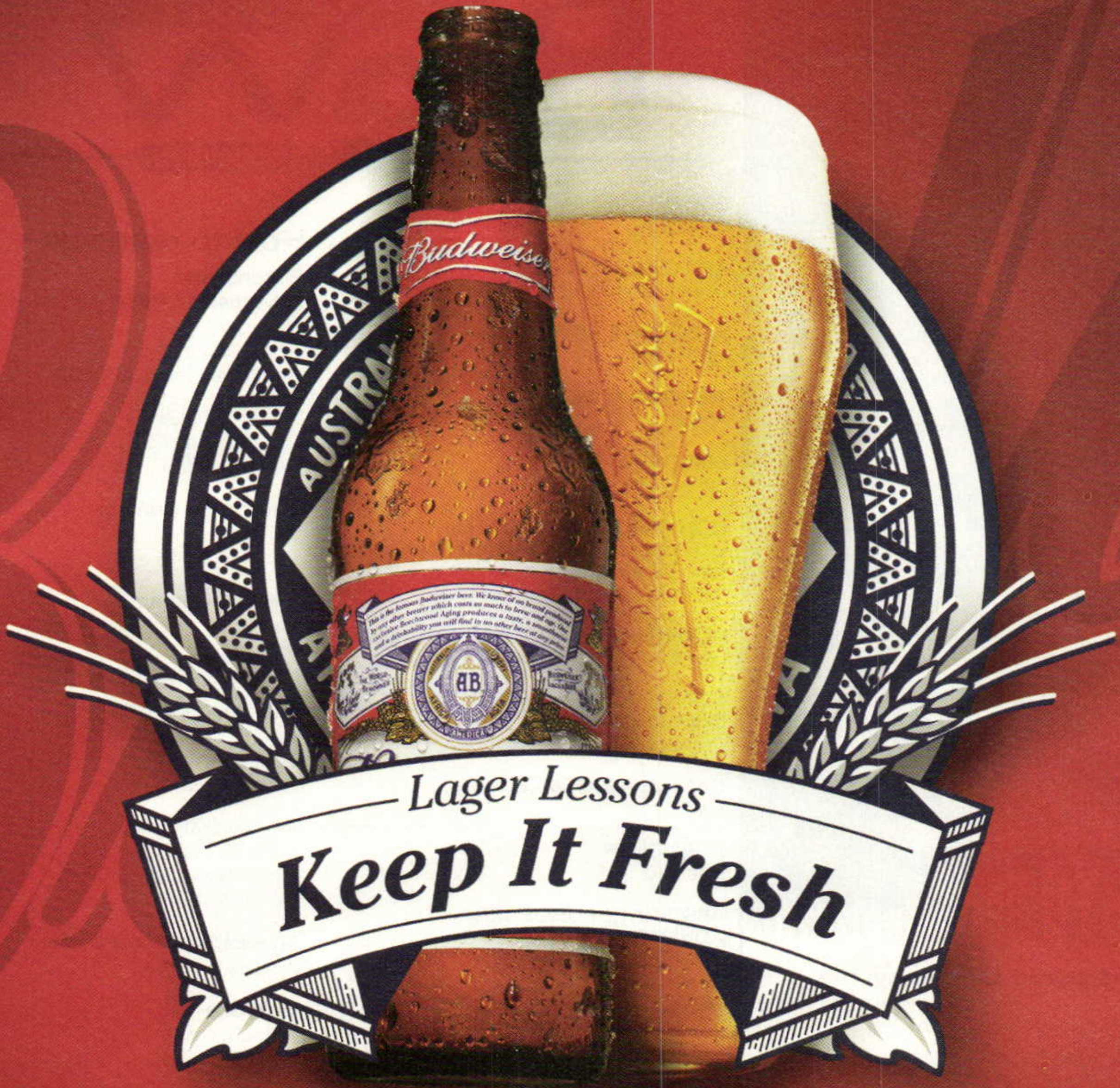

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RECIPE INDEX

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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Cover Photo: **Charles A. Parker**

MaiL

Sad News

I enjoyed the article you published written by Rich Rosen ("What Ale's You?," Last Call, July-August 2008). I just met Rich for the first time this past April so it is with a heavy heart that I tell you that he passed away June 26th.

Scott Taylor
via email

Math Mangled

I'm wondering whether there might be a mathematical mistake in Betsy Parks' article on "Brewing With Fruit" in your July-August 2008 issue. Parks offers an equation for calculating the effect on specific gravity of adding fruit to the wort. Her equation is . . .

"SG = [W x (P/100) x 45]V.

... "where W is the weight of the fruit, P is the percentage of sugar in the fruit, 45 is the extract potential in gravity points of simple sugars and V is the volume of the beer in gallons."

I question whether the product inside the brackets should be multiplied by V (i.e. the volume of the beer).

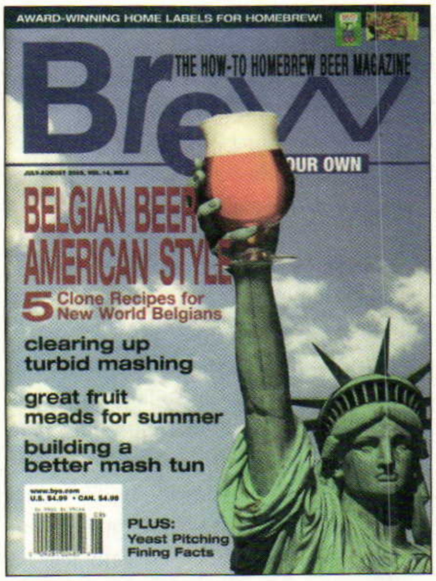
Steve Giere
Battle Ground, Washington

Yes, you are right, the variables in the brackets should be divided by volume (V).

Crazy Copper in Cooler

I recently read your "Copper Collector" article in the July-August 2008 issue of BYO, and I was somewhat surprised to note that the example in the article shows a rather inefficient manifold! I know that the author was directly referencing batch sparging, but the choice of a manifold is useful for both fly and batch sparging, and it doesn't seem right not to mention that the pictured manifold is not what a fly sparger would want. My reference is John Palmer's "How to Brew," which I read prior to making my own manifold.

The collection tubes should be oriented to minimize the distance that the wort has to travel to the spigot, in order to ensure that the maximum amount of sweet wort is drawn out. Since every quart of wort drawn out of the tun during fly sparging is less concentrated than the preceding quart, the way to maximize the amount of sweet wort collected is to ensure that the distance the wort has to travel inside the manifold is at a minimum. A few moments with a ruler will show that this is accomplished by orienting the manifold cross-tubes towards the outlet.



Thanks for your magazine, and here's hoping you remember us fly spargers, at least in a sidebar!

Evan Van Dyke
Rolling Meadows, Illinois

There's a big difference between a less than optimal design and a poor design. With batch sparging, the spacing of the manifold tubes does not matter. In the the case of fly sparging, however, spacing can make a difference in extract efficiency (as John Palmer discussed in "Advanced Brewing" in the Jan-Feb 2008 issue). However, on a homebrew scale, the difference in absolute distance between collection points and the lengths that wort has to flow is small when you are rearranging copper pipes inside a picnic cooler. (In commercial lauter vessels, outlets are spaced out more distantly than this. In modern lautering vessels, each outlet point collects wort over an area of 20–25 ft^2/1.9–2.3 m^2.) If you are fly sparging and collecting your wort over 60 or 90 minutes, differences in the arrangement of pipes in a manifold within a picnic cooler should not result in big differences in efficiency. (They may even fall below the level that you could tell the difference with an ordinary hydrometer, but this would have to be tested.)

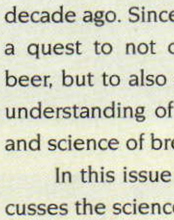
If you're a fly sparger and want to hit on the optimal spacing, just rearrange the crossing pipe so it flows directly to the drain.

ContribUTors

KRISTEN ENGLAND (right) wrestles under the stage name "el BJCP Continuing Education Directoro." He has won numerous NHC and MCAB gold medals in addition to being named the 2005 Midwest Home Brewer of the Year and 2005 High Plains Brewer of the year. He is a member of the St. Paul Home Brewers Club and a BJCP judge. In his spare time, Kristen recently received his PhD in Pharmacology from the University of Minnesota. He currently lives in St. Paul with his wife (left), daughter and a one-eyed dog. He discusses debittered black malt on page 26, the fourth of his stories for BYO.

CHRIS BIBLE is a chemical engineer from Tennessee whose love of beer and science intersected when he became a homebrewer nearly a decade ago. Since then, he has been on a quest to not only brew the perfect beer, but to also gain a deep, technical understanding of all aspects of the art and science of brewing.

In this issue on page 52, Chris discusses the science of mouthfeel in beer. This is his second story for *Brew Your Own*.



JAMIL ZAINASHEFF has never met a beer style he hasn't brewed. He set out learning about beer styles by brewing every one of the styles recognized by the Beer Judge Certification Program (BJCP).

In addition to writing the "Style Profile" column for every issue of *Brew Your Own*, Jamil is also a BJCP judge and assistant IT director for the BJCP. He hosts "The Jamil Show" on The Brewing Network about beer styles, and is the co-author of "Brewing Classic Styles" (Brewers Publications, 2008).

MaiL

Olive Oil

I too read with interest the May-June 2008 article on "Olive Oil Aeration." I conducted my own home trial and it works as written. I brewed (partial mash method) a 6-gallon batch of pale ale, which I split into two 3-gallon batches. I made two 1-pint yeast starters using White Labs California Ale. One batch was aerated in the traditional manner with an aeration wand and fish aquarium pump. For the other batch, I did as the article suggested. I dipped a 20-gauge piece of sanitized copper wire into olive oil between ¼ and ½ inch. I stirred the yeast starter with the copper wire and added the starter to the wort in the primary fermenter. No other aeration was performed. Both batches started noticeable fermentation at roughly the same time. It appeared that the first batch completed primary fermentation in about 5 to 6 days, while the olive oil batch completed in about 8 to 9 days. But both ended up with FG at 1.012 to 1.014.

Mike Hengel
Littleton, Colorado

Thanks for the data point, Mike. Your observations match those of the experiments of Grady Hull, whose research was the inspiration for the BYO article by John McKissack. You should set aside a few bottles from each batch and see how bottles from both treatments age. If the olive oil hypothesis is correct, the olive oil "aerated" batch should show fewer signs of oxidation with age.

Chiller Sanitation

In the March-April 2008 issue, the "Techniques" section was an article called "Cooling Out." In it, it was stated that 30–40 minutes of boiling water was required for sanitization. Is this much time necessary to properly sanitize the chiller? I've read — or someone told me? — that simply running about 1 cup of boiling wort through it was sufficient. I usually just let boiling water go through my counterflow wort chiller for 5 to 10 minutes just before using. Is this enough time or am I risking contamination of the beer? Of course, I rinse the chiller after each use.

Steve Dillard
Harmont, North Carolina

One cup of boiling water would not be sufficient to thoroughly sanitize a counterflow wort chiller. By the time the water exited the chiller, it would be cooler than pasteurization temperature. In addition, the contact time would be too short. On the other hand, we will admit that 30–40 minutes is longer than is strictly needed; if the chiller is clean inside to start, 5 minutes of recirculated near-boiling water should be sufficient. We just like to be sure about sanitation.

Questions, concerns, comments?

Contact us!

Brew Your Own — The How-To Homebrew Beer Magazine

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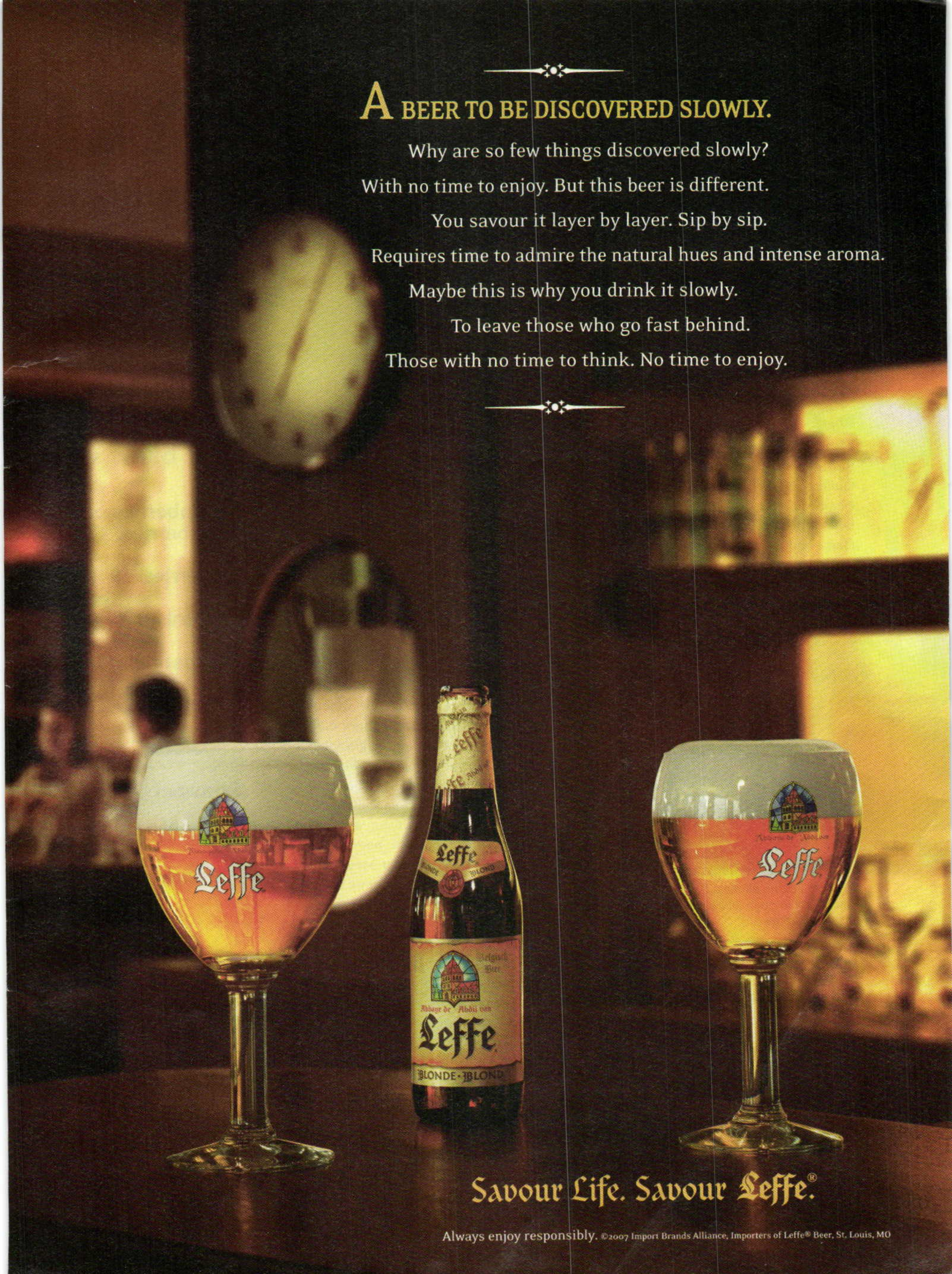
A BEER TO BE DISCOVERED SLOWLY.
Why are so few things discovered slowly?
With no time to enjoy. But this beer is different.
You savour it layer by layer. Sip by sip.
Requires time to admire the natural hues and intense aroma.
Maybe this is why you drink it slowly.
To leave those who go fast behind.
Those with no time to think. No time to enjoy.
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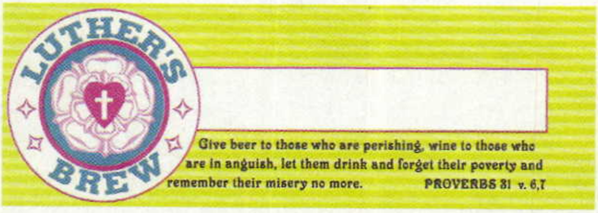
club PROFILE
St. Mark's Spirits Club

Cape Girardeau, Missouri

St. Mark's Spirits Club started in the fall of 2001 to promote fellowship among the men at St. Mark's Lutheran Church in Cape Girardeau, Missouri. It is both a good outlet for the men of St. Mark's and a great way to become friends and enjoy beer.



Membership is limited only to men over 21 years old and we range in age from 24 to 81. The club meets every two weeks, from September through May, and makes two types of beer: one dark, the other light, 15 gallons (57 L) each. Each man pays $10.00 at the brewing and two weeks later, when we bottle, we each take home two six packs — one of each style. Everyone later brings the bottles back clean. There is even usually enough beer left in the end for everyone to enjoy during the next brewing and bottling.

Members of the all-male St. Mark's Spirits Club bond through fellowship — and many tasty homebrews.

There is no formal meeting; we gather in groups of two or more and also take in newcomers and teach them how to brew. Most have said that they now feel like they are more at home at church since they know each other better. One of the members came up with the name "The Spirits Club" at the first meeting and another came up with the idea for our label, Luther's Rose.

Our beer is made from beer kits, and there has been a great variety. We usually try something new each month. We have tried all-grain but the time factor was too long. We have not made a bad batch, of course all the equipment has been humorously blessed by the minister and the bishop. Our favorite beers have been Russian imperial stout and Oktoberfest. Each October we sponsor, for free, an Oktoberfest for the congregation with beer, brats, music, as well as soda and games for kids.

The Spirits Club works because the goal is simple — fellowship — and the great beer is a plus. If anyone is thinking about starting a church group to make beer, we suggest obtaining approval from your church leader first and to keep it simple. Also, don't expect all members to be at each brewing, but be sure they know up front that they are expected to pay since you are buying enough supplies for the whole group. Anyone interested in learning more about St. Mark's Spirit Club can contact fredgrabel@charter.net.

byo.com BREW POLL

What is your favorite fruit to brew with?

Raspberries or Blackberries: 29%

Cherries: 19%

Citrus: 12%

Blueberries: 11%

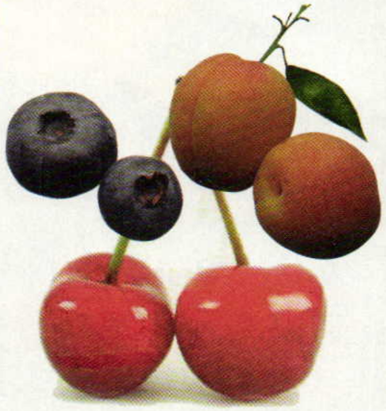
Apricots: 9%

Other: 7%

Strawberries: 5%

Cranberries: 4%

Peaches: 4%



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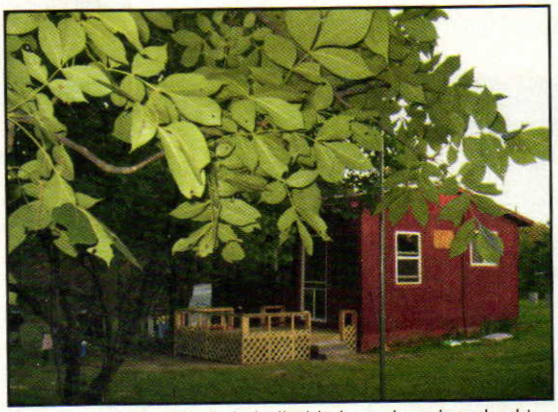
reader PROFILE
Dennis Elrod
McAlester, Oklahoma

One day, for a reason I can't remember other than my love for good beer, I decided to try brewing my own. My wife seemed up to the challenge, so we bought one of those basic bucket brewing systems — a wing bottle capper, some bottles and a hydrometer. We bought an extract beer kit, some pots and pans and officially became homebrewers.


Dennis and his wife Judy built this homebrewing shed to accommodate their burgeoning homebrewing habits.

I was fortunate to run across the President of FOAM (Fellowship of Oklahoma Ale Makers) in Tulsa. He encouraged me to join the club, so I did and, much to my surprise, he seemed to like my homebrew — even encouraged me to enter the 2003 FOAM Cup competition. Beware of that road — it can be addictive, especially when you win a ribbon in your first competition . . . with a jalapeno cream ale.

We soon realized that staying up until midnight waiting for the wort to chill was just not going to work, so we got an immersion chiller and ran the hose out the kitchen window. We had a little spare room that we designated "The Beer Room." But sooner rather than later all the beer, ingredients and equipment started coming out of that room into the bedroom. It reached a point where the beer stuff was pushing us out of our home. So we did what any homebrewer worth his salt would do — built a brewhouse!

We live in SE Oklahoma on 40 acres. An old deck down by the pond was about to fall down, but it had sentimental value, so we saved the roof for half of 'The Red Shed'. It had to be braced every step of the way to remove the old lumber underneath. Don't drink while trying to do that. A new roof would be easier.

The overall dimensions are roughly 20 ft. X 20 ft. with a screened in section for brewing, room to relax and a deck overlooking our pond. The other section is cozy with air conditioning and heat to help control fermentation temps. And so the Mountain Fork River Brewery was born the Summer of 2005.

Of course we had to upgrade our equipment, three banjo burners, three keggles, bench capper, a guest bed, chest freezer, two dorm size refrigeraters, and four kegs with accessories.

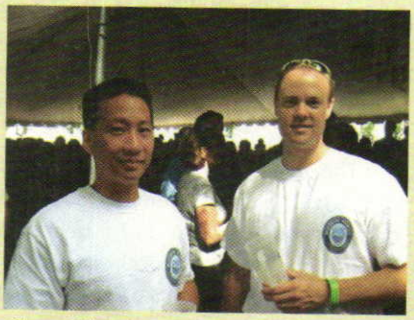
Did I really say we were saving money? There are many valid reasons for entering this hobby but saving money, for us, is very low on the list. Ours was purely a labor of love. The brewery has become a sanctuary for my wife Judy and me. She says I'm the brains and she's the brawn (all 120 lbs of her). I affectionately call her my Beerwench, but truthfully I wouldn't (and couldn't brew without her.

We've laid plans for a Bar & Grill and it will be another long labor of love for us, our family and friends with all the comforts of home. Sizzling steaks and cold beer on tap . . . Come see us. It's free!

homebrew systems that make you DROOL

Steve Chang and Benjy Edwards

Columbus, Ohio

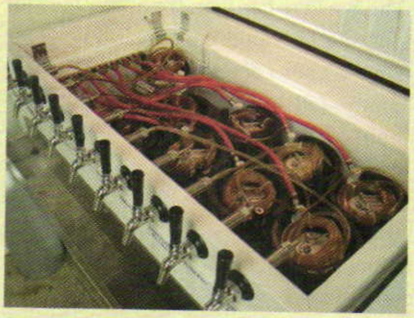


Steve Chang and Benjy Edwards have been brewing in Columbus since 1996. Their home brewery is called the Boathouse Brewery.

This is the Boathouse Brewery, including the taproom and a dedicated sink that is critical for cleaning.

Here is the Boathouse collection of British brewery pump clips for cask-conditioned ales.

Also in the brewery is the rack of equipment, including 19 corny kegs, 2 firkins, 1 pin and 3 half-barrel brewing vessels.



The kegerator has nine forward-sealing faucets that dispense the eight 5-gallon (19-L) corny kegs and the 3-gallon (11-L) corny on the freezer shelf.

A cask breather is attached to the corny keg and the 5 and 10 gallon (19 and 39 L) British casks.

These refrigerators are for fermentation, conditioning, and hop storage. The buckets contain specialty grain.

The brewing setup is a two-tier propane-fired brewing system with recirculating pump and water filtration.

replicator

by **Marc Martin**

Dear Replicator,

Las Vegas is great for several types of outdoor recreation but nothing involving snow. A friend and I had heard great things about the Mt. Shasta Wilderness area so we packed our cross country skis and made the trip. After three days of hard skiing we had developed quite a thirst and went into the town of Weed, California in search of good beer. Since it is a small town, our expectations were low so you can imagine our surprise to find Mt. Shasta Brewing Company. All of their beers were very good but our favorite was the Abner Weed Amber Ale. It was more bitter than most amber ales I have sampled. It also had a somewhat nutty finish that has stuck in my memory ever since. I have been homebrewing for almost three years and would like to duplicate this beer. I hope you can get the brewer to share his recipe.

David Purcell
Las Vegas, Nevada

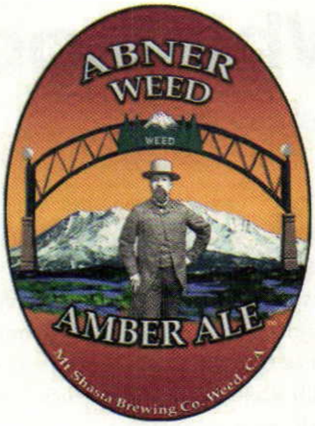
It took a total of about three minutes during my conversation with Vaune Dillmann to realize that I may be interviewing one of the most interesting brewery owners on the West Coast. It's not often you find someone that has been a cop in central California who decides to move to a small, somewhat remote, town, buy some old creamery buildings and start a brewery. It had been Vaune's dream to carry on the tradition of his German relatives who were in the brewing business and opportunity knocked.

Dillman found an ideal location in the small lumber town of Weed, California in the far northern part of the state. Their Amber Ale is named after the town founder, Abner Weed.

The brewery property was purchased in 1992 and it took several years of restoration plus ground soil cleanup before he could obtain his license to brew. Vaune claims the Mt. Shasta spring water that the brewery uses greatly contributes to the quality of their beers.

Lately the brewery is also embroiled in a battle with the US Bureau of Alcohol, Tobacco and Firearms over their bottle cap that reads, "Try Legal Weed."

Mt. Shasta's six main beers are produced in a 15 BBL, 2-vessel, infusion mash brewhouse. A bottling line was added in



2005 and this allowed their beers to also reach Oregon and Washington.

Josh Riggs, one of the two main brewers, described their Amber Ale. Josh works with Marco Noriega as a brewing team to run the entire brewhouse. Josh had no prior brewing experience and started from the ground up washing kegs and working under the former head brewer. Marco studied brewing at UC-Davis, which adds formal training to the brewing team. They typically brew two batches a day, ferment them separately and blend them later in a brite tank.

Josh says the Abner Amber Ale is a modified American amber and one of their most popular beers. Based on the style guidelines this beer's specifications would appear to be middle of the road but it is much more complex than most amber ales. Some of the complexity is created by using three different types of crystal malts together with an equal portion of Munich.

The hop additions are a blend of high alpha Chinook and low alpha Cascade producing a smoother bitterness. Dry hopping with only Cascade gives the beer the required "American" nose. Josh says that the medium alcohol level makes this a nice session beer that has a good malt-to-hop balance. Definitely a great choice for these cooler September evenings.

While weed may not be legal, at least now you have the recipe for Mt. Shasta's excellent amber ale and you can "Brew Your Own."

For further information about Mt. Shasta Brewing Company and their other fine beers, visit the Web site www.weedales.com or call them at 530-938-2394.

Mt. Shasta Brewing Co. Abner Weed Amber Ale

(5 gallons/ 19 L, extract with grain)

OG = 1.051 FG = 1.008
IBUs = 41 SRM = 11 ABV = 5.5 %

Ingredients

3.3 lbs. (1.5 kg) Coopers light, unhopped malt extract
2 lbs. (0.9 kg) light dried malt extract
0.6 lb. (0.27 kg) Munich malt
0.6 lb. (0.27 kg) crystal malt (15 °L)
0.6 lb. (0.27 kg) crystal malt (40 °L)
0.6 lb. (0.27 kg) crystal malt (70 °L)
6.5 AAU Chinook pellet hops (60 min.) (0.5 oz./ 14 g of 13% alpha acids)
1.4 AAU Cascade pellet hops (60 min.) (0.25 oz./ 7 g of 5.5% alpha acids)
3.9 AAU Chinook pellet hops (30 min.) (0.3 oz./ 8.5 g of 13% alpha acids)
1.1 AAU Cascade pellet hops (30 min.) (0.2 oz./ 5.7 g of 5.5% alpha acids)
1 oz. (28 g) Cascade whole leaf hops (dry hop for 1 week in the secondary)
½ tsp. Irish moss (last 15 min.)
White Labs WLP001 (American Ale) or Wyeast 1056 (American Ale) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 2 gallons (7.6 L) of water at 150 °F (65.5 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the liquid and dried malt extracts and bring to a boil. Add the hops and Irish moss as per the schedule. Add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 70 °F (21 °C) and hold it there until fermentation is complete. Transfer to a carboy, avoiding any splashing. Add the dry hops and let the beer condition for one week. Strain the dry hops and then bottle or keg. Allow to carbonate and age for two weeks.

All-grain option:

This is a single step infusion mash. Replace the malt syrup with 8.5 lbs. (3.9 kg) 2-row pale malt. Mix the crushed grains with 3.5 gallons (13.2 L) of 168 °F (75.5 °C) water to stabilize at 150 °F (65.5 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil for 60 minutes. Reduce the 60 minute hop additions to 0.4 oz. (11 g) Chinook and 0.2 oz. (5.6 g) Cascade to allow for the higher utilization factor of a full wort boil. The remainder of this recipe and procedures are the same as the extract with grain recipe.

Note: A thin mash is recommended by the brewer (1.5 quarts/1.4 L) strike water for each pound of grain).

Homebrew CALENDAR

September 6

West Campton, New Hampshire
2008 New England Homebrewer's Jamboree

The 12th annual competition is once again held at Branch Brook Campground. Jamboree includes live music, games, and camping. Competitors may enter beer, wine, mead, and/or cider. $10 admission. $3 per entry. Event benefits the Make-A-Wish Foundation of N.H. Anyone 21+ is welcome to be a judge. For more info visit www.homebrewersjamboree.com.

September 13

Racine, Wisconsin
Schooner Homebrew Championship

Competition is part of the Great Lakes Brew Fest. $5 per entry. Free entry with ticket stub for GLBF. Best of Show awarded for all BJCP categories of beer/mead/wine. Grand prize winner gets their beer brewed at Rock Bottom Brewery and includes a designed logo, full keg, and party for 20 friends. September 6 is deadline for entries. More info at www.theschooner.org.

September 19–20

Lubbock, Texas
2008 Cactus Challenge

The 11th annual competition is sponsored by the Ale-ian Society Homebrew Club. Deadline for entries is August 20. Participants will be competing for the coveted Cactus Challenge Best of Show Belt Buckle. Post-judging events include a pub crawl, special dinner, and awards ceremony. More info at www.ale-iansociety.org/cactus/.

October 10

Santa Cruz, California
2008 National Organic Homebrew Challenge, Entry Deadline

Entries accepted from Sept. 1 to Oct. 10. $7 for first entry, $5 for each entry thereafter. All ingredients must be certified organic or organically homegrown. Each entry must include recipe list w/ sources of each ingredient. BJCP sanctioned and judged. More information at www.brewerorganic.com/Competition/index.html.

BEGINNER'S block

Whirlpooling

by Betsy Parks

Every time you brew, your wort will end up with a lot of extra material floating around in it, such as materials from hops as well as hot and cold break proteins — all commonly known as trub. To separate the wort from the trub while salvaging as much wort as possible, try whirlpooling.

How it's done

Whirlpooling is a method that looks just like it sounds. Essentially at some point during brewing, either before or after chilling, the wort is swirled around the brewpot or whirlpooling vessel until a whirlpool forms in the center of the liquid. This motion pushes the wort against the walls of the container while pulling the solids toward the center. The rotation at the bottom of the pot is slower because of friction against the walls, so a cone-shaped pile of trub forms. Once the wort stops spinning, it is racked or transferred away from the trub to a separate vessel for fermentation.

Who does it?

Whirlpooling goes on in all breweries great and small. Many commercial brewers regularly use whirlpooling to separate the trub by pumping the wort into the lower half of a whirlpool vessel at a rapid velocity to make it spin. This usually goes on for about twenty minutes, followed by a twenty-minute resting period to let the trub cone build up and the wort to stop spinning. The wort is then pumped out of the whirlpooling vessel into a fermenter, leaving the trub behind. Some homebrewers whirlpool too, and aside from the scale of the batch, whirlpooling at home is a lot like the commercial method, and you can do it right in the brew kettle.

Chilled or unchilled

To whirlpool before chilling the wort, which is the best method if you are using a counterflow or plate chiller that will deposit the cold break into the fermenter, vigorously stir the just-boiled wort in the brewpot with a sanitized spoon until a strong whirlpool develops in the center of the pot — around one or two minutes. Take the spoon out, let it rest for twenty minutes until the spinning stops and run the wort through the chiller. Once your chiller begins to suck up trub, stop. If the trub doesn't seem to be collecting well, try stirring again more vigorously.

If you prefer to chill first, which you would do with an immersion chiller that will leave the cold break in the brewpot, immerse your chiller and cool the wort as you normally would. Once cool, remove the chiller and stir the wort well with a sanitized spoon. After a minute or two, remove the spoon, cover the brewpot to prevent contamination and let it rest for twenty minutes. Once the wort stops spinning, siphon, rack or drain it from a spigot (if you have a spigot on your brewpot) to a separate vessel for chilling. Once you drain the pot or container down to the trub cone, or when there is around a quart (~liter) of wort left, stop racking or draining as the trub cone may loosen up and get back into the wort.

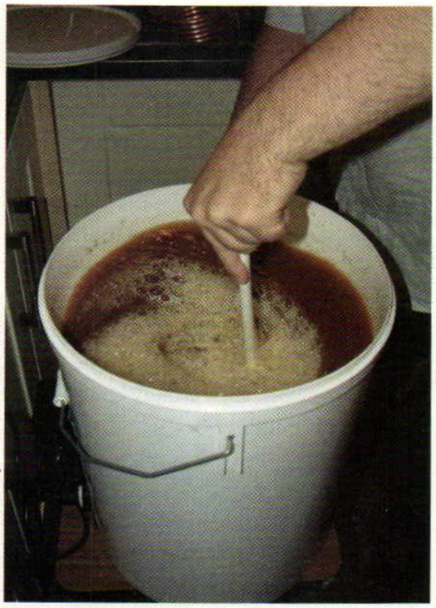


Photo Courtesy of Irish Craft Brewer

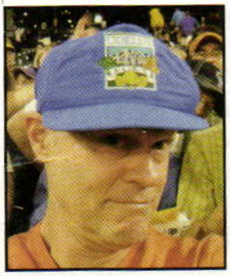
Whirlpooling can help remove hops as well as hot and cold break proteins from wort.

Scotch and Scottish

Kilt-free advice for brewing ales like a Scotsman

by Betsy Parks

Malty and not so hoppy, Scottish-style beers are not your typical ales. In this issue, three US brewers offer some suggestions for brewing the best mild Scottish or big Scotch ales possible.



DOUG ODELL, owner and founder of Odell Brewing Company in Fort Collins, Colorado. Doug started homebrewing in his kitchen in Seattle before moving to Colorado in 1989 to found Odell Brewing Company with his wife Wynne. Odell's award-winning Scottish ale and flagship beer, 90 Shilling, was introduced in 1989.

I always say that for Scottish ale, accent the maltiness over the hop character. Depending on the type of Scottish ale (they get maltier as they go up), the general description for all of them is that they are malty over hoppy — so sort of the opposite of an IPA. I use some dark malt like chocolate and dark crystal so that you get a dark color but not so much of a roast flavor.

Some people also use peat-smoked malt, which I think is more of an American rendition. If you use too much peat-smoked malt, you can ruin your beer — if you cross the threshold you can't do anything about it. One percent might be appropriate while three percent might be too much. Another problem with peat-smoked malt is if you use too much it can be too phenolic and smell like electrical fire and burning wires. If there are brewers that really like to start from scratch, I once brought peat back from overseas and smoked my own pale malt. It's very mild compared to the commercial peat-smoked variety, so it is more forgiving.

For choosing hops, keep in mind that you're not trying to get a whole lot out of them. I like to stay true to the style with Kent Goldings, Fuggles — mostly keeping with tradition and using the English varieties. Steer clear of any aggressive varieties. You do want enough bitterness to make sure it's not too sweet, but not hoppy overall.

Temperature is important for these beers. Keep in mind the climate of Scotland. When fermenting a Scottish ale, I like to go with a low temperature — not low like 50 °F (10 °C) for lager — but the mid to low 60s (~15 °C) therefore reducing the esters. As for conditioning, the bigger it is the longer I'll let it sit close to freezing. A lot of homebrewers don't have the ability to do that, but get it as cold as you can.

When it comes to choosing yeast strains, there are specific Scottish strains, but any yeast strain that you can go with a slightly lower fermentation temperature will work. Keep in mind that some ale yeasts may not even ferment below 60 °F (15 °C) and you want a strain with low to medium attenuation.

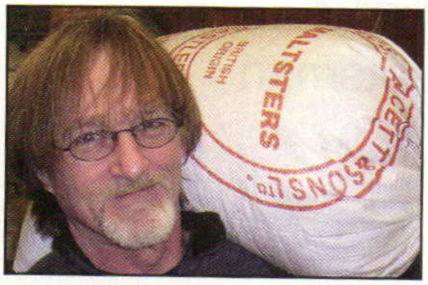
DENISE JONES, Brewmaster at Moylan's Brewery and Restaurant in Novato, California. Before coming to Molan's just over two years ago, Denise was the first female graduate of the American Brewers Guild in 1995. She served an apprenticeship at Great Basin Brewing Company in Sparks, Nevada and was the brewmaster at the Third Street Ale Works Brewpub in Santa Rosa, California for eight years.

Because we brew a lot of Kilt Lifter Scotch Ale, we start out with a basic North American 2-row. Traditionally you would use a nice cultivated malt from Scotland or England, which are expensive. But I think we can still make a great Scotch ale with our base malt by using very good English or German specialty crystal malts. There are lots of very good malts from overseas, and not to deny the US and the great roastings you can get here, but I've always had better success with quality specialty malts with Old World styling, plus it makes it more authentic in my mind.

A long 90 minute or 120 minute boil is important in Scotch ale because a lot of the malts you would normally use, such as English malts, have more dimethyl sulfides so a good long boil is important to drive off those nasty characters and have nice malty flavors.

When choosing yeasts, the thing you want to look at is that there is going to be more in the beer to ferment out, so you need something with a higher alcohol tolerance, say 10–11% tolerant. There's going to be a lot of residual dextrins and the yeast get tired after working on the simple sugars before going into the complex dextrins. At the same time there will be a lot of alcohol already there. The vessel is also one of the most important things in brewing Scottish ale in my opinion. You really want to control that rising temperature that moves from the bottom to the top of the fermenter.

Scotch ales also need time to condition. If you take a look at wine, which can also be in the 8-12% ABV range, those high alcohol levels need more time to mature. This style is not something that you want to drink super-fresh. The flavors, nuances and dextrins start to mellow in the beer over time and I think time does a great service — it will turn Scotch ale into a delicious beer for several years to come.



GREG NOONAN owner and founder of the Vermont Pub and Brewery in Burlington, Vermont. Greg is the author of many brewing books, including "Scotch Ale" (Brewer's Publications, 1993).

Scottish ales are recipe and temperature dependent rather than being heavily process dependent. They are defined by maltiness and residual sweetness with a little bit of roast character. So mash temperatures should be high, 154–155 °F (67–68 °C) or even up to 158 °F (70 °C), and fermentation temperatures should be kept low. Those are the critical techniques required by the style.

Scottish ales need to be fermented at cooler temperatures than English ales to achieve their classic, yeast-neutral flavor profile. The esters and higher alcohols produced by fermenting in the 70s (~20 °C and up) are antithetical to what defines the style. Diacetyl and a bit of fruitiness are perfectly acceptable, but the big ester profile of an English ESB is not.

The right temperature is pretty much dependent on the yeast strain employed, but it is always going to be below 68 °F (20 °C). A reasonable starting point would be pitching the yeast into 60 °F (16 °C) wort and keeping the temperature at or below 65 °F (18 °C) for at least the first 48 hours. The fermentation should finish out in 4–5 days. If the beer takes longer than five days to ferment the temperature is too cold for that strain, if it takes three or less it is too warm. Letting the temperature freely rise to room temperature after the yeast has passed its major ester-formation stage in the first 48 hours helps achieve a timely fermentation.

The grain bill is really important to nailing the style. It should be simple — classically it is nothing but pale malt and a dash of roast barley. If the recipe uses floor-malted Maris Otter or another moderately-modified barley as its base malt then only 1–2% roast barley is otherwise required to duplicate what's being poured in Scotland.

When the base malt is very well modified and produces relatively dry beers, brewers generally add a little caramel or crystal malt to give the beer a higher finish gravity. If the base malt will be an American or well-modified English malt, then the addition of 2–3% Crystal or 5–10% Carapils is necessary. The flavor contribution needs to be minimal for the beer to remain within the style characteristics. Caramel should never dominate the beer's flavor.

Web extra:

Read more tips about brewing Scottish ale from Greg Noonan at:
byo.com/departments/1776.html

Measuring Up

Avoiding oxidation and small brewery plans

"Help Me, Mr. Wizard"

by Ashton Lewis

Out of range

I've recently brewed 10 gallons (38 L) of an imperial IPA (Williams Brewing Kit Beer). I fully expected a high gravity beer, but I didn't know how high. When I went to take my OG, it was out of the readable range (up to 1.080) of my hydrometer. In the future, what would be the best thing for me to use to be able to get my OG? I'm not very familiar with refractometers (and I do not own one) and was wondering if this would be a worthwhile investment.

George Boras
Niantic, Connecticut

The easy thing to do here is to stick to lower gravity beers and you won't have to address this problem. But if you are like most homebrewers and craft brewers who don't find my humor funny, then my suggestion would be to purchase another hydrometer. Since hydrometers operate on a linear scale, the delineations of the scale are related to the range of the scale, for example 1.000 to 1.080, and the length of the hydrometer. You could have a short hydrometer with a wide range, but it would be difficult to read. Generally, longer hydrometers with smaller ranges are more accurate.

Most commercial brewers have hydrometer sets that cover the range of specific gravities encountered in the typical brewery. One common set has three hydrometers with ranges of 0–8 °Plato (~1.000–1.032 SG), 8–16 °Plato (~1.032–1.064 SG) and 16–24 °Plato (~1.064–1.096 SG). This covers the range from first wort collection through finished beer and the hydrometers are long enough to give an easy to read spindle with 0.1 °Plato resolution. I suggest asking your local homebrew supplier if they offer a range of hydrometers and if they do, then buy another hydrometer or two.

I like hydrometers because they are relatively inexpensive, durable when treated with respect and they do not require recalibration. They also measure density and that is the language of brewing. Refractometers work well for wort, but once fermentation begins alcohol affects light refraction and the data collected from a refractometer is not comparable to data collected from hydrometers. Personally, I do not believe a refractometer is a good investment for most brewers.

Another thing you could do is dilute your wort sample using volumetric flasks so that you have a true volumetric dilution. The math is not straightforward and you need to use an extract table. I won't clutter this answer with details because most brewers will probably not use this method. If you want to do this you perform a dilution and calculate the weight of extract in your sample after measuring the specific gravity or °Plato (both values are required for the calculation and if you know one you can calculate the other). Weight of extract equals specific gravity x °Plato x liters. If you know how much extract is in a diluted sample, then you can use a table to determine the specific gravity of your undiluted sample. At Springfield Brewing Company we routinely dilute wort after boiling with water to adjust specific gravity. Usually we dilute the wort by 1–2 °Plato. In order to do this we measure wort density and wort volume and do some simple number crunching with the aid of extract tables to accurately calculate dilution water volume.

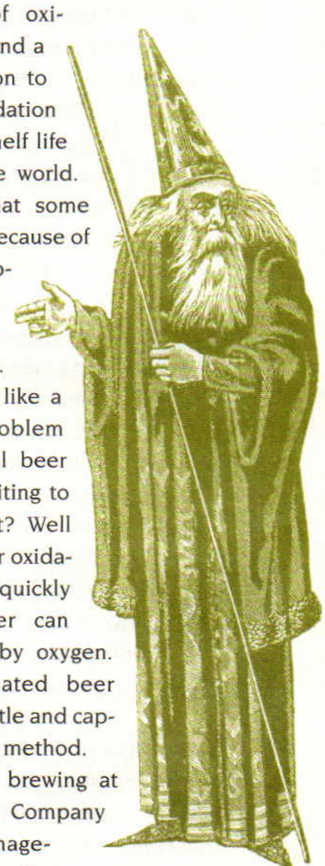
Of course the other option is to simply know that you have strong wort and to not sweat the details of knowing exact specific gravity. Happy brewing!

Counter-pressure proposal

What will happen if I just tap my force-carbonated beer into bottles and cap? Will the oxygen exposure really be that detrimental to the beer in the short term? I am contemplating using a counter-pressure bottle filler and wonder whether it is really required for the homebrewer. I know that counter-pressure bottle fillers purge the air from the bottle, replacing it with C02 and then reducing CO_2 loss during transfer, but the beer will still be exposed to air when capping. I see that oxygen-absorbing caps are available. Will these be effective in the removal of oxygen in the head of the bottle or are they just another gimmick? Do professional breweries use these types of caps?

Kary W. Robertson
Placerville, California

Kary, let me begin by stating for you and other readers that I absolutely despise oxidized beer. When I was a student at UC-Davis (located down the hill from Placerville), one of the things Dr. Michael Lewis instilled in his brewing students was a keen awareness of oxidized beer flavors and a vehement opposition to them. After all, oxidation is what limits the shelf life of most beer in the world. While it is true that some beers expire early because of microbiological problems, the real shelf-life issue in modern brewing is oxidation.



So this sounds like a big brewer problem because commercial beer sits on the shelf waiting to be purchased, right? Well the truth is that beer oxidation happens very quickly and excellent beer can quickly be ruined by oxygen. Dispensing carbonated beer from a keg into a bottle and capping it is not a good method. When I first began brewing at Springfield Brewing Company our restaurant management team at the time insisted that we sell growlers. I thought I hated growlers as much as any brewer back then, but my negative feelings swelled after dealing with them for a few months.

In the early days we would fill growlers the "traditional" way by hoisting one of these inelegant jugs up to the tap and filling it with beer until the foam was displaced and the whole jug was full of beer. This process is just a little bit wasteful! After filling, a screw cap is applied and the growler is hauled home for quick consumption. I don't know about other brewers, but I never was proud of the way my beer tasted from a growler because it was oxidized, even within a day or two of filling. Keep in mind my palate is biased to detect and dislike oxidized beer!

So we quickly began counter-pressure filling growlers to combat oxidation and also to have growlers pre-filled so that they were ready for sale. This helped a lot until one day we blew up a growler during the pressure cycle of filling. When I called the company who marketed the containers we were purchasing as "beer growlers" I learned that the containers were not rated for pressure. I guess the fact that beer is carbonated did not ring a bell with this company that pressure is associated with carbonation. In any case, we quickly discontinued using growlers and transitioned into normal beer bottled with crown caps.

For the record, there are growlers intended for pressure. I like the appearance and convenience of the large swing-top "siphons" from Germany, but these are comparatively expensive and I was looking for a reason to discontinue the use of growlers and was not in search of a suitable container. Growlers also have to be cleaned when brought in for refilling and this presents an entire separate set of logistical challenges for the pub brewery.

So once again we wanted to package beer in the best way possible to prolong the period over which our beer tasted fresh. And once again we were focused on minimizing oxygen in our packages. When beer is filled into a bottle there is indeed a gas space above the beer, but this gas space does not have to be air. If you could fill the beer in such a way to ensure an even gas space of carbon dioxide above the beer after capping, things would be great. Fortunately, this problem is easily solved by intentionally foaming or "fobbing" the beer after filling and before capping. By capping on foam there is no headspace for air to accumulate in and the foam collapses after filling and leaves a nice clean headspace of carbon dioxide. This method has been used for decades as an easy first line of defense against air pick-up at the filler.

Filler technology has progressed and today's modern fillers are amazing, both in terms of speed and performance. While no method totally eliminates oxygen from the package, modern filling technology comes pretty darn close. State-of-the-art filling technology today is synonymous with double, pre-evacuation fillers. These have been available for about twenty years now and work by pressurizing the bottle with carbon dioxide, evacuating the gas using a vacuum pump and then pressurizing once more prior to filling.

Once a system is in place to really minimize oxygen pick-up during filling the last measure of precaution is to attempt to mop up the small amount of oxygen that is introduced during filling. This is where the oxygen absorbing liners used on beer caps comes into play. These caps do work well, but they are not intended to make up for deficiencies in the method used to fill bottles. Rather they are used to make good filling practices using the latest filling technologies even better.

I can understand the desire to have bottles of beer because you can easily transport them. Your method begins with kegged beer. I suggest leaving your beer in the keg. Kegs can be purged prior to filling and are excellent packages. If you really want to take some beer from your keg to another location and do not want to get into counter-pressure filling, wait until the last minute to move your beer from keg to bottle. You can use a flexible hose to connect the tap on your keg to a long fill-tube (preferably made from stainless steel or a small diameter beer line). If you fill from the bottom of the bottle and control foaming by lowering your keg pressure by a few pounds during this process this method will work well as long as you consume the beer shortly after filling.

Equipment advice

Every time I see BYO's "Homebrew Systems that make you Drool," I think "that's nice, but they're still brewing in the garage/basement." I don't need to make more than five gallons (19 L) at a time, and I don't want an ever-present brewery look to my garage/basement. The homebrew system that would make me drool would be one that offers a convenient temperature controlled environment where all of my equipment is easily accessible without the industrial brewery appearance.

Enter my basement project. I am planning a dedicated area of my basement that is brewing friendly. I don't mean an unfinished area that has been turned into a small brewery but rather a "brewery kitchenette" as part of the finished space. The only thing that stands in my way between cooking inside instead of outside is the need for an adequate indoor heat source and proper ventilation. I have found a natural gas stock pot range capable of boiling 6+ gallons (87+ L) that should foot the bill, but making it fit in may be difficult (it is only two feet tall). I would also need a vent hood capable of moving a significant amount of air/steam, not unlike that which you would see in a commercial kitchen. I would like to incorporate these items amongst a fridge, sink, finished cabinets and quartz countertop. Then when my brewday is done my equipment can be conveniently tucked away on site (and out of sight). The "brewery kitchenette" would also function as a basement wet bar for entertaining. Does this sound crazy?

Ty Harrison
Chaska, Minnesota

I don't think this idea is crazy at all. In fact, I bet that most homebrewers do not want to turn their garages or basements into small breweries that prevent any other use of these valuable spaces. I must admit that when I see some of the photos in the "Systems that make you Drool" I often wonder how much money some of these systems cost and what happens to all the beer brewed using some of the larger systems!

Your question is part system design and part architectural design. I don't do architecture but I do design process systems as part of my job (Springfield Brewing Company is owned by Paul Mueller Company, a major supplier of stainless steel equipment). When I am approached by one of our customers regarding a new process system, the first thing that I do is to attempt to clearly understand what the equipment is expected to do. Equipment is a tool and when you buy a tool you usually have a reason for buying it. One of those giant "hot saws" that can zip through a 24" diameter log in a couple of seconds might make you drool like a St. Bernard, but when you go to buy a chainsaw intended to turn trees into firewood a hot saw is probably not a very good fit.

I cannot tell you what is the right tool for your brewing, but I will make some suggestions based upon my current views on brewing. I will assume you are brewing all-grain. There are several techniques that are used for mashing and they all have their merits. I suggest keeping things simple at home and that means using the infusion mash method. Forget about stirred and heat mashes, decoction mashing and double mashing. With today's well-modified and highly enzymatic malt you really can do a lot with the infusion mash method.

This choice simplifies the tool; now all you need is to build an infusion mash tun if you don't already have one. Two designs I really like are the time-tested double bucket "Zapap" unit described by Charlie Papazian. The one thing I would add to his original design is some insulation around the outer bucket as well as an insulated lid. The other design I really like is the one that uses a cooler and copper manifold. In the last issue of BYO (July-August 2008) Forrest Whitesides described how to build one of these babies in his "Projects" column.

You don't need to build a giant, expensive unit out of stainless steel to have a good infusion mash tun. You just need something that will maintain a reasonably constant temperature (i.e., something that is insulated) and has a mechanism to separate wort from spent grains. You don't even really need to have a fancy sparge setup as long as you keep a layer of water on top of the grain bed during wort collection.

If you brew 5-gallon (19-L) batches your mash tun should hold at least 4 gallons (14 L) of mash (you'll need more capacity if you like to brew really big beers). These types of mash tuns can simply be placed on top of the countertop. A step stool or a bar stool can be used to hold the container(s) used to collect wort. Your goal is to keep things on the small side and to use multi-functional utensils. Beer pitchers work great for wort collection and are small enough to make the transfer of wort into the brew kettle easy.

The kettle is really the most important part of the homebrew brewhouse. You need a kettle large enough to suit your brewing needs. I prefer boiling the entire wort volume and I like the idea of having a commercial-quality gas burner designed into your countertop that is large enough to suit your needs. If this thing is only two feet tall you could have the structure of your cabinet frame designed to support the burner and to have it level with the countertop. A vent hood is certainly a nice thing to have to remove steam vapors and exhaust from the gas burner. This is when an architect or a kitchen designer comes into play. Make sure your installation conforms with local building codes.

If there is an expensive, special item in your basement brewery/bar set-up, then use it for as many tasks as possible. Mash water and sparge water can both be heated with this unit. If you are willing to add a few minutes to your brew day you don't have to start heating the wort in preparation for boiling during wort collection. Use your burner for sparge water and keep your kettle that is being filled off to the side.

After you are done with sparging, then move the kettle onto the burner. If your kettle has a spigot in the side (something that is really recommended for convenience and safety) you can stir the wort to spin it in the kettle like a whirlpool. After the wort stops spinning and hop solids and trub have settled in the center of the kettle, move the wort from the kettle. (See page 12 for more information about whirlpooling.)

The last specialized item I would incorporate into your set-up is a compact and efficient wort chiller. If you want something small and tidy, a counter-flow chiller is going to take up far less space than an immersion chiller. These chillers are more expensive than immersion chillers, but they are more efficient (and therefore smaller) and they don't interfere with the whirlpool process.

Cool musings from the field

I recently took a two-day class from University of Idaho Extension at their Food Technology Center in Caldwell, Idaho. The title of the class was "Farmstead & Artisan Cheese Making" and it was an extremely interesting class — especially for a brewer who is also a food geek.

If you are looking for something else to make at home to complement your homebrewing hobby, I think that cheesemaking is a great fit. The topics of microbiology and enzymology are just as important to cheesemaking as they are to brewing. Plus, cheese goes great with beer! You can also buy starter cultures and enzymes from many homebrew suppliers.

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," available online at brewyourownstore.com.
Do you have a homebrewing question for Ashton? Send inquiries to *Brew Your Own*, 5515 Main Street, 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!

Dry Stout

Dark, roasty and easy-drinking

by Jamil Zainasheff

Several months ago I was enjoying an evening out at a local brew pub with several non-beer geek friends. One friend asked me what I would recommend from the pub's beer list. I began describing the various beers and what they might expect from each. And then it happened again. When I began to describe the pub's award-winning dry stout, he said, "Oh I don't like dark beers. They are too thick and have too much alcohol." Then another person chimed in, "I want something with a lot of flavor, but not so much alcohol."

Argh! I find it frustrating when people speak of all stouts as if they were the equivalent of used motor oil with enough alcohol to launch a rocket. Not all stouts are big and heavy and misconceptions keep a lot of people from trying some wonderful beers. While some stout substyles do have significant levels of alcohol and can be full-bodied, dry stout is usually a lower alcohol beer, with a dry finish and light body that makes it easy to consume. It is a great choice when you want to have a few flavorful beers without being overwhelmed by alcohol.

Photo by Charles A. Parker

DRY STOUT by the numbers

OG:	1.036–1.050 (9.1–12.4 °P)
FG:	1.007–1.011 (1.8–2.8 °P)
SRM:	25–40
IBU:	30–45
ABV:	4.0–5.0%

Dry stout is a very dark, roasty, bitter, and sometimes creamy ale. The commercial example most people know is Guinness Draught (4.1 to 4.3% ABV). It is a fine example of the style, right in the middle of the road as compared to some other commonly available dry stouts, such as Murphy's (4 % ABV) and Beamish (4.1% ABV). Like all dry stouts, Guinness Draught is a fairly low gravity, low alcohol, and low body beer with a relatively high level of hop bittering. It is dry and bitter, but easy to drink by the pint because of its dryness, low alcohol and low carbonation.

Guinness starts with an aroma full of coffee and chocolate. The ester levels are fairly low, with some fruity/grape notes. The flavor is rich with coffee, chocolate, and a touch of pear/grape fruit esters. Overall, it is far more bitter than Murphy's. The finish is sharp and dry with a long coffee and bittersweet chocolate finish.

Murphy's is less roasty than Guinness and is sweeter. The aroma is much fruitier than either Guinness or Beamish, with apples and pears mixed in with moderate coffee notes. The flavor, like all good dry stouts, starts with coffee. It continues with a little bit of cocoa and more fruity esters.

Beamish is my favorite of the big three. It has a touch more acrid roast character than Guinness, almost to the point where it is biting. Guinness is less acrid, chocolatier. Beamish has minimal fruity esters, slightly more than Guinness, but less than Murphy's. It also has something in the flavor and aroma that neither Guinness nor Murphy's display — hops. The floral hop character is moderate and is obvious alongside the coffee, chocolate and slight fruitiness. While Beamish has more roast notes than Guinness and slightly more sweetness up front, in the end it has a drier finish.

Much has been made of Guinness sourness or Guinness "twang." It is said that Guinness adds a portion of soured beer back to achieve that balance. To my

Continued on page 21

RECIPE

Guinness-Style Dry Stout
(5 gallons/19 L, all-grain)

OG = 1.041 (10.3°P)
FG = 1.010 (2.6°P)
IBU = 41 SRM = 44 ABV = 4.1%

Ingredients

6.25 lb. (2.83 kg) Crisp British pale ale malt or similar Maris Otter malt
1.75 lb. (794 g) Great Western flaked barley
14.0 oz. (397 g) Great Western roasted barley (500 °L) (crushed to powder)
8.35 AAU Kent Golding pellet hops (1.67 oz./47 g at 5% alpha acid) (60 min.)
White Labs WLP004 (Irish Ale), Wyeast 1084 (Irish Ale) or Fermentis Safale US-05 yeast

Step by Step

Crush the roasted barley very fine. Run it through a coffee mill or use a rolling pin to turn it almost to dust. That is critical to getting the right flavor and color with this recipe. Mill the remaining grains as normal and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 120 °F (49 °C). Hold the mash at 120 °F (49 °C) for 15 minutes then raise the temperature to 150 °F (66 °C) until enzymatic conversion is complete. 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 (24.4 L) and the gravity is 1.032 (8.1 °P).

The total wort boil time is 90 minutes. Add the bittering hops

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with 60 minutes remaining in the boil. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort rapidly to 65 °F (18 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate.

Ferment at 65 °F (18 °C). Slowly raise the temperature during the final ⅓ of fermentation by 6 °F (3 °C) to reduce diacetyl levels in the beer. When finished, carbonate the beer to approximately 1 to 1.5 volumes and serve at 52 to 55 °F (11 to 13 °C).

Extract with Grains Option
Replace the British pale ale malt and flaked barley with 5.25 lb. (2.38 kg) Muntons pale ale liquid malt extract.

Partial Mash Option
The recipe becomes 1 lb. (0.45 kg) British pale ale malt, 1.75 lb. (794 g) flaked barley, 14 oz. (397 g) roasted barley, and 3.5 lb. (1.58 kg) Muntons pale ale liquid malt extract. Place the crushed grains and flaked barley in a steeping bag. Heat 5 quarts (~ 5 L) to 160 °F (71 °C), add grain bag, and let steep for approximately one hour. Rinse out the grains and proceed as normal, adding the extract and water to the steeping liquour.

Beamish-Style Dry Stout
(5 gallons/19 L, all-grain)

OG = 1.041 (10.2 °P)
FG = 1.009 (2.4 °P)
IBU = 40 SRM = 50 ABV = 4.1%

Ingredients
6.0 lb. (2.72 kg) Crisp British pale ale malt or similar malt made from Maris Otter
1.75 lb. (794 g) Great Western flaked barley
17.0 oz. (482 g) Great Western roasted barley (500 °L) (crushed)
7.6 AAU Challenger pellet hops (0.95 oz./27 g at 8% alpha acids) (60 min.)
2.5 AAU Kent Golding pellet hops (0.5 oz./14 g at 5% alpha acids) (15 min.)
White Labs WLP004 (Irish Ale), Wyeast 1084 (Irish Ale) or Fermentis Safale US-05 yeast

Step by Step
Crush the roasted barley very fine. Run it through a coffee mill or use a rolling pin to turn it almost to dust. That is critical to getting the right flavor and color with this recipe. Mill the remaining grains as normal and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 120 °F (49 °C). Hold the mash at 120 °F (49 °C) for 15 minutes then raise the temperature to 148 °F (64 °C) until enzymatic conversion is complete. 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 (24.4 L) and the gravity is 1.032 (8 °P).

The total wort boil time is 90 minutes. Add the bittering hops with 60 minutes remaining in the boil. Add Irish moss or other kettle finings and the last hop addition with 15 minutes left in the boil. Chill the wort rapidly to 69 °F (21 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly.

Ferment at 69 °F (21 °C). Slowly raise the temperature during the final ⅓ of fermentation by 6 °F (3 °C) to reduce diacetyl levels in the beer. When finished, carbonate the beer to approximately 1 to 1.5 volumes and serve at 52 to 55 °F (11 to 13 °C).

Murphy's-Style Dry Stout
(5 gallons/19 L, all-grain)

OG = 1.040 (10 °P)
FG = 1.010 (2.5 °P)
IBU = 38 SRM = 33 ABV = 4%

Ingredients
6.0 lb. (2.72 kg) British pale ale malt
1.75 lb. (794 g) flaked barley
14.0 oz. (397 g) roasted barley (500 °L)
7.75AAU Kent Golding pellet hops (1.55 oz./44 g at 5% alpha acids) (60 min.)
White Labs WLP007 (Dry English), Wyeast 1098 (British Ale) or Danstar Nottingham yeast

Step by Step
I use Crisp Malting's British Pale Ale malt (made from Maris Otter) as my base grain, but other malts of a similar nature should work well. The roasted barley and flaked barley I use is from Great Western Malting Co. Feel free to substitute any high quality product of a similar flavor and color from a different supplier. My hops are in pellet form and come from Hopunion.

In this recipe the roasted barley is milled normally along with the other grains. Dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 152 °F (67 °C). Hold the mash at 152 °F (67 °C) until enzymatic conversion is complete. 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 (24.4 L) and the gravity is 1.031 (7.8 °P).

The total wort boil time is 90 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 rapidly to 69 °F (21 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly.

Ferment at 69 °F (21 °C). Slowly raise the temperature during the final ⅓ of fermentation by 6 °F (3 °C) to reduce diacetyl levels in the beer. When finished, carbonate the beer to approximately 1 to 1.5 volumes and serve at 52 to 55 °F (11 to 13 °C).

palate, Beamish has as much "twang" as Guinness and reportedly they don't add soured beer. I prefer to skip any sort of sour beer, sour wort, or acid malt addition. If you feel the beer you're making needs something sour, you can experiment with those methods.

The roasted character of this style comes primarily from highly kilned, unmalted barley. There is conflicting information out there about the flavor difference between roasted malt and roasted barley, with some sources saying there is no difference and others saying that roasted malt provides more coffee-like character, but it is more acrid too. The difference is reportedly because the malted grain forms far more melanoidins when kilned. I've always been in the camp that believes there is a difference between the two, and when making a dry beer, it is best to avoid the more acrid roasted malt and use only roasted barley.

Optionally, a touch of a lighter roasted malt, such as chocolate (350–450 °L) can add a nice complexity to the roast character (more nutty/chocolate). The combination of dark malts in this style should add up to around 10% of the grist, give or take a couple points. While caramel malts are appropriate for some of the bigger stout styles, especially those with a sweeter finish, it is a mistake to include large amounts of caramel malt in a dry stout recipe. Caramel malts add non-fermentable sugar and caramel flavor, which negatively affect the dryness of the beer. If you're trying to make a sweeter version, similar to Murphy's, then perhaps a tiny bit of crystal malt is acceptable. You can also increase the perception of sweetness by reducing the amount of highly kilned grain,

"Dry stout generally has a light body — some would say medium light."

reducing hop bitterness, or by using a less attenuative yeast.

There is also some debate over the role of unmalted barley in dry stout, with one side saying it is important to the mouthfeel of the beer and the other saying it is used by the breweries for cost efficiency only. If you're an all-grain brewer, it is simple enough to use flaked unmalted barley for a portion of your grist. If you're an extract brewer, you can skip the flaked barley, otherwise you should convert it via a partial mash.

I prefer British pale ale malt as the base for dry stout. It provides a nice background biscuit-like malt character. British pale ale malt is kilned a bit 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. If you're brewing with extract, your best choice is an extract made from British pale ale malt. Look for products labeled English pale, Maris Otter, or British-style malt extract.

Dry stout generally has a light body, some would say medium-light. Commercial breweries use all sorts of mash schedules, with the goal of converting the flaked barley and making a fermentable wort. You might hold the mash for a beta glucan rest, then a protein rest, and finally a saccharification rest when making a dry stout. I often combine the beta glucan rest and the protein rest at a temperature of 120 °F (49 °C) to simplify things. If you prefer a single infusion mash, a temperature around 150 °F (65 °C) strikes the proper balance between fermentable and non-fermentable sugars. I've read that Beamish uses a rest temperature of 143 °F (62 °C), so it seems that there is leeway for the saccharification rest. For extract brewers, most light colored extracts will get you fairly close. If not, you can make your extract-based wort more fermentable by replacing a portion of your extract with table or corn sugar or by doing a partial mash with some two-row malt and your extract.

Some brewers report various problems with the mash when making dry stout. One thing to keep an eye on is the mash pH as the dark grains can push the mash below 5.2 pH. If your water is low in alkalinity, you might need to tweak your water chemistry a bit to deal with the acidity of the dark malt. Adding a small amount of calcium carbonate and sodium bicarbonate to the mash to correct the pH is all it takes. Don't try to replicate the water of Dublin or anything like that. In more locations than not, the water you have is fine for brewing dry stout.

Another common issue is the recirculation or runoff of the mash. Unmalted, flaked barley can be gummy (especially if you do not perform a beta glucan rest). To make matters worse, when a grain is highly kilned, it becomes brittle and when milled it produces a much higher percentage of flour and stuck mashes.

A good friend of mine believes in cold steeping his roasted malt. He adds the crushed malt to cold water the day prior and then adds the roasty liquor to the boil kettle as needed. He tells me that this method reduces any roasted grain harshness. Personally, I've not had a harshness issue, but this might be a useful tool in your arsenal if you wish to give it a try.

It is the highly kilned grain along with substantial hop bitterness that enhances the dry finish of this style. Target a bitterness-to-starting gravity ratio (IBU divided by OG) between 0.9 and 1.1. Normally, a single addition at 60 minutes is all you need. If you want a beer with some hop character, along the lines of Beamish, then a moderate later addition, say ½ ounce (14 g) around 20 minutes or later is appropriate. Hop choice for bittering and flavor is fairly flexible. Kent Goldings, Fuggle, Challenger, Target, Perle, Magnum all work well. Don't use any citrusy or catty American-type hops.

Two great yeasts for brewing this style are White Labs WLP004 Irish Ale and Wyeast 1084 Irish Ale. Irish ale yeast provides the right low-ester profile but is only moderately attenuative. You'll need to pitch the proper amount of clean, healthy yeast and keep a close eye on fermentation temperatures to ensure good attenuation. As an alternative, you can use a neutral ale yeast with higher attenuation, such as White Labs WLP001 California Ale, Wyeast 1056 American Ale or Fermentis Safale US-05 with acceptable results. For a more fruity interpretation, similar to Murphy's, ferment warmer with the Irish ale yeast or switch to an English-style ale yeast. White Labs WLP007 Dry English or Wyeast 1098 British Ale work well. Some commercial breweries have been known to use lager yeasts for some stout styles. Whatever you use, pick a yeast that will finish dry enough for the style.

The final step in brewing a great example of this style is proper carbonation. Too much CO_2 can make smaller beers seem thin and harsh. Carbonation of 1 to 1.5 volumes and a serving temperature of 52 to 55 °F (11 to 13 °C) is ideal. If you really want to go stout crazy, you can serve your dry stout with beer gas (a nitrogen/CO_2 mix) on a stout faucet. (For more information about nitrogenating beer, read "The Nitrogen Effect," in the May 1999 issue of BYO or "Achieving Nitro Nirvana" in the January-February 2005 issue.)

Jamil Zainasheff is the author of "Brewing Classic Styles" (Brewer's Publications, 2008). He writes "Style Profile" for every issue of BYO.

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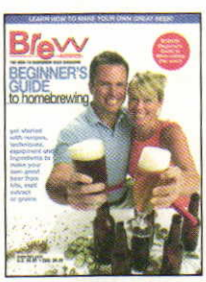

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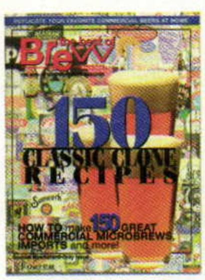

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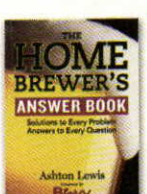

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DEBITTERED black MALT

SOMETIMES LESS IS MORE

When it comes to their beers, homebrewers generally like more — more malt, more hops, more flavor. But sometimes, when it comes to beer ingredients, less is more. Debittered black malt is black malt with most of the husk removed prior to kilning. Less husk material means that it imparts less of the dark-grain bitterness and astringency of regular dark-roasted malts. And for some beer styles, less of a dark malt "edge" means a more satisfying brew.

by **Kristen England**

In three recent issues of *BYO*, I have discussed three major types of darkly-roasted grains used in brewing — chocolate malt, roasted barley and black malt. Each of these types of malts is available from many different maltsters and each often comes in different forms. For example, there are pale chocolate malts (often in the 200 °L range) in addition to "regular" choco malts. In addition, roasted barley comes in two common forms — one around 300 °L and another at 500 °L or higher. Black malt also comes in different forms, including a "dehusked" version called debittered black malt.

A vast number of brewers, not just homebrewers, haven't even heard of the stuff so don't feel bad if you are in that number. Originally coming from Germany, this malt is used the world over. But how is debittered black malt different from "regular" black malt you ask? Debittered black malt has some unusual characteristics that black malt doesn't possess. Actually, it not so much possesses different characteristics as lacks them.

A good part of the character of the roasted grain is supplied by the husk. Specifically, the husk is what provides nearly all the astringency and bitterness, and when it is darkly roasted, this character increases many times. Black malt has a lot of uses in brewing. (For examples, read my November 2007 BYO article on this malt.) However, there are a lot of beers out there that can use some tasty dark character without the drying bitterness that comes with most darkly-roasted malts. So how would we get the dark character we do want without the bits we don't want? The easiest way is to use a malt from which that husk has been removed (or reduced) from the barley. In debittered black malt, the husk has been worn down substantially prior to kilning.

Weyermann Specialty Malting Company of Bamberg probably sells more debittered black malt than anyone else on the planet. Their labels, Carafa® Special I, II and III, have color ratings around 320 °L, 400 °L and 525 °L respectively. The flavors of Carafa® Special I , II and II go from chocolate to black malt as you increase from more lightly to more darkly roasted. Weyermann also sells "plain" (husked) versions of these malts, which they call Carafa® I, II and III (no "Special").

"Weyermann describes the process of dehusking as akin to rice polishing [...] as the grain is worn down from the outside in."

All Carafa® malts are made from German-grown 2-row spring barley and Weyermann describes the process of dehusking as akin to rice polishing — making brown rice into white rice — as the grain is worn down from the outside in. They do make a note of leaving about 40% of the husk intact. After much experience and research, it was found that leaving any less husk would allow the kernel to be damaged during kilning.

Dingemans malting also produces a debittered black malt. Malted from Prestige barley (a European 2-row variety), their malt is rated at 525–600 °L.

Liquid Debittered Black Malt

Debittered black malt also comes in liquid form. As you no doubt recall, the German Reinheitsgebot did not allow anything other than malt, hops, yeast and water in German beers. If German brewers wanted to adjust the color of a finished beer, and remain in compliance with

Debittered black malt gives these commercial beers a deep color and roast character without contributing the bitterness and astringency of "regular" black malt. Debittered black malt can be substituted for "regular" black malt in any recipe for which you wish to decrease the "edge" that comes with darkly roasted malts.

the Reinheitsgebot, they couldn't have just added caramel color, as brewers around the rest of the world commonly do. They would have needed to use malt, or something derived from malt.

So, in 1903, Weyermann began making an extract of their dehusked malt. This product was called SINAMAR®, a name derived from the Latin *sine amaro* (without bitterness), and is a jet black liquid used for color adjustment. (It's actually fermented, so it's a beer.) It's color rating is around 3,000 to 3,200 °L, so it only takes a little to change a beer's color substantially.

How much, exactly, do I need to add? It's simple. To raise the color of 5.0 gallons (19 L) of beer by 1 SRM, you will need to add approximately 5 g (0.17 oz.) of SINAMAR®. For example, if you wanted to add 20 SRM you would need 20 x 5 g = 100 g (3.5 oz.) of SINAMAR®.

(For more on SINAMAR® and the uses of liquid malt color extracts, see Horst Dornbusch's article on it in the May-June 2005 issue of *BYO*.) Briess also makes a malt coloring agent called Maltoferm. This product, available as a liquid or powder, is a malt extract made from their "regular" black malt.

When to Debitter

Debittered black malt is most popular in German-style beers, where it adds color to bocks, Munich dunkels and other dark lagers. In these beers, a dark color — and in some cases, a roasty flavor — is desired, but the bitterness and astringency from a darkly-roasted, husked malt would be detracting. If there is a style of beer that screams for the use of debittered black malt, it is schwarzbier. In this beer, a dark color is desired, but little or no roast flavor and certainly no dark grain astringency. (See the May-June 2007 issue for more on schwarzbiers.)

Some brewers may also wish to smooth out certain English-style dark beers, such as brown ales, porters or stouts, by substituting a debittered black malt for the regular black malt. But before you run to your recipe book and write "debittered" in front of every instance of black malt, keep in mind that a little husky bitterness and astringency is a good thing in certain beers. Finally, there's no reason that you couldn't combine black malt and debittered black malt, in a recipe that called for one or the other, to add a little complexity to the brew.

Recipes

Debittered black malt is most popular in Germany, and two of the four clone beer recipes in the recipe section are from Germany — Ettal Curator Doppelbock and Schneider Aventinus, a weizenbock. Since *BYO* recently published an article on schwarzbiers, I skipped that style and picked a couple beers that homebrewers might not think about when they think about debittered black malt — Dragon Stout from Jamaica and St. Bernardus Abt 12, the 60th Anniversary version. Enjoy!

Kristen England is the Continuing Education Director for the Beer Judge Certification Program (BJCP). He has also written about chocolate malt, black malt and roasted barley.

Dragon Stout clone

(5 gallons/ 19 L, all-grain)
OG = 1.075
FG = 1.016
IBU = 35
SRM = 74
ABV = 7.5%

Jet black, yet showing little evidence of roast character . . . more like brown sugar like sweetness.

Ingredients

12 lbs. (5.4 kg) pale malt (6-row)
14 oz. (0.40 kg) crystal malt (75 °L)
0.75 lbs. (0.34 kg) Simpsons debittered black malt
1.75 lbs. (0.79 kg) corn sugar
2.0 oz. (57 g) SINAMAR®
11 AAU Yakima Magnum hops (60 min.) (0.67 oz./YY g of 16% alpha acids)
Wyeast 2112 (California Lager) yeast

Step by Step

Mash grains at 153 °F (67 °C) for 60 minutes. Boil wort for 120 minutes, adding hops with 60 minutes left in boil. Add sugar for final 15 minutes. Ferment at 70 °F (21 °C). Condition at 58 °F (14 °C) for 2 weeks. Add SINAMAR® when kegging or bottling. (Use 0.75 cups corn sugar for priming.)

Dragon Stout clone

(5 gallons/19 L, extract with grains)
OG = 1.077 FG = 1.016
IBU = 35 SRM = 74 ABV = 7.7%

Ingredients

5 oz. (0.14 kg) pale malt (6-row)
14 oz. (0.40 kg) crystal malt (75 °L)
0.75 lbs. (0.34 kg) Simpsons debittered black malt
1.75 lbs. (0.79 kg) corn sugar
2.0 lbs. (0.91 kg) Briess Light dried malt extract
5.5 lbs. (2.5 kg) Briess Light liquid malt extract (late addition)
2.0 oz. (57 g) SINAMAR®
11 AAU Yakima Magnum hops (60 min.) (0.67 oz./YY g of 16% alpha acids)
Wyeast 2112 (California Lager) yeast

Step by Step

Place crushed grains in a nylon steeping bag. In a large kitchen pot, steep grains in 3.0 qts. (2.8 L) of water at 153 °F (67 °C) for 45 minutes. While steeping, begin heating 2.0 gallons (7.6 L) of water to a boil. After steep, place bag in colander over brewpot. Pour "grain tea" through bag (to strain out "floaties"), then rinse bag with 1.5 qts. (~1.5 L) of 170 °F (77 °C) water. Bring brewpot to a boil, then stir in dried malt extract. Add hops and boil wort for 60 minutes. Stir in liquid malt extract for final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) and aerate well. Pitch yeast and ferment at 70 °F (21° C). Condition at 58 °F (14 °C) for 2 weeks.

Klosterbrauerei Ettaler Curator clone

(5 gallons/19 L, all-grain)
OG = 1.086 FG = 1.022
IBU = 56 SRM = 37 ABV = 8.3%

This doppelbock is much darker tasting than others, with massive aromas and flavors of fruitcake, port, figs and raisins. Although extremely rich and thick, this beer is readily drinkable which poses a dilemma after a liter or so. There seem to be a lot of German bierkellars that have tilted, uneven floors!

Ingredients

- 14 lb. 4 oz. (6.5 kg) Munich malt (20 °L)
- 4 lb. 12 oz. (2.2 kg) Munich malt (10 °L)
- 11 oz. (0.31 kg) Carafa® Special III malt
- 14 AAU Yakima Magnum hops (120 min.) (0.88 oz./25 g of 16% alpha acids)
- White Labs WLP833 (German Bock) yeast
- 0.75 cups corn sugar (for priming)

Step by Step

This is a three mash system. Mash in cold with 2–2.5 qt./lb. (4.2–5.2 L/kg) water. Bring up to 95 °F (35 °C) with direct heat. Pull a third of the mash, boil for 30 minutes. Add back to main mash to bring temperature up to 131 °F (55 °C). Repeat the decoction. Add back to main mash, which should be at 146 °F (63 °C). Repeat decoction, boil longer than first two decoctions. Add back to main mash to raise temperature to 166 °F (74 °C). Let stand a few minutes then move on to lautering and sparge.

"Debittered black malt is most popular in German-style beers, where it adds color to bocks, Munich dunkels and other dark lagers."

Wort boil time is 120 minutes. Ferment at 50 °F (10 °C). Lager at 30 °F (-1.1 °C) for four to five months.

Klosterbrauerei Ettaler Curator clone

(5 gallons/19 L, countertop partial mash)

OG = 1.086 FG = 1.022
IBU = 56 ABV = 8.3%

Most Munich malt extracts are a made from a mixture of pale malt and Munich malt, so this clone may not be quite as malty as the original.

Ingredients

3 lb. 5 oz. (1.5 kg) Munich malt (20 °L)
11 oz. (0.31 kg) Carafa® Special III malt
10 lbs. (4.5 kg) Munich liquid malt extract
16 AAU Yakima Magnum hops (60 min.) (1.0 oz./28 g of 16% alpha acids)
White Labs WLP833 (German Bock) yeast
0.75 cups corn sugar (for priming)

Step by Step

Put crushed grains in a large nylon steeping bag. Heat 5.5 qts. (5.2 L) of water to 163 °F (73 °C) and pour into your 2.0-gallon (7.6-L) cooler. Slowly submerge grain bag, then open the bag and use a large brewing spoon to ensure that grain mixes completely with the water. Let mash rest, starting at 152 °F (67 °C) for 45 minutes. While mash is resting, heat 0.75 gallons (2.8 L) of water to 152 °F (67 °C) in your brewpot. Also heat 5.5 qts. (5.2 L) of water to 180 °F (82 °C) in a large kitchen pot.

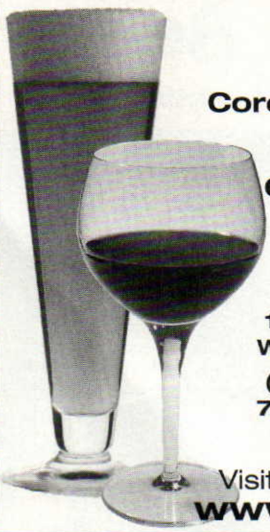
Recirculate your partial mash wort by drawing off a pint or two of wort from the cooler and returning it to the top of the mash. Repeat until wort is clear or 3 quarts (~3 L) have been recirculated. Next, run off entire first wort and add to the hot wort in your kettle. Stir 180 °F (82 °C) water into grains in cooler until liquid level is the same as during the first mash. Let rest for 5 minutes, then recirculate and run off wort as before. Bring wort to a boil, then turn off heat and stir in roughly a third of the liquid malt extract. Resume heating, add bittering hops and boil for 60 minutes. Stir in remaining liquid malt extract with 15 minutes left in boil.

After the boil, put a lid on your brewpot and cool the wort (either in a cold-water bath in your sink or with a wort chiller). Cool until the side of the brewpot no longer feels warm. Rack cool wort to fermenter and top up to 5 gallons (19 L) with cool water. Aerate and pitch yeast. Ferment at 50 °F (10 °C). Lager in secondary at 30 °F (-1.1 °C) for 4–5 months.

Schneider Aventinus clone

(5 gallons/19 L, all-grain)

OG = 1.073 FG = 1.018



IBU = 10 SRM = 21 ABV = 7.1%

This beer is basically a wheat doppelbock, made to compete with the true doppelbocks. It features notes of raisins, plums, bananas, cloves and a touch of chocolate. A decoction mash and extended boil are really needed to bring out the dark malt and caramel flavors. I've always wondered what Johannes Aventinus's problem was. If you stuck my mug on the label of this beer, I wouldn't be frowning!

Ingredients

8.75 lbs. (4.0 kg) wheat malt
4 lb. 6 oz. (2.0 kg) Pilsener malt
1.5 lbs. (0.68 kg) CaraMunich® malt
0.33 lbs. (0.15 kg) Carafa® Special I malt
3 AAU Hallertau Hersbrucker hops (60 mins) (0.75 oz./21 g of 4% alpha acids)
Wyeast 3068 (Weihenstephan Weizen) yeast
1.25 cups corn sugar (for priming)

Step by Step

Employ a triple decoction mash. Mash in cold with 2–2.5 qt./lb. (4.2–5.2 L/kg) water. Bring up to 95 °F (35 °C) with direct heat. Pull a third of the mash, boil for 30 minutes. Add back to main mash to bring temperature up to 131 °F (55 °C). Repeat the decoction. Add back to main mash, which should be at 146 °F (63 °C). Repeat decoction, boil for 45 minutes to an hour. Add back to main mash to raise temperature to 166 °F (74 °C). Let stand a few minutes then move on to lautering and sparge. Wort boil time is 60 minutes. Ferment at 60 °F (16 °C). Condition in secondary for three to four weeks at 42 °F (5.6 °C).

"[...] there's no reason that you couldn't combine black malt and debittered black malt, in a recipe that called for one or the other, to add a little complexity to the brew."

Schneider Aventinus clone

(5 gallons/19 L, extract with grains)

OG = 1.073 FG = 1.018
IBU = 10 SRM = 21 ABV = 7.1%

Ingredients

- 2.0 oz. (57 g) wheat malt
- 1.0 oz. (28 g) Pilsener malt
- 1.5 lbs. (0.68 kg) CaraMunich® malt
- 0.33 lbs. (0.15 kg) Carafa® Special I malt
- 3.0 lbs. (1.4 kg) dried wheat malt extract
- 5.5 lbs. (2.5 kg) liquid wheat malt extract (late addition)
- 3 AAU Hallertau Hersbrucker hops (60 mins) (0.75 oz./21 g of 4% alpha acids)
- Wyeast 3068 (Weihenstephan Weizen) yeast
- 1.25 cups corn sugar (for priming)

Step by Step

Place crushed grains in a nylon steeping bag. In a large kitchen pot, steep grains in 3.0 qts. (2.8 L) of water at 152 °F (67 °C) for 45 minutes. While steeping, begin heating 2.0 gallons (7.6 L) of water to a boil in your brewpot. After steep, place bag in colander over brewpot. Pour "grain tea" through bag , then rinse bag with 1.5 qts. (~1.5 L) of 170 °F water. Bring brewpot to a boil, then stir in dried malt extract. Add hops and boil wort for 60 minutes. Stir in liquid malt extract with 15 minutes left in boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) and aerate well. Ferment at 60 °F (16 °C) and condition beer for three to four weeks at 42 °F (5.6 °C).

St. Bernardus Abt 12 60th Anniversary Edition clone

(5 gallons/19 L, all-grain)

OG = 1.103 FG = 1.017
IBU = 15 SRM = 37 ABV = 11%

This particular recipe is for their 60th anniversary edition, which is closer to their original recipe. Although probably not authentic, I find that using the debittered black malt will give you a much smoother product. Also, it's reported that St. Bernardus uses a different bottling strain than the fermentation strain so I find that using Westmalle's yeast gives me as good as I can get.

Ingredients

- 10 lbs. (4.5 kg) Pilsener malt
- 3.0 lbs. (1.4 kg) Munich malt (10 °L)
- 1.0 lbs. (0.45 kg) aromatic malt
- 0.5 lbs. (0.23 kg) Carafa® Special III malt
- 3.0 lbs. (1.4 kg) Belgian candi syrup (Dark 2) (15 min.)
- 1.0 lb. (0.45 kg) beet sugar (15 min.)
- 3.5 AAU Wye Challenger hops (60 min.) (0.50 oz./14 g of 7% alpha acids)
- 1.3 AAU Styrian Goldings (20 min.) (0.25 oz./7.1 g of 5% alpha acids)

Wyeast 3787 (Trappist High Gravity) yeast

Step by Step

Mash with a 15 minute rest at 135 °F (57 °C), a 35 minute rest 145 °F (63 °C), a 25 minute rest at 165 °F (74 °C) and 5 minutes at 172 °F (78 °C). Boil wort for 60 minutes, adding hops and sugars at times indicated in the ingredient list. Cool wort and aerate. Pitch yeast at 70 °F (21 °C). Let fermentation temperature rise to around 83 °F (28 °C). Rack beer to secondary and condition for six to eight weeks at 50 °F (10 °C). Carbonate to 3.0–3.5 volumes of CO_2.

St. Bernardus Abt 12 60th Anniversary Edition clone

(5 gallons/19 L, countertop partial mash)

OG = 1.103 FG = 17 IBU = 15
SRM = 37 ABV = 11%

Ingredients

- 2.5 lbs. (1.1 kg) Munich malt (10 °L)
- 1.0 lb. (0.45 kg) aromatic malt
- 0.5 lbs. (0.23 kg) Carafa® Special III malt
- 3.0 lbs. (1.4 kg) Belgian candi syrup (Dark 2) (60 min.)
- 1.0 lbs. (0.45 kg) beet sugar (60 min.)
- 8.0 lbs. (3.6 kg) Pilsner liquid malt extract (late addition)
- 3.5 AAU Wye Challenger hops (60 min.) (0.50 oz./14 g of 7 % alpha acids)
- 1.3 AAU Styrian Goldings (20 min.) (0.25 oz./7.1 g of 5% alpha acids)
- Wyeast 3787 (Trappist High Gravity) yeast

Step by Step

Partial mash the crushed grains at 152 °F (67 °C) for 45 minutes in 5.5 qts. (5.2 L) of water. Boil wort for 60 minutes, adding hops and sugars at times indicated. Stir in liquid malt extract with 15 minutes left in boil. Ferment starting at 70 °F (21 °C). Let fermentation temperature rise to around 83 °F (28 °C). Rack to secondary, condition for 6–8 weeks at 50 °F (10 °C).

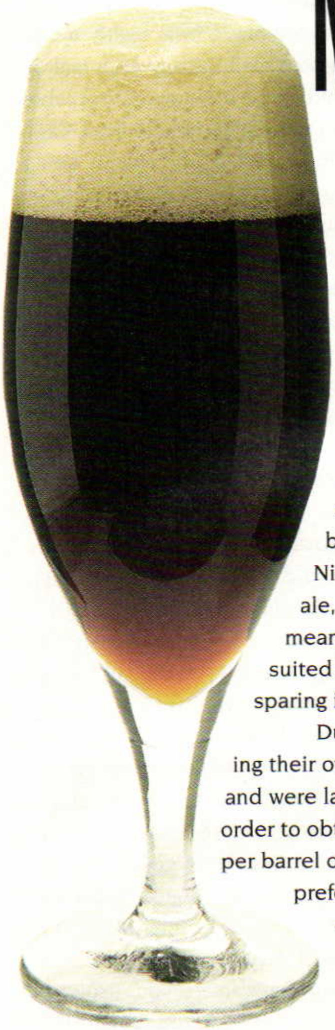
These Edinburgh residents are all rushing home to check on their Scottish ale fermentations.

Photo Courtesy of Wikipedia

SCOTTISH ALES

MULTIPLE PATHS TO MALTY ALES

by **Terry Foster**



Scotland has always had an uneasy relationship with England, even in the days when Scots sat on the English throne in the Seventeenth Century. Indeed, Charles I of England, the king who was beheaded by the English Parliament, was of Scots descent. Even when Scotland had become part of the United Kingdom, the Scots continued to maintain their own individualism, and kept themselves as separate from the English as possible. In fact, just a few years ago, although still formally remaining under the Great Britain umbrella, Scotland set up its own parliament again, some two hundred years or so after union with England.

Scottish brewers too have never entirely fallen under the English yoke. They have usually brewed their own styles in their own way, starting right back in the days of the Picts, with "heather ale," a legendary beer that has recently been revived. Some brewers maintained the use of bear or big, two names for a hardy variety of barley grown only in Scotland and used in brewing up into the Nineteenth Century. In the Seventeenth and early Eighteenth Centuries, the favorite drink was strong ale, much as was the case in England. Yet there were important differences, for the climate in Scotland meant that brewers there had to ferment at lower temperatures than those in England. It also was not well suited for hop-growing, so hops had to be imported from England, with the result that the thrifty Scots were sparing in their use of this ingredient.

During the Eighteenth Century, Scots brewers turned to the new English beer, porter, somewhat pushing their own fine ales into the background. The Edinburgh brewers were first to turn to this new style of beer, and were later followed by those of Glasgow. One company in the latter city hired a London-trained brewer, in order to obtain the secret of brewing this beer. Brewers began to define their beers by the amount of duty paid per barrel on a given brew, which was essentially a measure of the strength of the brew. In contrast, the English preferred vaguer terms, such as extra porter, stout porter and so on. Thus the Scottish brewers used names such as eighty shilling porter, forty shilling porter, usually written in the abbreviated form of 80/-, and 40/-. The shilling was one-twentieth of a pound, and was phased out in 1971, when Britain adopted a decimal system, and was replaced by 5 new pence, or about ten cents in today's money.

Photo by Charles A. Parker

The shilling system lives on today in the names of Scottish ales, although the numbers no longer bear any relation to the actual amount of duty paid on the beer today.

But though popular for some years, the production of porter began to dwindle, and had slowed to a trickle by the second quarter of the Nineteenth Century, as many drinkers reverted to their own Scotch ales. Also, as IPA became popular, the Scots got into the act, particularly the Edinburgh brewers since the water in that city was high in gypsum, and somewhat similar to Burton water. At this time, the Scots introduced the idea of sparging the mash, as opposed to making a second and third mash, as was the standard English practice. They had been quick to take up the use of the hydrometer, and adopted one reading specific gravity, rather than the more cumbersome brewers' pounds per barrel used by the English, and other developments were to follow. Prior to this, Scotch ales had been mainly brewed from pale malts, sometimes in combination with amber malts; since they also practiced a relatively short boil of one-and-a-half hours, these beers would have been relatively pale. Now they began to add black patent malt, as had become the practice for making porters. Indeed, it also appears that some had developed techniques for roasting barley, and used this in their ales. The net result, of course, is that these ales became a little darker, and had some roasted notes.

In the latter part of the nineteenth century, lower-strength ales became more and more popular, a trend that accelerated as beer duties increased, and other factors intervened, such as raw material shortages during two World Wars. As this happened, the division that we see today, namely that of lower-strength beers (below say 1055 original gravity) being called Scottish ales, and the term Scotch ales being reserved for stronger beers.

This article can be thought of as follow-up to "Scottish Ales" by Jamil Zainasheff in the October 2007 issue. There are two main reasons we now revisit the Scottish styles, the first being that Scottish Ales don't rely on hops for flavor — a useful point in a time when hops are scarce and expensive. The second reason, for me, is that they are low-alcohol session beers, a genre I feel is too often ignored by American craft brewers. My friend Jeff Browning, brewer at Bru Rm@BAR in New Haven, has several such beers on its list, all of them interesting and flavorful, and all of them low enough in alcohol that you won't fall over after two pints! In some parts of this article, I may not agree with Jamil, but that does not mean either of us is incorrect. It merely reflects the richness and flexibility of the craft of brewing. I also thought that I might add a recipe for Scotch ale, a style which certainly is not a session beer, yet really only differs from Scottish ales in terms of strength.

OVERVIEW

Scottish ales are predominantly malty in flavor, with hops present just in sufficient amount to allay the sweetness of the malt. These beers are characterized by roasted malt notes merging into the full-bodied palate, which is largely due to low attenuation. The latter is the result of high mash temperatures giving wort high in dextrins, and of low fermentation temperatures. Traditionally, finishing gravities should only be around one-third of the original gravity, as compared to the standard one-quarter of original gravity normally achieved in the brewing of English ales. Largely because of cool fermentations, Scottish ales do not — and should not — have any ester character. They may have caramel and biscuit notes, as well as those of high-roasted malts.

Lastly, I have to say a few words on the question of smoke flavor in Scottish ales. Modern beers in this style do not have this characteristic, and a beer which does so — as Jamil rightly points out — is not an authentic Scottish Ale. There seems to be a misconception that these beers must be brewed with peat-smoked malt, especially among some beer judges. In fact, to the best of my knowledge, no Scottish commercial brewer uses peat smoked malt.

Of course, you could argue that malts in the Eighteenth Century were often dried over wood or straw (and possibly peat), and therefore likely to be smoky in character. But this case has yet to be proven definitively, and even if it were so, brewers apparently never much liked it and moved to the use of other fuels, such as coke, and to improved malt drying methods. So Scottish ales brewed after that time would surely not have had a smoky flavor from the malt.

Of course, it is your beer, and if you like the flavor of smoke, you can use peat smoked malt if you wish. On that basis I have included at the end a recipe that does exactly that, and was a "Scottish ale" we brewed at Bru Rm@BAR recently. A word of warning on using peat smoked malt is that it is very variable in quality, and you can easily overshoot on it and finish up with a beer which tastes of nothing but smoke! You should use a maximum of 5% of the total grist, and smell the smoke malt very carefully before you use it. If the smoke odor is strong, reduce the amount to about 2–3%; if it is weak, you can go to the full 5%.

BASE MALTS

Scottish ales are made from highly-modified British pale malt, so any such malt is suitable, and there are several available to the homebrewer. Malt made from Maris Otter barley is quoted by many as being the best malt for this purpose, but the quality of modern U.S. 2-row malt is good enough to stand alongside British pale malts, especially in a brew where most of the malt flavor is going to come from specialty and roast malts. Simpsons also makes a pale malt from Golden Promise barley, a Scottish spring barley variety, that will work well.

Pale malts need not be the only base in a Scottish ale, especially as these ales can be relatively dark in color. There are one or two mild ale malts on the market, which are very slightly higher-kilned than pale malts, and work well in this style of beer, although the difference is not great. Much better from my view is extensive use of Munich malt (keep to the paler versions at up to 10 °L) and of Vienna malt. These together can make up to 50–70% of the grist, with the rest being pale malt plus specialty malts. Use the Vienna at 30–50%, and about 20% Munich; these malts give good mouth feel to the beer, along with desirable nutty, toasty flavor notes.

Whatever base malt you use, you must mash at high temperature (154–158 °F, 68–70 °C). This will ensure a good level of dextrins in the beer, which is essential for this style. If you mash at lower temperatures, especially with a 60/-

or 70/- beer, it will be thin, bland and disappointing!.

If you prefer to use malt extract then you can go for a pale extract based on Maris Otter barley. For the best results, you are going to have to perform a partial mash or steep specialty or roasted malts to add to your extract base. You can easily therefore use other British or American pale extracts, providing that only malt, and no adjuncts, is used in its preparation.

SPECIALTY AND ROASTED MALTS

You can make a fine Scottish ale from base malts and little roasted barley for color and a hint of roast. However, there are also many specialty malts you can try. Amber malt can add some good biscuit notes, and Briess Victory will have a similar result. Do not overdo them, as they can overpower other malts, and they will also add color (both being around 27 °L). These should form a maximum of 5–10% of the total, should you wish to try them. These really need to be mashed along with the base malts as they contain significant quantities of starch. If you are using extract, then you would need to do a partial mash. If you wish to try that, use 1.0 lb. (0.45 kg) of either, and 1.0 lb. (0.45 kg) Munich malt along with it, and do the partial mash as usual, along with any crystal or roasted malts.

If you haven't realized it already from the descriptions, this is a style well suited to the use of crystal malts, which not only adds caramel flavors, but also non-fermentables, helping you to keep that finishing gravity high. I like to keep to the medium grades at 40–60 °L, at around 10% of the grist, or about 0.5-1.0 lb. per 5 gallons (12–24 g/L) of extract brew. Higher roasted grades at 80–120 °L also work well, but should be used in smaller amounts, around 5% of grist in mashing, or 0.25 lbs. per 5.0 gallons (6.0 g/L) in an extract beer.

High-roasted malts and roasted barley certainly have their place in such beers. Current usage in Scotland is to add roast barley, but black and chocolate malts also serve well. Whichever you use is purely a matter of choice; black malt and roasted barley give a little bite to the beer, with black having a tendency to be a trifle harsher. Chocolate malt still gives a roasty note, but is a little softer, and so is preferred by a good many brewers. The proportion you use is partly determined by the color you wish to achieve, but a maximum of 2% of the grist, or around 0.25 lb. per 5.0 gallons (6.0 kg/L) brew is where you should be.

HOPS

As mentioned earlier, hops are conspicuous more by their absence than anything else in this style. Flavor and aroma hops are not generally used, so we are only concerned with bittering. Even for this you do not want strong-flavored hops, so that Goldings or Fuggles are commonly used. These can obviously be of English origin, though I very much like U.S. Fuggles for this purpose. However, here is where you may have to be a little inventive depending upon what is available from your supplier. Any mild hop will do, such as

English Target or Challenger, or U.S. Willamette, Liberty or Mount Hood, and the newer variety, Palisade, can also be used. High alpha-acid hops in general can give these beers too harsh a flavor, and should be avoided. Since we are only looking for bittering, all the hops go in at the start of the boil.

YEAST

As with the hops, we are looking for yeasts that give neutral flavors; any strain giving high esters must be avoided. White Labs WLP028 (Edinburgh Ale) and Wyeast 1728 (Scottish Ale) yeasts are obvious choices. Jamil recommends White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale), and either are well suited for this beer, being very clean fermenters. I still like White Labs WLP002 (English Ale), or Wyeast 1968 (London ESB), since both tend to give fairly low attenuation.

Whatever your choice, you want to keep fermentation temperatures as low as possible. Historically, Scots brewed only between October and May, and brew day temperatures of 40–50 °F (4–10 °C) were not unusual. However, 60–65 °F (16–18 °C) is a good target to aim for, and will give good results with the yeasts recommended above. The colder you plan to ferment, the larger your yeast starter should be, with lager-sized starters being appropriate if you ferment near lager temperatures.

WATER

Soft water is often recommended for this style, and if you have it, as we do here in New Haven, Connecticut that is fine. If you don't, go with what you have and don't worry about it! If you have very hard water the risk is that it might accentuate the bitterness. I doubt it, for the bittering rates in these beers are low anyway, and in any case tweaking the hop rates down by about 15% should prevent this. Temporarily hard water can be dealt with by boiling to precipitate calcium carbonate, which also removes any chlorine which might be present. However, permanently hard water can only be softened by using an appropriate ion exchanger or by diluting with distilled water.

Terry Foster is a frequent contributor to Brew Your Own. *He wrote about brown ale in the September* 2007 *issue.*

Robbie Burn's 60/- Ale

(5 gallons/19 L, all-grain)

OG = 1.033 (8.3 °P) FG = 1.011 (2.8 °P)
IBU = 13 SRM = 14 ABV = 2.6%

Ingredients

2.5 lbs. (1.14 kg) 2-row pale malt
2.0 lbs. (0.91 kg) Munich malt
2.0 lbs. (0.91 kg) Vienna malt
0.5 lbs. (0.23 kg) crystal malt (40 °L)
0.25 lbs. (0.11 kg) chocolate malt
3.5 AAU U.S. Fuggles hops (90 mins)
(0.8 oz./23 g at 4.5% alpha acids)
White Labs WLP028 (Edinburgh Ale) or Wyeast 1728 (Scottish Ale) yeast

Step by Step

Mash in with 9.0 qt (8.5L) water, a ratio of 1.2 qt. water per lb. of grain (2.7 L/kg); aim for a mash temperature of 154–158 °F (68–70 °C). Let rest 1 hour, then run off and sparge with sufficient hot water to collect 5.5–6.5 gallons (21–25 L) wort in the kettle (depending upon your evaporation rate in boiling). Bring to a boil, add boiling hops and boil for 90 minutes, adding kettle finings if desired. Cool to 60–65 °F (16–18 °C), aerate and pitch the yeast. Fermentation should be complete within 2–3 days, but let the beer sit for another 3–4 days before racking. Ideally it should be racked to a keg or carboy, and allowed to rest another 5 days or so, before racking to the final keg or bottling. Use forced carbonation if kegging, and add priming sugar for the latter (½ cup corn sugar is fine). Drink as soon as the beer has cleared and conditioned — the fresher this beer is when drunk the better!

Arthur Conan Doyle's 60/- Ale

(5 gallons/19 L, extract plus grains)

OG = 1.031 (7.8 °P) FG = 1.011 (2.8 °P)
IBU = 15 SRM = 14 ABV = 2.5%

Ingredients

3.0 lbs. (1.4 kg) pale liquid malt extract
1.0 lb. (0.45 kg) crystal malt (40 °L)
2.0 oz. (57 g) roast barley
0.5 lb. (0.23 kg) Munich malt

0.5 lb (0.23 kg) Victory malt
4.0 AAU Kent Goldings hops (45 mins)
(1.0 oz./28 g at 4.0% alpha acid)
White Labs WLP028 (Edinburgh Ale) or
Wyeast 1728 (Scottish Ale) yeast

Step by Step

Place the grains in a grain bag and steep in hot water (1–2 gallons, 3.8–7.6 L) of water at around 160 °F (71 °C) for 30 minutes. Remove the bag, let it drain and rinse it with a little more hot water, then add the extract to the kettle. Stir carefully to ensure the extract is dissolved, then make up to boil volume (about 5.5 gallons/21 L, depending upon your rate of evaporation). Bring to a boil, add boiling hops and boil for 45 minutes, adding kettle finings if desired. Cool to 60–65 °F (16–18 °C), aerate and pitch the yeast. Fermentation should be complete within 2–3 days, but let the beer sit for another 3–4 days before racking. Ideally it should be racked to a keg or carboy, and allowed to rest another 5 days or so, before racking to the final keg or bottling. Use forced carbonation if kegging, and add priming sugar for the latter (½ cup corn sugar is fine). Drink as soon as the beer has cleared and conditioned — the fresher this beer is when drunk the better!

Hutton's Timely 70/- Ale

(5 gallons, 19L, all-grain)

OG = 1.040 (10 °P) FG = 1.013 (3.3 °P)
IBU = 19 SRM = 11 ABV = 3.5%

Ingredients

3.0 lb. (1.4 kg) English pale ale malt
2.5 lb. (1.1 kg) Munich malt
2.5 lb. (1.1 kg) Vienna malt
0.5 lb. (0.23 kg) crystal malt (80 °L)
0.25 lb. (0.11 kg) English amber malt
5 AAU Willamette hops (90 mins)
(1 oz./28 g at 5.0% alpha acids)
White Labs WLP002 (English Ale) or
Wyeast 1968 (London ESB) yeast

Step by Step

Follow the instructions for the all-grain 60/- Scottish ale.

Lyell's Uniform 70/- Ale

(5 gallons/19L, extract plus grains)

OG = 1.043 (11 °P) FG = 1.014 (3.6 °P)
IBU = 15 SRM = 15 ABV = 3.7%

Ingredients

4.8 lbs. (2.2 kg) pale liquid malt extract
1.0 lb. (0.45 kg) Munich malt
0.50 lb. (0.23 kg) crystal malt (80 °L)
2.0 oz. (57 g) chocolate malt
2.0 oz. (57 g) black malt
5.6 AAU Palisade hops (45 mins)
(0.7 oz. /20 g at 8.0% alpha acid)
White Labs WLP002 (English Ale) or
Wyeast 1968 (London ESB) yeast

Step by Step

Proceed exactly as for extract with grains 60/- Scottish ale recipe.

Scott's Switch (80/- Ale)

(5 gallons/19 L, all-grain)

OG = 1.050 (12.4 °P) FG = 1.017 (4.3 °P)
IBU = 20 SRM = 20 ABV = 4.3%

Ingredients

4.5 lbs. (2.0 kg) 2-row pale malt
2.0 lb. (0.91 g) Munich malt
2.0 lb. (0.91 kg) Vienna malt
1.0 lb. (0.45 kg) Victory malt
4.0 oz. (0.11 kg) crystal malt (120 °L)
4.0 oz. (0.11 kg) roasted barley
5.4 AAU U.S. Fuggles hops (90 mins)
(1.2 oz./34 g of 4.5% alpha acids)
White Labs WLP001 (California Ale) or
Wyeast 1056 (American Ale) yeast

Step by Step

Proceed exactly as for the all-grain 60/- Scottish ale recipe.

Knopfler's Dire 80/- Ale

(5 gallons/19 L, extract plus grains)

OG = 1.052 (12.9 °P) FG = 1.017 (4.3 °P)
IBU = 25 SRM = 25 ABV = 4.5%

Ingredients

6.2 lbs. (2.8 kg) Maris Otter pale liquid extract
1.0 lb. (0.45 kg) crystal malt (40 °L)
3.0 oz. (85 g) chocolate malt
3.0 oz. (85 g) black malt
3.0 oz. (85 g) roasted barley
6.8 AAU U.S. Fuggles hops (45 mins)
(1.5 oz./43 g of 4.5% alpha acids)
White Labs WLP001 (California Ale) or
Wyeast 1056 (American Ale) yeast

Step by Step

Proceed exactly as for the extract with grains 60/- ale.

Fleming's Fabulous Fungi (Scotch Ale)

(5 gallons/19 L, all-grain)

OG = 1.074 (18 °P) FG = 1.025 (6.3 °P)
IBU = 30 SRM = 30 ABV = 6.4%

Ingredients

8.0 lbs. (3.6 kg) English Pale malt
3.0 lbs. (1.4 kg) Munich alt
2.0 lbs. (0.9 kg) Amber malt
2.0 lbs. (0.91 kg) Victory malt
1.0 lb. (0.45 kg) crystal malt (80 °L)
4.0 oz. (114 g) chocolate malt
8.0 AAU East Kent Goldings hops

(2.0 oz./57 g of 4.0% alpha acids)
White Labs WLP028 (Edinburgh Ale) or
Wyeast 1728 (Scottish Ale) yeast

Step by Step

Proceed exactly as for 60/- Scottish ale, except that this beer will benefit from some months aging before drinking.

Maxwell's Demon (Scotch Ale)

(5 gallons/19 L, extract plus grains)

OG = 1.080 (19 °P) FG = 1.027 (6.8 °P)
IBU = 35 SRM = 30 ABV = 6.9%

Ingredients

9.4 lbs. (4.3 kg) Maris Otter pale liquid malt extract
1.0 lb. (0.45 kg) crystal malt (40 °L)
1.0 lb. (0.45 kg) crystal malt (80 °L)
4.0 oz. (114 g) chocolate malt
4.0 oz. (114 g) roasted barley
9.2 AAU East Kent Goldings hops
(2.3 oz./65 g of 4.0% alpha acids)
White Labs WLP028 (Edinburgh Ale)
or Wyeast 1728 (Scottish Ale) yeast

Step by Step

Proceed as for extract with grains 60/- ale, but note that this beer will age nicely for several months, and does not need to be drunk while still young.

Reekie Tartan Scottish Ale

(5 gallons/19L, all-grain)

OG = 1.056 (14 °P) FG = 1.018 (4.6 °P)
IBU = 15 SRM = 20 ABV = 4.9%

Finally, here's a recipe which was brewed at Bru Rm@BAR in New Haven Connecticut. It's really an 80/- ale, though slightly on the high side of the style range for OG. There are a couple of other twists, one being the use of peat smoked malt, the other the addition of a touch of Special B malt to add a biscuit note. And just because the Scots like their porridge we threw some oats into the grist! I have adapted the recipe to 5-gallon (19-L) length (from 11 barrels), and made a few adjustments to allow for different grain extraction rates and hop usage rates. Here it is, and let me know if you have a shot at it, how it turns out!

Ingredients

4.0 lb. (1.8 kg) Munich malt
6.0 lb. (2.7 kg) Vienna malt
0.5 lb. (0.23 kg) oat malt
0.4 lb. (0.18 kg) crystal malt (80 °L)
0.2 lb. (91 g) black malt
0.3 lb. (0.14 kg) Special B malt
0.4 lb. (0.18 kg) peat smoked malt
4 AAU East Kent Goldings hops
(1 oz./28 g of 4.0% alpha acids)
Wyeast 1098 (British Ale) yeast

Step by Step

Proceed as under the first Scottish ale recipe; drink it, enjoy it!

Hop Substitution Information

Scottish ales do not feature a prominent amount of hop flavor or aroma. If you need to substitute for any of these hops, any mild or neutral hop will do.

Low hop

TEN RECIPES FOR **FLAVORFUL** HOMEBREW BREWED WITH **SMALL** AMOUNTS **OF HOPS.**

RECIPES

Hops are in short supply right now, but the enthusiasm for brewing remains unabated among homebrewers. Due to high prices, and the scarcity of some of our favorite hop varieties, many homebrewers are looking for homebrew recipes that are full of flavor, but don't require a lot of hops. They are also looking for ways to stretch their hop charges a little further. And . . . they're in luck.

For centuries, brewers around the world have made a wide variety of classic beer styles that are focused on malt or on the characteristics imparted by the yeast. See, for example, Terry Foster's article on page 34 discussing Scottish ale. The nine recipes there will fill your mouth with flavor, but don't empty your freezer of hops.

In search of more low-hop recipes, *Brew Your Own* put out a call to homebrew shops around the US for low-hop recipes that were currently popular . . . and featured hop varieties you could still get your hands on. The recipes in this collection range from low-gravity session milds to big, strapping Tripels. For the adventurous, there's even a beer bittered with mugwort.

In this package, we also pass along some inventive ways to stretch your hop supply. Plus, using many of these ideas, we've assembled a pale ale recipe for the thrifty homebrewer — a brew that shows all the hop character you could want in 5 gallons (19 L) of pale ale but uses only two ounces (57 g) of hops.

Someday, hopefully soon, our homebrew shops will once again be overflowing with hops of every variety. Until then, check out these recipes for beers that are hearty without being hoppy.

by **Chris Colby**

LOW HOP HOMEBREW RECIPES
Low on Hops. High in Flavor.

BANKSIDE BEACH LONDON MILD ALE
The Beverage People, Santa Rosa, California

(5 gallons/19 L, all-grain)
OG = 1.035 FG = 1.009
IBU = 19 ABV = 3.4%

This style — London Mild — is the smallest of historic English brown ales, all of them fairly low in hops. Our beer came out very tasty, and as a bonus, low in carbs, thus the name Bankside, which was the neighborhood of pubs and theatres famous in Shakespeare's time, on the south side of the River Thames. If it had a beach, it would be a South Beach!

Ingredients
5.0 lbs. (2.3 kg) domestic 2-row pale malt
1.5 lbs. (0.68 kg) British brown malt
2.0 oz. (57 g) Special B malt
2.0 oz. (57 g) Chocolate malt
½ tsp. gypsum
¼ tsp. calcium chloride
½ tsp. chalk
2 tsp. Irish Moss (15 min.)
3.3 AAU Kent Golding hops (60 min.) (0.5 oz./ 14 g of 6.6% alpha acids)
1 oz. (28 g) Fuggle hops (30 min.)
Wyeast 1028 (London Ale) yeast
0.75 cup corn sugar (for priming)

Step by Step
Mash all grains at 140 °F (60 °C) and hold for one hour. Heat to 150 °F (66 °C) and hold for another 30 minutes. Mash out and sparge at 170 °F (77 °C). Use a 60 minute boil, with water salts and adding hops as indicated above. Irish Moss added as clarifier for last 15 minutes.

BLONDE ALE
South Hills Brewing Supply Pittsburgh, Pennsylvania

(5 gallons, 19 L, extract)
OG = 1.040–45 FG = 1.008–12
IBU = 10 ABV = 4+%

Ingredients
3.0 lbs. (1.4 kg) extra light dried malt extract
1.0 lb. (0.45 kg) rice syrup solids
1.0 lb. (0.45 kg) light honey
1.75 AAU Mt. Hood hops (bittering) (0.35 oz./10 g of 5% alpha acids)
0.5 oz. (14 g) Mt. Hood hops (aroma)
1 tsp. yeast nutrient
1 whirlfloc tablet
White Labs WLP029 (German Ale/ Kölsch) yeast
1 cup corn sugar (for priming)

Step by Step
Add bittering hops to 1.5 gallons (5.7 L) of water, bring to a boil for 30 minutes and remove from heat. Add malt and rice extracts and stir until thoroughly dissolved. Bring to a light simmer and maintain for 15 minutes. Add one teaspoon of yeast nutrient and the whirlfloc tablet (this aids in clarity) along with the finishing hops and honey. Continue simmering for another 10 minutes. Cool with the aid of a wort chiller to a temperature of 70–80 °F (21–27 °C). Add to plastic fermenter with 3 gallons (11 L) of room temperature water. Alternatively, cover pot and chill in ice water bath for 15–20 minutes. Add to fermenter and top up with 3 gallons (11 L) of cold water. (If using this method, refrigerate water the day before brewing.) Pitch yeast and ferment for a week to 10 days. Transfer to a glass carboy and ferment until completion. Prime, bottle and age for three weeks or more (if you can wait).

KARMELEIT CLONE (BELGIAN TRIPEL)
Bader Beer & Wine Supply Vancouver, Washington

(5 gallons, 19 L, extract with grains)
OG = 1.081 FG = 1.019
IBU = 22 ABV = 8.2%

This recipe for a Belgian tripel is a smooth, warm, slightly dry version of the Belgian tripel. The coriander and orange peel in the recipe along with the spiciness of the Belgian ale yeast give it a bit of a complex taste. While this beer is low in hop bitterness, the phenolic flavors of the yeast help to give the perception of a higher hop level, without the hops! High yeast attenuation attributes a dry flavor not normally found in high-gravity beers.

Ingredients
3.3 lbs. (1.5 kg) unhopped light liquid malt extract
3.3 lbs. (1.5 kg) unhopped wheat liquid malt extract

1.0 lb. (0.45 kg) light dry malt powder
1.0 lb. (0.45 kg) candi sugar (boil 15 min.)
1.0 lb. (0.45 kg) Belgian Pilsner malt
0.5 lbs. (0.23 kg) wheat malt
0.5 lbs. (0.23 kg) aromatic malt
0.75 lb. (0.34 kg) flaked oats
1.0 oz. (28 g) sweet orange peel (15 min.)
0.5 oz. (14 g) coriander (crushed, 15 min.)
5 AAU Northern Brewer hops (60 min.)
(0.5 oz./14 g of 10% alpha acids)
0.5 oz. US Goldings hops (5 min.)
0.5 tsp. Irish moss (45 min.)
1 Servomyces tablet (15 min)
White Labs WLP 550 (Belgian Ale) yeast
0.75 cup corn sugar (for priming)

Step by Step

Steep crushed malted grain in 2.0 gallons (7.6 L) of 150 °F (66 °C) water for 30 minutes. Remove the grain from the hot water with a strainer, and then bring water to a boil. When boiling starts, remove pot from burner and add 1 cup (237 mL) malt syrup. Return to a boil, then add boiling hops and boil for 60 minutes. Add Irish moss for last 45 minutes of boil. Add candi sugar, sweet orange peel, coriander and Servomyces for last 15 minutes of the boil. Add finishing hops for last 5 minutes of the boil. Then add remainder of malt syrup and dry malt extract and stir to mix, wait 10 minutes to sanitize. Fill your sanitized carboy with 2 gallons (7.6 L) of cold water. Strain the hot wort into the carboy and top off to the 5-gallon (19-L) mark. Add yeast when beer is less than 78 °F (26 °C), and ferment and bottle as usual.

MAPLE RED ALE

NFG Homebrew Supplies
Leominster, Massachusetts
(5 gallons/19 L, extract)
OG = 1.060 FG = 1.010
IBU = depends on extract ABV = 6.5%

Ingredients

1 can Coopers Real Ale hopped liquid malt extract kit
(This 3.75 lb./1.7 kg beer kit is hopped, so there is no need to boil hops.)
3.0 lbs. (1.4 kg) amber dried malt extract
3.4 fl. oz. (100 mL) real maple syrup
Danstar Nottingham Ale or White Labs WLP009 (Australian Ale) yeast
0.75 cup corn sugar (for priming)

Step by Step

Soak can of malt in hot water for 5 minutes to soften. Pour 2.0 gallons (7.6 L) of hot water into your brew kettle and bring to a boil. When boil commences, remove kettle from heat, add dried then liquid malt extracts and maple syrup to your kettle. Stir in to completely dissolve, rinse out can and add it to the brew. Bring back to a boil. Boil for 10 minutes. After the boil is complete, cool wort (unfermented beer) quickly. (Immerse brew kettle into an ice bath.) Put 2 gallons (7.6 L) of cold water (filtered or bottled) into your sanitized brew bucket. Add the cooled wort to your bucket and top up to the 5-gallon (19-L) mark. When the temperature reaches 70–75 °F (21–24 °C), you should aerate the wort well. (Aggressive stirring or shaking works.) Sprinkle the yeast on top, cover and let stand for 5 minutes, stir in yeast and re-cover. Make sure you have a ster-

Getting More From Your Hops

With hops well over $20 (US) per pound, and many popular varieties scarce or absent from store shelves, many homebrewers are looking for ways to stretch their hop supplies. While you can't get something from nothing, there are ways to get the absolute most from your hops . . . if you're willing to put in some extra work. Before we discuss some of the newer, still-experimental methods, let's review some tried and true ways to get more from your hops.

The Basics

One of the most obvious ways to get more from your hops — more bitterness, at least — is to boil them longer. If your recipe calls for a 90-minute or longer boil, with the bittering hops added for the final 60 minutes of the boil, consider adding the bittering hops earlier in the boil. By boiling them longer, you will get a little better hop utilization and therefore you can use slightly less. For example, if you had been boiling 2.0 oz. (57 g) of hops for 60 minutes, you could boil 1.8 oz. (51 g) for 90 minutes instead. Obviously, on a homebrew scale, this adjustment doesn't save a lot of hops. And, boiling hops for longer times may yield a harsher bitter character.

You can also adjust your recipe and procedures to try to accent the hops. Water chemistry plays a noticeable role in how hops are perceived. Beer brewed from water high in carbonates often has a harsh hop character. In contrast, beer brewed from water with moderate levels of sulfate show a pleasing hop character. When brewing a pale, hoppy beer, adjust your water so that carbonates are under 50 ppm and sulfates are in the 150–200 ppm range. The easiest way to do this is check your local water report for the carbonate level. Dilute your tap water with distilled water until it is under your target carbonate level. Next, add gypsum to your brewing liquor (brewing water). If your water contained no sulfates, one and a half teaspoons of gypsum per 5 gallons (19 L) of brewing liquor would give you approximately 180 ppm of sulfates.

The perception of bitterness and hop flavor is also influenced by the amount of hop aroma in the beer. Hop aroma will intensify the flavor of the hops. In any hoppy beer, be sure to achieve enough aroma in the finished beer to accentuate the early hops. One cheap way to do this is to look in your freezer for any old hops you may have. As hops age, their alpha acid levels drop. However, if they are kept frozen, their aroma may remain fresh for several years. Some commercial breweries even purposely age their aroma hops, believing this gives them a finer character. If you have any old hops that you are not inclined to use for bittering, open up their packaging and give them a sniff — if they smell good (with no cheesiness), use them as late addition or dry hops. Likewise, this issue of *BYO* will land in your mailbox or at your local homebrew shop right around hop harvest time. If you are growing your own hops, you should have plenty. Use them as dry hops to enhance the hop character of all your hoppy brews.

During your brewday, and during fermentation, ensure that your hops "stay in the brewing stream." During the boil, hop material will frequently cling to the side of your kettle. Knock these clumps down with your brewing spoon, so their contribution is not lost. Likewise, avoid boilovers, which will carry hop material out of your kettle. While fermenting, don't use a blowoff tube — ferment in a vessel large enough to contain the kräusen generated during fermentation. The brown "crud" that gets spit out of a blowtube is intensely bitter and you are losing IBUs if you don't retain it. (Some commercial lager brewers purposely remove some of this kräusen, believing it contributes a harsh note to their beers. However, most commercial breweries do not use the equivalent of blowoff tubes. In breweries that use uni-tanks, the kräusen is not separated from the beer, although it may stick to the top and sides of the vessel.)

Your pitching rate also affects your beer's hop character. During fermentation, yeast absorb some hop components. If you were to bake a loaf of bread using spent brewer's yeast, you would find that the yeast actually sequester quite a bit of bitterness. When determining how much yeast to pitch for a hoppy beer, consider two things. First, you need enough yeast to conduct a healthy fermentation. A sluggish fermentation may yield a beer with high final gravity (FG), dulling the perception of the hops. However, pitching too much yeast will directly remove bitterness from your wort.

(*Cont. on page 48*)

ile, sanitized solution in your airlock. Allow to ferment for 7 days in primary fermenter at 65–70 °F (18–21 °C). Rack (siphon) into a carboy for another 7 days. To bottle, bring 1 cup of water to a boil, add the priming sugar and boil for 5 minutes. Allow sugar solution to cool and then add to the bottling bucket, rack finished beer into the bottling bucket, without any splashing and quietly stir in. Fill your sterile bottles and cap, quietly stir about half way through bottling to mix the sugar in again. Allow your bottled beer to stand in a warm place (70–75 °F/21–24 °C) for 1 to 2 weeks to naturally carbonate then transfer to a cool place for an additional week.

RYE-ZEN-SHINE

Beer & Winemaking Supplies, Inc.
Northampton, Massachusetts
(5 gallons/19 L, extract with grains)

OG = 1.048–52 FG = 1.012–14
IBU = 44–56 ABV = 5+%

Ingredients

7.0 lbs. (3.2 kg) Northwestern Light liquid malt extract
10 oz. (0.28 kg) German rye malt
6.0 oz. (0.17 kg) torrified wheat malt
4.0 oz. (0.11 kg) US Special Roast malt
6.0 oz. (0.17 kg) German CaraHell® malt
1 oz. (28 g) any high-alpha hop variety (from 12–15% alpha acids)
ale yeast of your choice (dried or liquid)
5 oz. (0.14 kg) corn sugar (for priming)

Step by Step

Heat 2.5 quarts (2.4 L) of water to 172 ° F (78 °C), and mix with grains in small cooler, stirring well, until temperature stabilizes between 150–154 °F (66–68 °C). Close cover, and let grains steep for 45 minutes. If no cooler is available, try to keep temperature steady in a small covered pot, off of stove, insulated with towels. While grains are steeping, heat 2 gallons (7.6 L) of water up to 168 °F (76 °C) in your smaller stockpot. Place strainer or colander on large stockpot, and spoon grains and any liquid into it. With a small pitcher or measuring cup, pour the water over the grains, so that the color and flavor is rinsed from the grain, and drains through into your stockpot. Discard or compost the grain when done. Bring to a boil, then shut off. On a cold burner, cut open a corner of the malt extract bag, and squeeze all of it into stockpot. Stir well, then return to a boil, constantly stirring to dissolve well. When boil returns, add the hop pellets. Continue stirring. Continue boil for 60 total minutes, then shut off heat. Let sit covered at least 15 minutes to cool. You can run cold water around the pot if further cooling is needed. Put 2 gallons (7.6 L) of very cold water in your sanitized bucket, then pour the boiled liquid in, leaving hop residue behind. Stir well with sanitized spoon, and add more very cold water, to slightly over the 5-gallon (19-L) mark. Take a hydrometer reading and temperature as well. If still above 85 °F (29 °C), cover loosely and wait. When temperature is 85 °F (29 °C) or below, sprinkle yeast on surface (or follow package instructions), and stir well to mix and aerate. Aerating well will help yeast to grow. Snap lid on, with water-filled airlock in place, and place at room temperature for 4–5 days. After 4–5 days, siphon beer over to sanitized glass carboy, and attach water filled airlock. Swirl gently to release carbon dioxide bubbles, which will push air out through airlock and protect the beer. Let sit at least 7 days to finish and clear. Take hydrometer reading, and if close to final gravity, prepare to bottle the beer by sanitizing bottles, caps, siphon, bottle filler, etc. Dissolve priming sugar in 2 cups of water on stovetop, by boiling for a few minutes, then shutting off heat to let cool. Transfer beer to bucket, and stir in priming syrup to distribute evenly. Siphon into bottles and cap them well. Let sit at room temperature for at least 2 weeks to allow beer to carbonate, at which time it can be moved to a cooler area. Beer will benefit from aging.

EVIL MONK BELGIAN PALE ALE

Culver City Home Brewing Supply
Culver City, California
(5 gallons/19 L, extract with grains)

OG = 1.048 FG = 1.010
IBU = 22 SRM = 8 ABV = 4.9%

What happens when you brew an English-influenced pale ale in a country whose brewing is dominated by Trappist monks? You get this dark golden beer which will keep you going back for more!

Ingredients

6.0 lbs. (2.7 kg) Alexander's pale liquid malt extract
0.5 lbs. (0.23 kg) corn sugar
4 oz. (0.11 kg) Caravienne malt
4 oz. (0.11 kg) Carafoam® malt
4 oz. (0.11 kg) aromatic malt
4 oz. (0.11 kg) biscuit malt
4.9 AAU Perle hops (60 min.) (0.7 oz./20 g of 7.0% alpha acids)
1.6 AAU Saaz hops (15 min.) (0.4 oz./11 g of 4 % alpha acids)
0.2 oz. (5.7 g) Saaz hops (0 min.)
Wyeast 3522 (Belgian Ardennes), WhiteLabs WLP565 (Saison I) or Wyeast 3942 (Belgian Wheat) yeast
0.75 cup corn sugar (for priming)

(Cont. from page 46)

So, taking in consideration your planned level of aeration and fermentation temperature, pitch enough yeast to conduct a fermentation that proceeds at a reasonable pace and finishes at an appropriate final gravity. For an average-strength (SG 1.044-1.052) hoppy ale — with adequate wort aeration, fermented in the middle of the yeast's recommended temperature range — a 1 qt. (1 L) yeast starter should allow you to ferment the beer in 3–5 days, reaching an attenuation level appropriate for that yeast strain. (Most of the time, the manufacturer will specify the strain's normal attenuation range.) Use a pitching rate calculator, such as the one written by Jamil Zainasheff, to fine tune your pitching rate. His can be found at mrmalty.com.

Newer Methods

One experimental hopping method seems — in initial investigations by a few homebrewers — to yield a lot of late hop character with a small amount of hops. This method involves making a "hop tea" using a french press coffee maker and adding the tea to secondary. The basic procedure is to make your beer as normal, except that you end up with 1–2 quarts (1–2 L) less wort in your fermenter. Essentially, you use the same amount of ingredients as you normally would and make a slightly concentrated beer. When it is time to rack the beer to secondary, heat a little over a quart (~1 L) of low-gravity wort to boiling. Make the wort by adding 1.0 oz. (28 g) of dried malt extract to 1 qt. (~1 L) of water, producing a wort of approximately SG 1.012 (~3 °Plato). Add your hops to an 8-cup (1 L) French press and fill the press with the hot wort. (Note that, in French press sizes, a cup refers to a cup of coffee, not the usual 8-oz. cup.) Let the hops steep for awhile — from 15 minutes to an hour — then press off the hops and pour off the hop tea. This process can be repeated, depending on if you planned for 1 or 2 quarts (1 or 2 L) on brewday. The hop tea is then added to the secondary fermenter, yielding 5.0 gallons (19 L) of beer at regular strength. The result is lot of hop flavor and aroma imparted to the beer — up to three times as much as if the hops were added late in the boil.

Why might this work? Nobody knows, but it's tempting to speculate that, when the beer is in secondary and the yeast density is far lower than it was during primary fermentation, little of the hop character gets absorbed by yeast. In addition, because the wort is not vigorously fermenting, volatile hop oils are not being scrubbed out by the rising of carbon dioxide bubbles. It's important to note that this method does not extract an appreciable amount of hop bitterness from the hops, which makes sense as the hops are not boiled.

To add a twist to this technique, it is possible to make a hop tea from your bittering hops. The wet hops from the French press could then be boiled and the tea could be added to the wort at the end of the boil. The idea here is that normally, the volatile components that contribute hop flavor and aroma would be boiled off from the bittering hops. So why not extract them before the hops are used for bittering?

A slight variation on this technique would be to make a small batch of highly late-hopped beer and add it to your main batch of beer. In lager brewing, adding a small amount of fermenting beer to a conditioning brew is called kräusening. In a preliminary experiment of mine, I added 2 qts. (2 L) of fermenting beer to 5 gallons (19 L) of conditioning pale ale. The result was that a powerful late hop character was added to the brew — more than I expected, given the amount of hops used. (For homebrewers who use conical fermenters, the added beer could also be used to fill the fermenter's headspace after primary.)

Both of the above ideas are fairly similar and there is yet a third idea along these lines for adding more hop character to beer using fewer hops — hopping your priming sugar. When bottling 5 gallons (19 L) of homebrew, brewers typically boil some corn sugar and stir it into their beer in their bottling bucket. Why not boil a little malt extract instead and add some hops? One plan might be to take a cup of light dried malt extract and dissolve it in 2 cups (16.0 fl. oz./470 mL) of water and heat it to 180 °F (82 °C). Add about half an ounce (14 g) of hops and let the mixture steep for 15 minutes above 160 °F (71 °C). You could also boil this wort for 15 minutes. Then, cool the mixture and pour it through a sanitized strainer into your bottling bucket. Once bottled, the extracted hop aroma could not be blown off. Preliminary tests have been promising.

— *C. C.*

Step by Step

In a small pot, bring 3 or 4 quarts (3 to 4 L) of water to around 150 °F (66 °C). Remove from the heat and stir in the specialty grains, cover and steep for 20–30 minutes. Meanwhile, fill the large brew pot half full with water and apply heat. When bubbles start to rise from the large pot, turn off the heat and stir in the extract. After the grains have steeped for 20–30 minutes, pour them through a strainer into the large brew pot. Add some hot water to the small pot and rinse the grains in the strainer. Bring what is now called wort to a full, rolling boil. Watch for boilovers! Once the foaming stops, add the contents of the first hop package. Sanitize your fermenter, strainer, airlock and stopper. Maintain the boil for one hour, adding hops as per recipe. When the boil is done, cool the pot in a sink until sides are cool to the touch.

Pour the wort into your sanitized fermenter, add pre-chilled water to bring it up to 5 gallons (19 L) at about 75 °F (24 °C) and pitch the yeast. Ferment at 65–75 °F (18–24 °C).

HAIRY PORTER AND THE FRENCH KISS

Adventures in Homebrewing
Taylor, Michigan

(5 gallons/19 L, extract with grains)

OG = 1.050–1.055 FG = 1.012–1.014
IBU = no hops ABV = 4.5–5.0%

Ingredients

6.0 lbs. (2.7 kg) dried malt extract
  or 7.2 lbs. (3.3 kg) liquid malt extract
0.5 lb. (0.25 kg) crystal malt (60 °L)
1.0 lb. (0.45 kg) chocolate malt
0.5 lb. (0.25 kg) flaked barley
0.5 lb. (0.25 kg) biscuit malt
0.5 lb. (0.25 kg) kiln coffee malt
1 oz. (28 kg) mugwort (boiling)
½ dram Amaretto extract (flavoring)
White Labs WLP028 (Edinburgh Ale) yeast
0.75 cup corn sugar (for priming)

Step by Step

Remove crushed grains from package and put in muslin bag. Tie bag at end to allow maximum circulation. Place in minimum 1.0 gallon (3.8 L) cold water, slowly bring to approximately 160 °F (71 °C), hold temperature for 10 minutes. Discard grain. Add malt extract, stir well to dissolve. Bring to a boil, add mugwort, and continue boil for 60 minutes. Pour unfermented beer (wort) slowly into fermentation vessel containing enough cold water to total 5 gallons (19 L). Let temperature drop to approximately 80 °F (27 °C). Take hydrometer reading, sprinkle or pitch yeast on top. Affix cover and airlock to fermenter and stabilize temperature at approximately 67–72 °F (19–22 °C). Airlock should be active within 24 hours, with fermentation slowing down by the end of day 7. Siphon beer into clean carboy, add amaretto and affix airlock and cover to keep light out and let clear for approximately 7 days. When ready to bottle, boil priming sugar in approximately 1 cup water for 1 minute, add to bottom of bottling bucket, then siphon beer into the same bucket. Fill bottles to 1 inch (2.5 cm) from top of bottle and cap. Store beer at 67–70 °F (19–21 °C) for 7–10 days minimum.

VANILLA CREAM ALE

Bet-Mar Liquid Hobby Shop
Columbia, South Carolina

(5 gallons/19 L, all-grain)
OG = 1.059 F.G. = 1.015
IBU = 9 ABV = 5.7%

Ingredients

10 lb. (4.5 kg) Pilsen malt
0.5 lb. (0.23 kg) torrified wheat
1.0 lb. (0.45 kg) Carafoam® malt
0.5 lb. (0.23 kg) flaked rice
2 oz. (57 g) heather tips
2.3 AAU Vanguard hops (90 mins)
(0.5 oz./14 g of 4.6% alpha acids)
1 oz. (28 g) dried woodruff
4 fresh vanilla beans
White Labs WLP080 (Cream Ale Blend) yeast
0.75 cup corn sugar (for priming)

Step by Step

Add all grains in 4 gallons (15 L) water at 163 °F (73 °C). Mash at 150 °F (66 °C) for 90 minutes. Sparge with 5 gallons (19 L) of water at 168 °F (76 °C). Collect wort, bring to a boil and add heather tips, hops and one vanilla bean (split). Boil for 65 minutes, then add woodruff and one vanilla bean (split) Boil for 20 min, then add one vanilla bean (split) Boil for 2 min. Chill, aerate wort and pitch yeast. Ferment at 65–70 °F (18–21 °C). During secondary fermentation, add one vanilla bean (split) to the fermenter.

DESPERATE TIMES INDIA PALE ALE

DeFalco's Home Wine and Beer Supplies
Houston, Texas

(5 gallons/19 L, extract with grains)
OG = 1.064 FG = 1.015
IBU = 23 ABV = 6.3%

I don't care if times are bad. . . I ain't giving up my hoppy ales! You just have to be a little innovative! Here's my attempt at a hoppy beer without too many hops (huh?). I'm using hop varieties that seem to be commonly available these days.

Ingredients

6.0 lbs. (2.7 kg) Muntons light hopped dried malt extract

2.0 lbs. (0.91 kg) 2-row pale malt
12 oz. (0.34 kg) British medium crystal malt
1 pkg. Burton Water Salts
  (or 1.5 tsp. gypsum)
6 AAU Glacier hops (50 min)
  (1 oz./28 g of 6% alph acids)
  (use Mt. Hood hops if Glacier hops
  are unavailable)
1.3 AAU U.S. Goldings (10 mins)
  (0.33 oz./9.4 g of 4% alpha acids)
  (second choice: Mt. Hood or any
  other variety that smells nice)
0.33 oz. (9.4 g) U.S. Goldings (end of boil)
0.33 oz. (9.4 g) U.S. Goldings (dry hop)
  (if using pellets, crush)
1 cup turbinado sugar (end of boil)
White Labs WLP 007 (Dry English
  Ale) yeast
⅔ cup turbinado sugar (priming)

Step by Step

Heat a gallon of water to approximately 165 °F (74 °C). Add water salts and the crushed grains (if you're lazy like me, throw them into a muslin steeping bag). Resulting temperature should be between 150 and 160 °F (66 to 71 °C). Cover and steep for 20 minutes. Remove bag and rinse with hot tap water until you've collected at least 3 gallons (11 L) of "grain tea." (Personally, I like to collect at least 5 gallons/19 L.) Bring the "tea" near a boil and add the dried malt extract. Stir like crazy to dissolve, then bring to a full boil. Add the Glacier hops and boil for 50 minutes. Then add the first third of an ounce of Goldings. Boil an additional 10 minutes, then add another third of an ounce of hops. Turn off heat and cool as rapidly as possible. Add to sanitized fermenter and top off with cool water to five U.S. gallons (19 L). Add the vial of yeast (now warmed up to room temperature), stir like crazy, again, to aerate. Ferment in the mid 60s to low 70s Fahrenheit (~18–23 °C), if possible. Once the active fermentation has subsided, it's time to dry hop this puppy with that last third of an ounce of hops. Either crush up your hop pellets and add them to the bottom of your sanitized secondary fermenter immediately prior to syphoning the beer over (double stage fermentation), or add the crushed hops directly to the existing fermenter (single stage fermentation). Bottle in your usual fashion. Good luck! I hope this takes care of your hops jones!

TOKI'S BRUTAL PALE ALE

Brew Your Own magazine

(5 gallons/19 L, all-grain)

OG = 1.050 FG = 1.010
IBU = up to 50 (depending on
  hop selection)
SRM = 9 ABV = 5.1%

This 5-gallon (19-L) recipe uses only two ounces (57 g) of hops, but delivers plenty of hop bitterness, flavor and aroma. How? By expending a little extra effort to get the most from the hops. Essentially, there are three main ways this is done: First, hop aroma is extracted from the bittering hops before they are boiled. It is added back to the wort at the end of the boil. Next, some of the alpha acids are recovered from the late hops after they have been used. And finally, the late hopping is done in secondary. This reduces the loss of hop compounds due to being absorbed by yeast or blown off due to the churning and outgassing that occurs during primary fermentation. To brew this recipe, you will need one unusual piece of equipment, a 1-liter (8 cup) French press, used for making coffee. If you don't already have one, you can find one cheap (~$20 US) at almost any store that sells housewares.

Ingredients

7.0 lbs. (3.2 kg) 2-row pale malt (US) or
  German Pilsner malt
1.0 lb. (0.45 kg) Munich malt (10 °L)
0.50 lbs. (0.23 kg) crystal malt (30 °L)
1.0 lb. (0.45 kg) cane sugar
0.25 lbs. (0.11 kg) Muntons light dried malt
  extract (secondary)
¼ tsp. yeast nutrients (15 mins)
1 tsp. Irish moss (15 mins)
1 oz. (28 g) Columbus, Tomahawk, Zeus,
  Simcoe, Chinook or Nugget hops
  (75 min.)
  (second choices: Magnum, Summit,
  Newport, Horizon or Sun)
1 oz. (28 g) Glacier, Mt. Hood, Palisades,
  Santiam, Sterling, Strisselspalt or
  Vanguard hops (secondary)
  (second choice: your favorite hop
  among the choices you have)
Wyeast 1056 (American Ale) or
  White Labs WLP001 (California Ale) or
  Safale US-05 yeast
  (~1.25 qt./1.25 L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mash at 150 °F (66 °C) for 60 minutes in 3.0 gallons (11 L) of brewing liquor. Mash out to 168 °F (76 °C). Recirculate until wort clears substantially. Run off wort to kettle, sparging with water hot enough to keep the top of the grain bed at 168 °F (76 °C). Collect about 6.0 gallons (23 L) of wort, and bring to a boil. (Shoot for 4.25 gallons (16 L) at end of 90-minute boil.) Once wort boils, add the bittering hops to the French press and ladle in boiling wort until full. Let sit for 15 minutes, then press off hops. Pour hoppy liquid from French press into a clean container, cover and set aside. Scrape wet hops from French press to kettle. Boil these hops for 75 minutes. With 15 minutes left in the boil, add cane sugar, Irish moss and yeast nutrients to kettle. At end of boil, add hoppy liquid and let steep for 15 minutes before cooling. Cool wort and transfer to fermenter. You should have approximately 4.25 gallons (16 L) at this point. Aerate and pitch yeast. Let ferment at 65–68 °F (18–20 °C). Once fermentation has stopped, add malt extract to one gallon (3.8 L) of water and bring to a boil. Add hops to French press. Boil wort for 15 minutes, turn off heat, then ladle 1 qt. (1 L) of hot wort into french press. After 15 minutes, pour off hoppy liquid into a sanitized bowl and cover. Add wet hops to remaining wort and boil for 30 minutes. Aim to reduce wort volume to 2 qts. (2 L). If wort volume dips below this, add boiling water to top up. Combine reserved hoppy liquid and boiled wort and cool this combined wort. With minimal splashing, transfer cooled, hoppy wort to secondary fermenter. Do not transfer hop debris to fermenter. Rack primary batch onto this "hop shot" to make 5 gallons (19 L) of beer (give or take, depending on racking losses and other factors). Condition at 60–65 °F (16–18 °C) until renewed fermentation settles down and beer clears. Rack to keg or bottle.

TOKI'S BRUTAL PALE ALE

Brew Your Own magazine

(5 gallons/19 L, countertop partial mash)

OG = 1.050 FG = 1.010
IBU = up to 50 (depending on
  hop selection)
SRM = 9 ABV = 5.1%

Ingredients

2.5 lbs. (3.2 kg) 2-row pale malt
1.0 lb. (0.45 kg) Munich malt (10 °L)

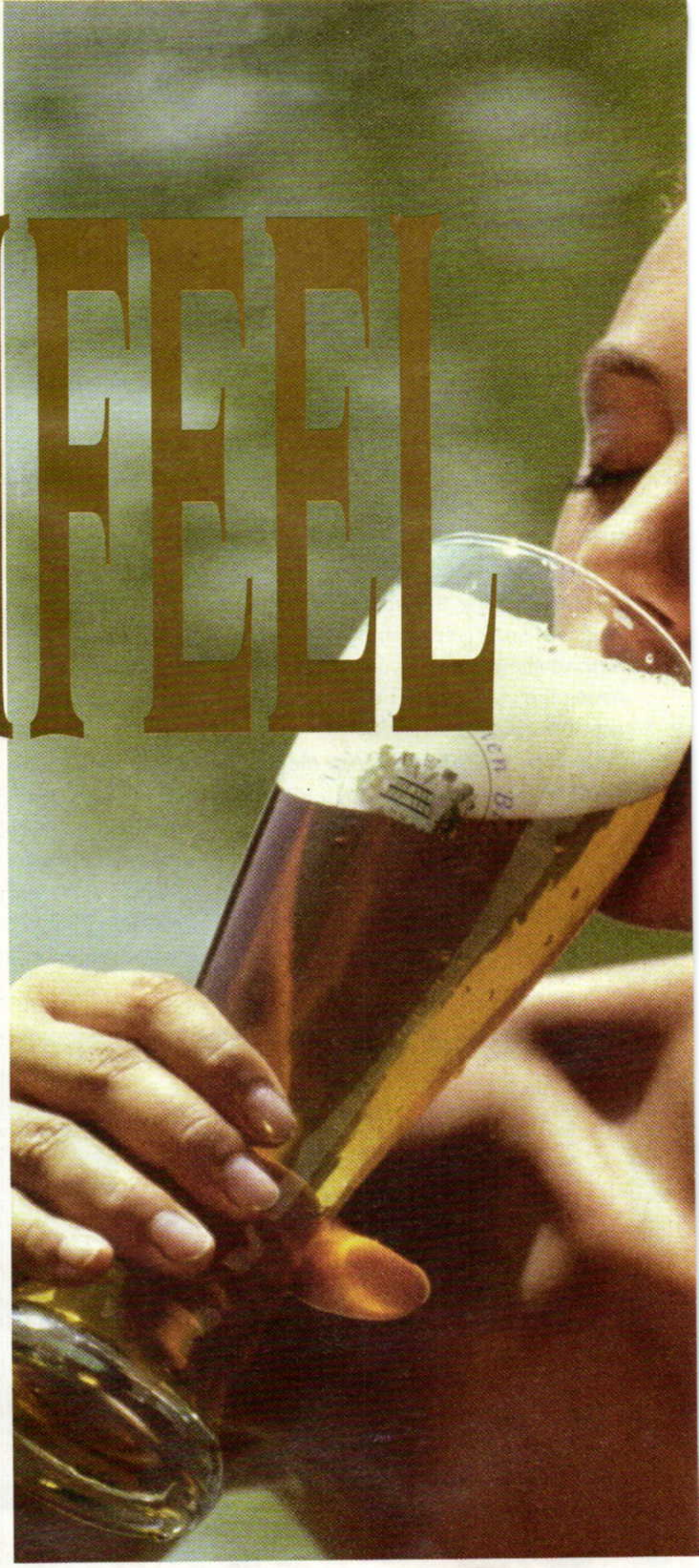
- 0.5 lbs. (0.23 kg) crystal malt (30 °L)
- 1.0 lb. (0.45 kg) cane sugar
- 3.3 lbs. (1.5 kg) Muntons Light liquid malt extract (late addition)
- 0.25 lbs. (0.11 kg) Muntons light dried malt extract (secondary)
- ¼ tsp. yeast nutrients
- 1 tsp. Irish moss
- 1 oz. (28 g) Columbus, Tomahawk, Zeus, Simcoe, Chinook or Nugget hops (75 min.) (second choices: Magnum, Summit, Newport, Horizon or Sun)
- 1 oz. (28 g) Glacier, Mt. Hood, Palisades, Santiam, Sterling, Strisselspalt or Vanguard hops (secondary) (second choice: your favorite hop among the choices you have)
- Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) or Safale US-05 yeast (~1.25 qt./1.25 L yeast starter)
- 1 cup corn sugar (for priming)

Step by Step

Place crushed grains in a large nylon steeping bag. Heat 5.5 qts. (5.2 L) of water to 161 °F (72 °C) and pour into a 2.0-gallon (7.6-L) beverage cooler. Submerge grain bag, stir grains and let mash at 150 °F (66 °C) for 45 minutes. While grains are mashing, heat another 5.5 qts. (5.2 L) of water to 170 °F (77 °C). Also, add 4 qts. (~4 L) of water to your brewpot and bring it to a boil. After the mash, recirculate 2 or 3 quarts (~2–3 L) of wort, then begin the runoff. Do this by collecting 2 cups of wort and adding it to your brewpot. Then add 2 cups of your 170 °F (77 °C) water to the top of the grain bed. Repeat this process until you have collected about 10 qts. (9.5 L) of wort, bringing your kettle volume to 3.5 gallons (13 L). (Keep heating your kettle during the wort collection, but don't bring it to a boil.) Once all the wort is collected, bring your wort to a boil. Once boiling, add the bittering hops to the French press and ladle in boiling wort until full. Let sit for 15 minutes, then press off hops. Pour hoppy liquid from French press into a clean container, cover and set aside. Scrape wet hops from French press to kettle. Boil these hops for 75 minutes. With 15 minutes left in the boil, add cane sugar, liquid malt extract, Irish moss and yeast nutrients to kettle. At end of boil, add hoppy liquid and let steep for 15 minutes before cooling. Cool wort and transfer to fermenter. Top up wort to 4.25 gallons (16 L) with water. Aerate wort and pitch yeast. Let ferment at 65–68 °F (18–20 °C). Once fermentation has stopped, boil dried malt extract in 1.0 gallon (3.8 L) of water. Add hops to French press and ladle 1 qt. (1 L) of hot wort into French press. After 15 minutes, pour off hoppy liquid into a sanitized bowl and cover. Add wet hops to remaining wort and boil for 30 minutes. Aim to reduce wort volume to 2 qts. (2 L). If wort volume dips below this, add boiling water to top up. Combine reserved liquid and boiled wort and cool. Transfer hoppy wort to secondary fermenter. Rack primary batch onto "hop shot" to make 5 gallons (19 L) of beer. Condition at 60–65 °F (16–18 °C) until renewed fermentation settles down and beer clears. Rack to keg or bottle.

by **Chris Bible**

MOUTHFEEL

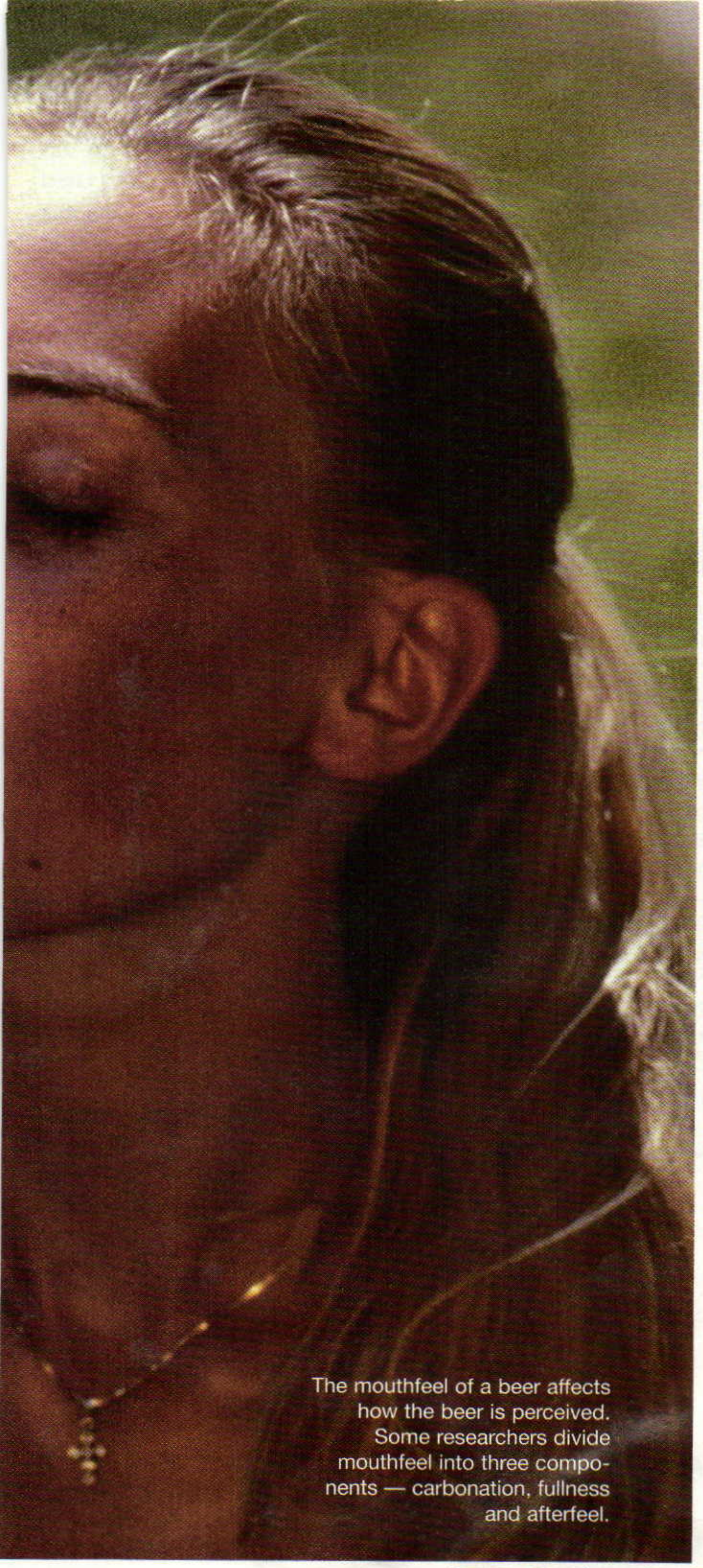


Whether a flavor or a sensation all its own, it is important to your beer.

Mouthfeel can be defined in numerous ways. One definition[1] states that mouthfeel is "a sensation perceived by the nerves in the skin of the mouth cavity resulting from thermal or chemical reactions." Another definition[2] states that mouthfeel is "those textural attributes of a food or beverage responsible for producing characteristic tactile sensations on the surfaces of the oral cavity." A third definition[3] states that mouthfeel is "a descriptive word used in the judging of beer samples to denote the amount of body a sample contains."

However it is defined, it is clear that the concept of mouthfeel is complex and is comprised of many factors that interact to create a particular feeling or sensation. A list of the factors that may play a role in mouthfeel is contained within the American Society of Brewing Chemists (ASBC) flavor wheel. Presently, mouthfeel is included on the ASBC flavor wheel as a subcategory of taste. On

MAKING **SENSE** OF THIS **SENSATION**



The mouthfeel of a beer affects how the beer is perceived. Some researchers divide mouthfeel into three components — carbonation, fullness and afterfeel.

the current wheel, mouthfeel is given the following descriptors:

Alkaline
Mouthcoating
Metallic
Astringent
Powdery
Carbonation
Warming

There have been proposals put forth to expand the flavor wheel in order to place mouthfeel characteristics on a level equal to aroma and taste characteristics[4]. Under this proposal, mouthfeel descriptors are broken out as follows. Mouthfeel encompasses three main attributes — carbonation, fullness and afterfeel. Descriptions under the heading of carbonation include sting, bubble size, foam volume and total carbon dioxide. Density and viscosity make up fullness. And finally, afterfeel consists of oily mouthcoat, astringency and stickiness.

This proposal is based largely on the research[5] performed by Langstaff, Guinard and Lewis at the University of California at Davis. In their research, they identified and evaluated the sensory attributes that make up the sensation that we label as mouthfeel. They evaluated 30 commercial beers using a panel of 20 judges. The 30 beers were selected as reference standards that represented the extremes of the attributes that were being tested. The mouthfeel attributes, definitions and examples of reference commercial beers that were used in their research are shown[5] in Table 1. Table 2 shows these nine sensory attributes grouped into their respective categories.

Their research showed that there was the degree of correlation between many of these sensory attributes. The correlation coefficients and degrees of significance of the correlation between these sensory attributes are shown in Table 3.

The numbers in Table 3 are correlation coefficients. A coefficient of (positive) 1 would mean the two attributes varied with each another in a linear manner. For example, if the judges

IN BEER

TABLE 1. Mouthfeel Attributes, Definitions and Reference Beers

Mouthfeel Attribute	Definition of Attribute	Commercial Beer Reference
Sting	Initial sharp pain intensity associated with carbonation	High=Kaliber
Bubble Size	Size of bubbles in foam	Large=Kaliber Small=Chimay Ale
Foam Volume	Extent of gas bubbles trapped in beer head	High=Sam Smith's Oatmeal Stout
Total CO_2	Amount of CO_2 in beer	High=Molson Light
Density	Perception of weight per unit volume of beer	High=Watney's Cream Stout
Viscosity	Resistance to flow under applied force within mouth	High=Oatmeal Stout and Watney's Cream Stout
Lingering Burn	Lingering pain in mouth	High=Kaliber
Oily Mouthcoat	Oil-like coating within the mouth	Extreme=Spaten Doppelspaten
Gritty Mouthcoat	Feeling of tiny granules coating the mouth	Extreme=Boulder Porter
Astringency	A puckering or constricting sensation within the mouth	High=Pilsner Urquell and Chimay Ale
Stickiness	Sensation of tougue sticking to palate	High=Chimay Ale

TABLE 2. Sensory Attributes Important to Mouthfeel

Major Characteristic Perception	Specific Sensory Attribute
Carbonation	Sting Bubble Size Foam Volume Total Carbon Dioxide
Fullness	Density Viscosity
Afterfeel	Oily Mouthcoat Astringency Stickiness

scored the density of one beer as 20% greater than another, and they also rated oily mouthcoat as 20% greater — and this pattern of correspondence between density and oily mouthfeel appeared in every single test — the correlation coefficient would be one.

A negative number indicates that the two numbers are related to each other in an inverse manner. For example, if you had several beers that were all brewed from the same original gravity (OG), final gravity (FG) and alcohol content would have a negative correlation coefficient — the

> "Variables can also be correlated simply as an artifact of what samples are included in a study."

lower the FG, the higher the alcohol.

A value of zero means the numbers show no correlation and numbers between 0 and 1 (and 0 and -1) indicate an intermediate level of correlation.

Variables can be correlated for a variety of reasons. The most obvious is that there is a real connection between them. One variable might, for instance, directly influence or determine the other. For example, the original gravity of a beer is strongly correlated to its alcoholic strength. (Attenuation also plays a role, though, so the correlation is less than 1.0.) Variables can also be linked to an underlying variable. To pick an example frequently used in statistic courses, cities with more churches have more crimes committed each year. Do churches cause crime (or vice versa)? No, this is because bigger cities have both more churches and more crime. Variables can also be correlated simply as an artifact of what samples are included in a study. If, for example, you conducted a study that looked at correla-

TABLE 3. Correlations Between Attributes Associated With Mouthfeel

Sensory Attribute	Sting	Bubble Size	Foam Volume	Total CO_2	Density	Viscosity	Oily Mouthcoat	Astringency	Sticky
Sting	1.0	—	—	—	—	—	—	—	—
Bubble Size	0.78^{c}	1.0	—	—	—	—	—	—	—
Foam Volume	0.46^{b}	0.11	1.0	—	—	—	—	—	—
Total CO_2	0.81^{c}	0.60^{c}	0.78^{c}	1.0		—	—	—	—
Density	-0.75^{a}	-0.80^{a}	-0.13	-0.64^{a}	1.0	—	—	—	—
Viscosity	-0.78^{c}	-0.85^{c}	-0.08	-0.61^{c}	0.96^{c}	1.0	—	—	—
Oily Mouthcoat	-0.75^{c}	-0.75^{a}	-0.25	-0.70^{c}	0.87^{a}	0.83^{c}	1.0	—	—
Astringency	-0.20	-0.41	0.08	-0.29	0.55^{b}	0.52^{b}	0.46^{b}	1.0	—
Sticky	-0.63	-0.82^{a}	0.04	-0.50^{b}	0.84^{a}	0.88^{c}	0.79^{c}	0.69^{c}	1.0

tions among three Irish stouts (pushed with nitrogen), three Scottish 80/- ales and three Belgian tripels, you would find some interesting correlations between alcohol levels, color, carbonation and the longitude of the brewery location. These correlations would be much weaker — or, more likely, non-existent — if you instead chose to study nine American pale ales.

Some of the correlation coefficients in Table 3 have the superscripted letters "a," "b" or "c" next to them. These indicate how statistically significant the correlation is between them. Statistical significance is a way to assess the likelihood that a correlation arose by chance. In a small study, even completely unrelated variables may have a non-zero correlation coefficient and sometimes, the coefficient can be fairly large. A test for statistical significance, however, should indicate if the correlation was unlikely to be due to chance.

In this study, the coefficients with a "c" next to them were the most highly significant, followed by coefficients with "b" and "a." Coefficients without a letter next to them were found not to have a statistically significant correlation. Note that a statistically significant correlation does not mean that one of the variables causes the other or that there is practical or meaningful connection between the two. It just means that — by the numbers — the association between the variables appears not to be a product of chance.

Looking at Table 3, we see a variety of different correlations. Some seem to make

TABLE 4. How to Influence Sensory Attributes of Mouthfeel

(Continued on page 56)

Major Characteristic Perception	Sensory Attribute	How to Influence Sensory Perception of the Attribute
	Viscosity	**To Increase:** Decrease total CO_2 level. Decrease bubble size. Increase amount of arabinoxylan, beta-glucans and dextrins. Increase FG. **To Decrease:** Increase total CO_2 level and bubble size. Decrease amount of arabinoxylan, beta-glucans and dextrins.
Afterfeel	Oily Mouthcoat	**To Increase:** Decrease total CO_2 level. Increase density. Increase FG. **To Decrease:** Increase total CO_2 level. Decrease density. Decrease FG.
	Astringency	**To Increase:** Oversparge. Increase sparge temperature. Decrease dextrin content. Raise pH of sparge water. Overmill grain. **To Decrease:** Don't oversparge. Reduce sparge temperature. Increase dextrine content. Lower pH of sparge water. Don't overmill grain.
	Sticky	**To Increase:** Decrease bubble size. Increase density. Increase viscoosity. Increase FG. Increase astringency. **To Decrease:** Increase bubble size. Decrease density. Decrease viscosity. Decrease FG. Decrease astringency.

TABLE 4. How to Influence Sensory Attributes of Mouthfeel (Continued from page 55)

Major Characteristic Perception	Sensory Attribute	How to Influence Sensory Perception of the Attribute
Carbonation	Sting	**To Increase:** Increase total CO_2 level. Decrease viscosity and density by decreasing dextrin content or FG of finished beer. **To Decrease:** Decrease total CO_2 level. Increase viscosity and density by increasing dextrin content or FG of finished beer.
	Bubble Size	**To Increase (perceive bubble size to be large):** Increase CO_2 level. Decrease viscosity and density by decreasing dextrine content or FG of finished beer. **To Decrease: (perceive bubble size to be small):** Use nitrogen blend gas, decrease CO_2 level. Increase viscosity and density by increasing dextrine content or FG of finished beer.
	Foam Volume	**To Increase:** Increase total CO_2 level. **To Decrease:** Decrease totol CO_2 level.
	Total CO_2	**To Increase:** Increase total CO_2 level. **To Decrease:** Decrease total CO_2 level.
Fullness	Density	**To Increase:** Decrease total CO_2 level. Increase viscosity by increasing dextrine content or FG of finished beer. **To Decrease:** Increase total CO_2 level. Increase viscosity by decreasing dextrin content or FG of finished beer.
	Viscosity	The viscosity of beer is influenced by the macromolecules present. It has been found that the presence of arabinoxylan, beta-glucans and dextrins all increased the viscosity of beer.

sense. Others seem a bit more mysterious. For example, foam volume is strongly, and significantly, correlated with total CO_2. This is almost certainly due to a causal relationship between CO_2 and foam. On the other hand, astringency and oily mouthcoat show a moderate, and significant, correlation. Why these are correlated — and foam volume and bubble size show only a weak, and insignificant, correlation — is tougher to explain.

The results in Table 3 could provide suggestions regarding which brewing variables to adjust in order to influence the perception of a particular sensory attribute of mouthfeel. Table 4 provides some guidelines regarding how to manipulate brewing variables in order to influence a specific perception of the important sensory attributes of mouthfeel, based on the results of this study. Keep in mind of course, these suggestions are all based on correlation data from this one study, taking the view that some of these correlations may prove to be spurious, but it's doubtful they all are.

Although mouthfeel may be one of the least understood aspects of beer flavor[6], it is a very important factor in the overall enjoyment of beer. Any brewer who understands and properly manipulates the variables that drive the important sensory attributes of mouthfeel will be able to produce the desired results for any beer.

Chris Bible is a frequent contributor to Brew Your Own.

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Buffers

...and what they mean to homebrewers

by Chris Colby

In this installment of "Advanced Brewing," we'll take a look at buffers and what advanced homebrewers should know about them. I will assume that you have knowledge of the basics of acids, bases and pH. (If not, see Chris Bible's article, "The Principles of pH," in the September 2007 issue of BYO.) For serious brewers, understanding pH can be an avenue to improving their beers. However, without an understanding of buffers, and buffering capacity, it can also cause them to venture down some blind alleys. This article will get fairly chem-nerdy, but I'll summarize the key points as we go along and give a summary of the practical information at the end.

Armed with our knowledge of acids and pH, let's conduct a quick thought experiment. Let's imagine we have a large beaker of pure water — water with no minerals or anything else dissolved in it. Let's also say we have a dropper bottle full of a strong acid (hydrochloric acid, HCl, for example) and a pH meter. Now, let's imagine we take the pH of the pure water. It should be 7 if the meter is calibrated and we take the reading at room temperature. Now, let's say we keep the pH electrode in the water and add drops of acid, checking on the pH after each drop. What you would see if you did this experiment is that the pH would lower each time a drop of acid was added.

Every college chemistry major has done (or at least should have done) this experiment. I remember sitting in lab with my beaker of deionized water, magnetic stir bar spinning, adding drop after drop of acid and making a graph of the nice smooth curve it generated.

Now let's imagine a second experiment that adds a slight twist to the previous experiment. Let's say we repeat the experiment, except we add a buffer to the water. What's a buffer? The results of this experiment — that I did for real in introductory chemistry "a few" years ago — will show you. Initially, as the drops of acid are added, the pH drops at the same rate it did in the first experiment. However, at some point, the rate of pH change rapidly slows to a halt. (What point that is depends on what the buffer was.) For awhile, adding acid does not change the pH. Then, suddenly, the pH will begin to drop again, at the same rate it did in the pure water solution.

Buffers

As the second experiment shows, a buffer is a substance that resists pH change within a limited pH range. It is usually a combination of a weak acid and its conjugate base (or sometimes weak base and its conjugate acid). The conjugate base is usually supplied as the salt of the acid. The salt of any acid is the acid with one or more of the acidic hydrogens replaced with something else. For example, phosphoric acid (H_3PO_4) has three sodium salts, monosodium phosphate (NaH_2PO_4), disodium phosphate (Na_2HPO_4) and trisodium phosphate (Na_3PO_4).

You can write the general equation of a buffer system as:

$$HX + H_2O \longleftrightarrow H_3O^+ + X^-$$

On the left side of this equation, HX is the acid and H_2O is water. In the formula for the acid, H represents a hydrogen ion and X is any ion that can combine with a hydrogen ion to form a weak acid. On the right hand side of the equation, X^- is the conjugate base of the acid and H_3O^+ is a hydronium ion. (When the acid breaks up into X^- and H^+, the H^+ instantly interacts with a water molecule (H_2O) and becomes H_3O^+.) For example, if you added acetic acid (CH_3COOH) and sodium acetate (CH_3COONa), you would have a buffer system as described above. The "X" would be a CH_3COO- group. (The sodium (Na) does not play a role in the buffering, so it is ignored in the equation.)

The arrows in the equation represent an equilibrium. HX molecules would constantly be splitting apart at some rate, in the presence of water, to form H_3O^+ and X^- ions. Likewise, these two ions would constantly be combining to form water and the weak acid (H_2O and HX) at some other (usually much lesser) rate.

Recall that pH is the negative log of the hydronium ion content. So whatever the concentration of the hydronium ion is, $pH = -\log[H_3O^+]$. So, the buffer solution would exist at a certain pH. This can be calculated as:

$$pH = pK_a + \log [X^-]/[HX]$$

where pK_a is acid dissociation constant of the weak acid and $[X^-]$ and [HX] are concentrations of X^- and HX, respectively. dependent on the concentration of acid (HX) and concentration of the conjugate base (X^-).

If you don't know, don't worry about what an acid dissociation constant is. The only thing you need to see in the above equation is this — by adding different amounts of weak acid and the base/salt to a buffer solution, you can change the pH and make a buffer solution for any pH value you want. (More on this later.)

Now, let's get to the interesting part. Imagine you add some strong acid to this buffered solution. In solution, the acid would dissociate and contribute H_3O^+ ions — H^+, combined with water — and its conjugate base to the solution. (The conjugate base for the strong acid would differ from the conjugate base for the weak acid, the "X" above.) The "extra" H_3O^+ ions would combine with X^- ions and form HX and H_2O. The newly-formed HX would join the pool of HX in solution and break into H_3O^+ and X^- at the same rate as before. The upshot of all these chemical interactions is that, due to the equilibrium between the reactions, the buffered solution would essentially "absorb" the acid and remain at nearly the same pH.

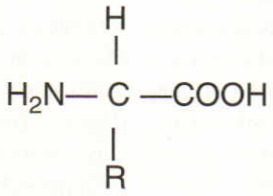
Of course, you could keep adding acid until the buffer is overwhelmed. Once this occurs, the pH would again change more quickly with the addition of more acid, almost as if you were adding the acid to a pure water solution.

Before we go on, let's summarize everything up to this point. Buffers resist

Amino Acids pH and Properties

Amino acid	pI
Glycine	5.97
Alanine	6.00
Valine	5.96
Leucine	5.98
Isoleucine	6.02
Methionine	5.74
Proline	6.30
Phenylalanine	5.48
Tryptophan	5.89
Asparagine	5.41
Glutamine	5.65
Serine	5.68
Threonine	5.60
Tyrosine	5.66
Cysteine	5.07
Aspartic acid	2.77
Glutamic acid	3.22
Lysine	9.74
Arginine	10.76
Histidine	7.59

Amino acid (general structure)



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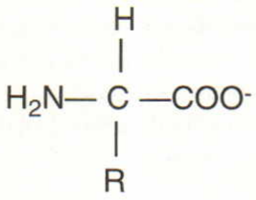
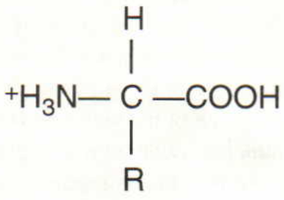
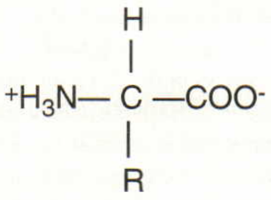


Amino acid (pH < pI)



Amino acid (pH = pI)



pH change, but this buffering capacity only exists within a certain pH range. I'll also add one more comment that should be obvious, but is worth saying explicitly — the more buffering agent in solution, the more acid it takes to overcome its buffer capacity.

Two important buffers

In brewing liquor, wort and beer, there are a variety of different acids and ions that can form buffer pairs. If you have water that is high in carbonates, you can have a buffering solution composed of carbonic acid (H_2CO_3) and bicarbonate (HCO_3^-). Likewise, phosphoric acid (H_3PO_4) and various phosphates (including $H_2PO_4^-$, $NaHPO_4^-$, $Na_2PO_4^-$, etc.) can form buffer pairs. Both carbonates and phosphates exist in different forms at different pH values, and can thus form different buffering systems (at different pH values).

In water that is high in carbonates, you might need to add quite a bit of acid if you were adjusting the pH of your brewing liquor. But, the phosphates are a bit more interesting. Remember the equation for calculating the pH of a buffer solution? Remember how I said that, by varying the amount of the ingredients, you could make a buffer solution for any pH. Well, by mixing various phosphate compounds — which are safe for human consumption — you can make a buffer to hold your mash at any value you wish.

Since phosphoric acid has three hydrogens it can give up, the calculations are a little more involved than the equation on the previous page (which are based on a simple acid with a single donatable hydrogen). However, there are web-based calculators that will do the work for you. Search for "phosphate buffer" and "calculator" or "calculation" or "preparation" and you will find all sorts of help. For example, if you wished to make 10.0 mM solution with a pH of 5.2, you would mix 0.135% monosodium phosphate (monohydrate) and 0.0057% disodium phosphate (heptahydrate) into your buffer solution.

(The unit mM stands for millimolar, a measure of concentration. The hydrates mentioned are just the form of the chemical. Some "dry" powdered chemicals have water molecules associated with them. For example, disodium phosphate (heptahydrate) would have seven water molecules associated with each molecule of disodium phosphate.)

So let's give a practical example. Let's say you were planning to brew 5 gallons (19 L) of pale ale and planned to mash in with 4.0 gallons of water (15 L). To attempt to buffer your mash at a pH of 5.2, you wish to make a 10.0 mM solution for your brewing liquor. Fifteen liters of water weighs 15 kilograms. So you would need [0.00135 X 15 kg =] 20 g of monosodium phosphate (monohydrate) and [0.000057 X 15 kg =] 0.86 g of disodium phosphate (heptahydrate) to make this buffered brewing liquor. (I used metric units for these calculations, as that made things much easier.)

Given the mineral content of your water, composition of your grist and thickness of your mash, you may need to make the solution stronger or weaker (but not so strong it affects the flavor of your beer.) For solutions stronger or weaker than 10.0 mM, you would need to add proportionally more or less of the phosphate ingredients. The commercial product 5.2 pH stabilizer, by Five Star Chemicals — which claims to be "a food-grade blend of phosphate buffers" — recommends a usage rate of 1 tbsp. per 5 gallon (19 L) batch. Obviously, the units have shifted here, but that's in the ballpark of the amounts calculated above. If you try this, test the pH of your mash with a pH meter and, of course, see if you taste any difference in your finished beer. Also, when mixing buffer solutions, it is often necessary to fine tune the pH with a little acid or base. A little phosphoric acid should be used if your pH is just a little bit above the target.

Acids and their salts aren't the only things with the ability to buffer. Next we'll look at amino acids, biological molecules that are found in relatively high concentrations in wort.

Amino acids

One class of molecules found in wort are amino acids. Amino acids are the building blocks of proteins and come from the malt and the breakdown of proteins in the malt. An amino acid can be pictured as a central carbon atom with 4 "arms." One arm is a hydrogen atom. Another arm varies, depending on the amino acid and is often symbolized with a "–R." The R group can be as simple as a hydrogen atom, in the case of the amino acid glycine, or a much larger collection of atoms (as in the heterocyclic R group in tryptophan). The third arm is a carboxyl group, which consists of a carbon atom, two oxygen atoms and a hydrogen atom (in chemical short hand, –COOH). The final arm would be an amino group, consisting of a nitrogen atom and two hydrogens ($-NH_2$).

Like many molecules, amino acids are either positively charged, neutral or negatively charged, depending on the pH of the solution they are dissolved in. In a high pH solution, the carboxyl group is prone to losing a hydrogen ion and leaving behind a $-COO^-$ group, leaving the amino acid with a net negative charge. In a low pH solution, the amino group is prone to picking up a hydrogen ion to form a $-NH_3^+$ group. This gives the molecule a net positive charge. At a certain pH, called the isoelectric point, the amino has both a $-COO^-$ and a $-NH_3^+$ group. The molecule has a net neutral charge, but positive and negative portions of the molecule. The isoelectric point varies for each different amino acid.

Amino acids and other molecules that have positively and negatively charged ends are called zwitterions. (The term comes from the German word "zwitter" which means hermaphrodite and is pronounced "tsvitter-ion.") Just as a weak acid and its conjugate base will buffer a solution at its pK_a, a zwitterion will buffer a solution at its isoelectric point (pI). If acid is added to a solution, the "minus end" will absorb some of the hydrogen ions. If a base is added, the "plus end" will absorb some of the negation ion.

The take-home message

So let's combine what we've learned here with some other stuff we should know and see what the take-home message of this article should be.

Unless it is completely devoid of dissolved minerals, your brewing water is likely to have some things dissolved in it that will act as a buffer. These buffers will resist a change in pH within their given range. For this reason, it's impossible to say "add X fl. oz. (mL) of acid to Y quarts (L) of water to change the pH by Z units." Unless you know exactly what's dissolved in your water, you don't know what pH values it's buffered at and how strong the buffer is. When adjusting the pH of water, it's easier to just add acid (or base) and check the result with a pH meter. The concentration of acids, bases and buffers in tap water is tiny compared with the concentration of acids and buffers in wort. Amino acids are strong buffers and are present in wort in concentrations greater than any mineral dissolved in your brewing liquor. Thus, the pH of your brewing liquor is relatively unimportant. The pH of your brewing liquor does not determine your mash pH. In fact, almost all brewing waters will yield a mash pH in the low to mid 5 range, regardless of water pH. For this reason, adjusting your water pH is of little use (unless you know from experience that adjusting your water to a certain pH yields a given pH in the mash). Likewise, the pH of your sparge water does not determine the pH of the wort you collect. Even near the end of wort collection, the weak wort in your grain bed is more heavily buffered than your water.

You can mix up buffer solutions to a given pH. In brewing, phosphate buffers are used by some brewers to control mash pH. At the concentrations they are used, phosphate buffers are not harmful and won't alter your beer's flavor. Finding the minimum amount of buffer solution required may take a few trials.

The concepts of buffers and their effects on pH can be a little intimidating when you first encounter them. But, they do have some practical value (and you do get to say "zwitterion" a lot).

Chris Colby is Editor of Brew Your Own.

Save the Wort!

Build your own DIY pickup tube

Story and photos by Forrest Whitesides

To make this pickup tube, you will need a propane torch and soldering supplies.

1

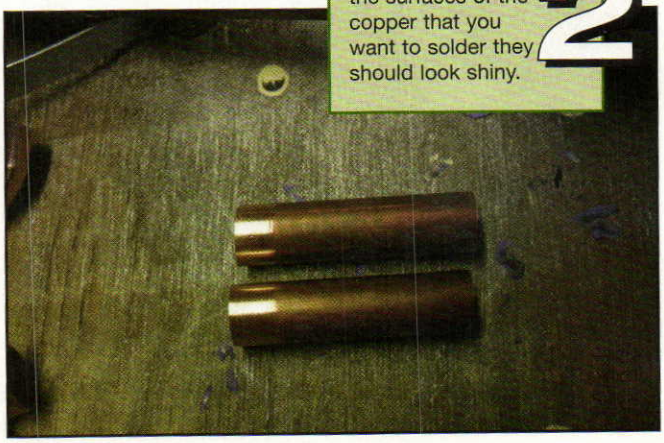
The cost of just about everything is climbing ever skyward, and homebrewing is no exception. While the equipment and hardware for brewing are generally a one-time cost (until you upgrade, anyway), the fresh ingredients that are essential to our beloved hobby/obsession are an ongoing and increasing expense. Therefore, it is in your own financial best interest to collect every last bit of hot wort from your brew kettle every time you brew a batch. One great way to do this is to add a pickup tube (also called a dip tube) to the ball valve bulkhead on the inside of your kettle.

Essentially, a pickup tube allows for the draining of wort that is in the dead space below the bottom of the valve. Depending on how high your valve is mounted, this dead space can account for quite a bit of beer. The valve in my kettle is mounted very low, and the liquid that sits below the valve turned out to be 1.6 liters (or 54 ounces — about 4.5 standard American beers) in volume. I don't know about you, but I could always use another four or five homebrews for the same money.

This project is designed for kettles with a ball valve installed. If you have a kettle without a valve, I highly suggest you read the "Projects" column in the March-April 2007 issue of *Brew Your Own*, as it outlines a simple and effective method for adding a valve (and optionally a thermometer as well) to either aluminum or stainless steel kettles. This is a very useful and inexpensive improvement to your equipment that will save time and effort every time you brew.

Pickup artist

Like most things DIY, there are more than a few ways you can go about fabricating a pickup tube. For several factors — including cost, availability of parts, durability, and simplicity — I selected copper as the main material for this project. I made both a single-tube and double-tube versions, but the assembly of the latter version is outlined here.



Once you brush the surfaces of the copper that you want to solder they should look shiny.

2

For the sake of stability during the boil, we're going to solder most of the pickup tube connections. That means you'll also need a propane torch, some lead-free silver-bearing solder, and solder flux (Figure 1). I recently bought a kit with these things included for about $20 at a big-box hardware store.

The process of soldering copper is simple to learn (the basics), and it's a great general home-improvement skill to have as well. There are several excellent illustrated introductory guides online that you can use for reference to help you get started, but here are the basic steps:

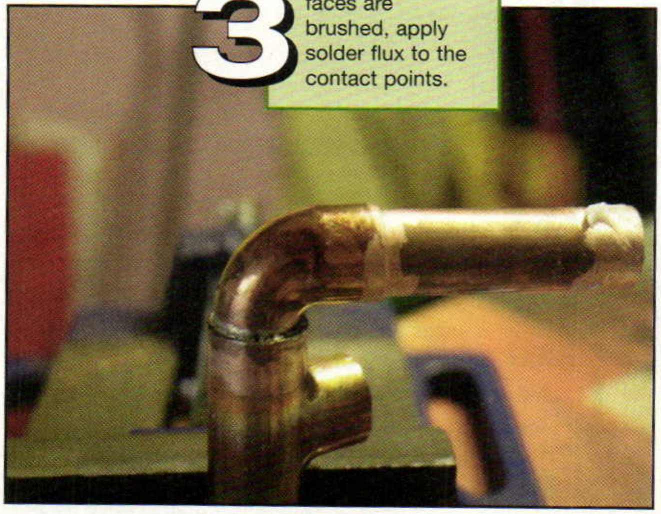
PARTS AND TOOLS LIST

Parts: Total cost of materials should be less than $10.

- (2) 4-inch (10 cm) sections of ½-inch hard copper pipe (approximate length)
- (1) ½-inch (1.27 cm) copper male pipe thread fitting
- (1) ½-inch (1.27 cm) copper T connector
- (2) ½-inch (1.27 cm) copper 90-degree street elbow fittings
- (2) ½-inch (1.27 cm) copper end cap fittings (optional)

Tools:

- propane torch
- lead-free silver-bearing solder
- solder flux



3 Once the surfaces are brushed, apply solder flux to the contact points.

• Use an abrasive (such as sandpaper or a wire brush) to scuff all surfaces of the copper that will come into contact with the solder. The copper should get noticeably shinier (Figure 2)

• Apply a light coat of solder flux to the scuffed surfaces (Figure 3)

• Put the fittings together, apply direct heat with the torch for approximately 20–30 seconds, remove the flame, and then touch a short length of solder to the heated joint. If the solder doesn't melt and suck into the joint, reapply the heat for a few more seconds and try again.

Safety first! Be sure to operate a propane torch only in a well-ventilated area. If you're in a garage, keep the door open for the entire time you use the torch.

4 When you fit the pipes into the pot, angle them pointing down.

Check for fit

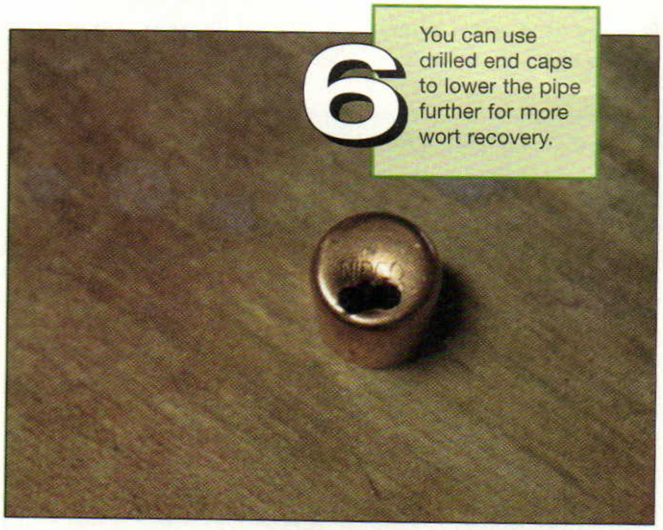
Before you get to any soldering, first screw the male pipe thread fitting into the bulkhead and assemble the pipe sections together with the T fitting and elbows (and optionally the end caps — see Figure 6). The ideal fit will have the end of the pipes a fraction of an inch short of touching the edge of the kettle. You should also angle the pipes down so that they rest on the bottom of the kettle (Figure 4). Once the fit is proper, use a Sharpie or similar to put a mark on both the T fitting and the two elbows (Figure 5). This will aid in the proper alignment of the fittings when you solder them together. I can tell you from experience that trying to eyeball the proper angle will likely yield disappointing results.

5 Mark the T fitting and two elbows to align the fittings when you solder.

Cap it off (or not)

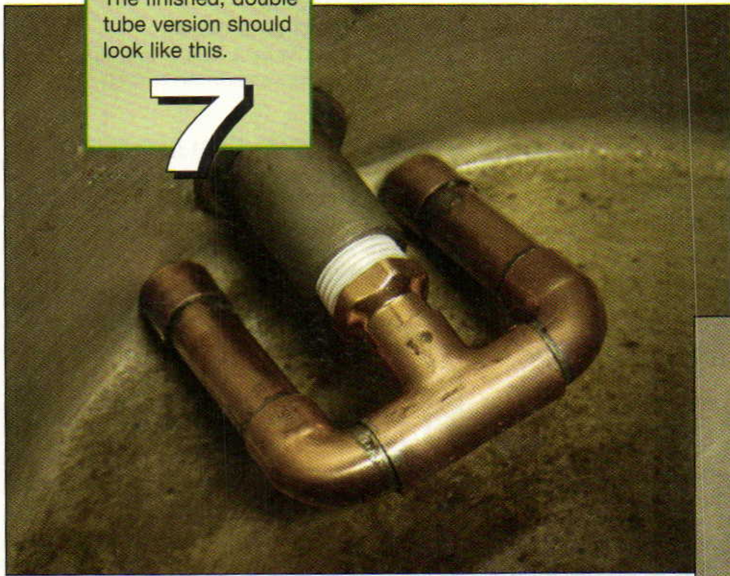
Just adding a pickup tube itself will greatly improve wort recovery, but while we're at it, let's get really greedy and go a step further. The pickup tube will stop working when the wort level drops below the top of the pipe opening. So we're going to effectively lower the pipe opening to get more wort. This can be accomplished in one of two ways: crimp the end of the pipe with pliers, or drill out the bottom half of an end cap and solder it on. I used drilled end caps (Figure 6), but crimping works just as well.

Although you'll get more wort from the kettle this way, the flow rate will also drop off. If you normally chill with an immersion chiller, this probably won't affect your setup. If you use a counterflow chiller, the reduced wort flow will also likely mean you'll need to adjust the cooling water flow rate accordingly.



6 You can use drilled end caps to lower the pipe further for more wort recovery.

All that remains is to solder the copper fittings together. Do not, however, solder the T joint to the male pipe thread fitting, as this will make your pickup tube next to impossible to attach to the valve's threaded bulkhead fitting. If the main part of the pickup tube assemble doesn't fit snugly in the threaded fitting, you



The finished, double tube version should look like this.

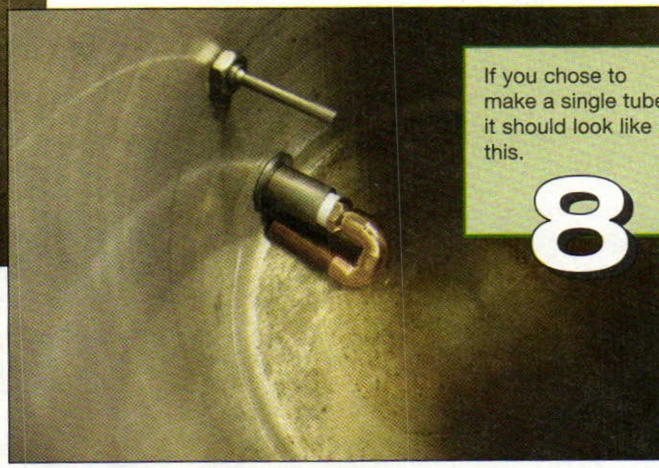
7

can very lightly crimp the edges of the fitting to reduce the size of the opening (thus facilitating a tighter fit).

Whirlpool for best results

A pickup tube works best when used in conjunction with the whirlpool technique (described in detail on page 12). By moving the hop particulate and hot/cold break coagulate to the center of the kettle, the pickup tube can pull clearer wort from the edge and will be far less likely to get clogged. Enjoy the extra homebrew, and happy brewing!

In addition to writing about homebrewing for Brew Your Own, *Forrest Whitesides is also the managing editor of a medical journal based in Parsippany, New Jersey.*



If you chose to make a single tube, it should look like this.

8

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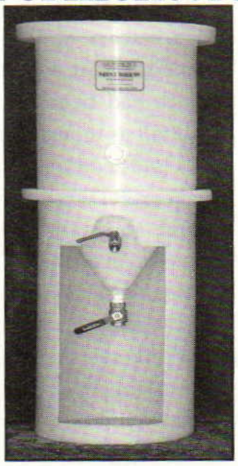

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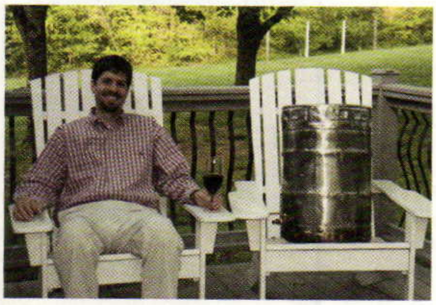
How a wine kit opened one brewer's mind

J.L. Hicks • Chapmansboro, Tennessee

As I recall, it was a winter evening late last year when I made my declaration. My wife was reading by the fireplace and I was enjoying a black ale that I had brewed about six months earlier.



J.L. decided that homebrewing and winemaking can live in harmony.

"I have decided to quit making beer," I stated in my most convincing voice.

"Um-hum," replied my wife absently. Apparently she had heard me say this before.

"No, I am serious this time! I am no longer making beer. I will buy beer in the stores like most other people," I insisted.

"Um-hum," replied my wife again. She had heard that one too. Most likely it was peppered with a few well-placed expletives and coincided with an ill-timed brewing mishap.

"Well," I said, after she continued to ignore my life-changing proclamation, "aren't you going to ask what I will do instead of brewing beer?"

When it comes to my hobbies, I am quite attuned to my wife and I know her like a favorite ale recipe. The thoughts that passed though her mind in that split second were something like this:

"What is he going to get into now? Oh, please don't let it be moonshining. He could blow up the whole house doing that! Plus, he told me that was illegal! What is he going to do with all the equipment he has in the basement? What is this going to cost? OH NO, what is he going to do to my kitchen this time?!"

"Why would you quit making beer? You love brewing," she said sweetly, realizing that brewing suddenly looked a lot better than it had a few minutes before.

"I need to expand my horizons," I insisted, "I am a renaissance man and I want to open myself up to new things. Plus, you like wine so it will be something we both enjoy."

I had an image in my mind of a dusty room in our basement that did not exist, with wine racks from floor to ceiling. Everyone had to start somewhere, right? I would plant vines, make wine, expand and maybe even give the vineyard tours myself. Of course at the moment I had five carboys and some grapevines that had yet to produce enough grapes to keep the local birds interested. Overall, I was off to a good start. My wife turned her interests back to her book with a somewhat vexed look that was not there a few minutes ago.

The transition from beer to wine was much less difficult than I expected. As a matter of fact, most of the equipment I used for beer works equally well when making wine. I had some concerns about my lack of experience in winemaking so I chose a Pinot Grigio kit and a new six-gallon (23-L) glass carboy.

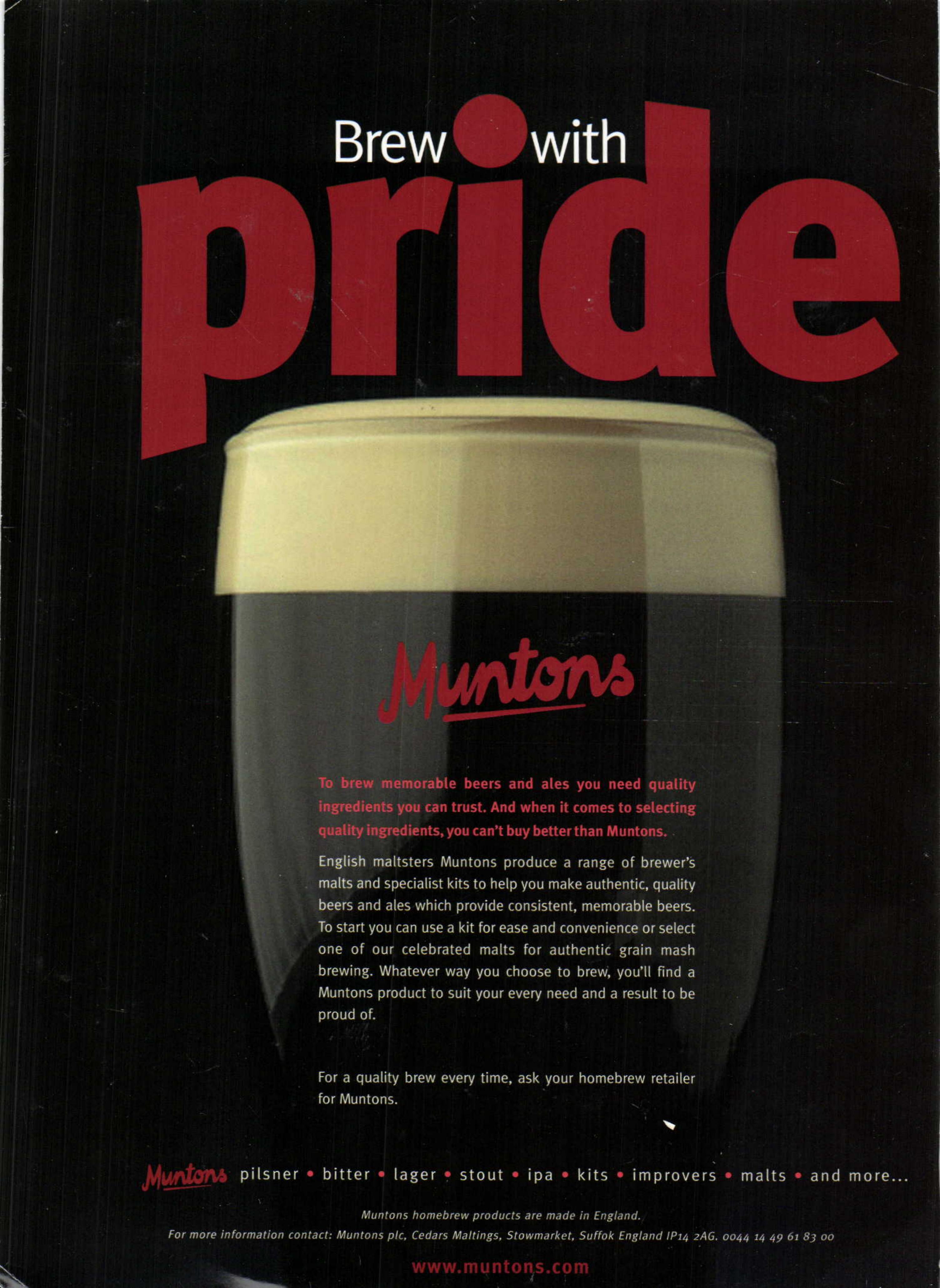
I began by sanitizing all my equipment and getting out my large brew kettle named Barney (I am going under the assumption that all brewers name their kettles and carboys). I sat Barney aside for the moment and read the instructions. Step one did not require a long slow boil. Barney stared at me accusingly but said nothing. I read on. The remainder of the process did not require a long slow boil either. As a matter of fact, there was no need for a brew kettle at all (I had a feeling Barney and I might be spending a lot less time together in the future). I would have to retire my hop bags, my gas cooker and my mash tun as well! I would have to start making new friends in this endeavor. Well, no one said becoming a renaissance man would be easy.

I followed the instructions that came with my wine kit, checked my specific gravity (exactly where it needed to be), checked the must temperature, pitched my yeast and . . . that was it. I sat stunned in the kitchen as Barney looked on in infuriated silence. Is this what retired people complain about when they leave the workforce? My first kit beer took at least two hours before I could pitch any yeast. This whole process was done in 20 minutes and my wife's kitchen had a different look about it. It was clean. Maybe wine was the way to go after all.

I deserved a beer to celebrate this new boon. I reached into the refrigerator and found an India pale ale I had made over the summer that I was very proud of. I put oak chips in the secondary fermentation which gave it a really nice, dry finish. But enough about that; I was now a winemaker and I left the beer making to those who wanted to spend afternoons watching for boil-overs, making sure hop bags didn't stick to the bottom of the kettle and cleaning the kitchen. I thought, at that point, I was going to enjoy a much simpler way of life.

Over the next few weeks, the wine behaved exactly as the instructions said it would. It cleared beautifully and turned a nice golden color. I cleaned and sanitized thirty wine bottles, filled them, corked them and sat them in what would be my new wine cellar. As I contemplated the overall experience of my first batch of wine, I knew that something was wrong. It wasn't in the wine itself, after countless bad batches of beer; I knew what failure tasted like. It wasn't in the winemaking, which had been an enjoyable venture. I just felt as though something was missing.

Suddenly, it came to me. My wife was right again! What I missed was the smell of hops, the satisfaction of a successful starch conversion and the taste of barley. I missed making beer. I had been too quick to set aside my brewing, especially when both interests complement each other. It is possible to do both! A true renaissance man would have known that — my wife knew it. In the end, I found that learning a new craft does not mean completely leaving another behind, and that I should listen to my wife on occasion.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