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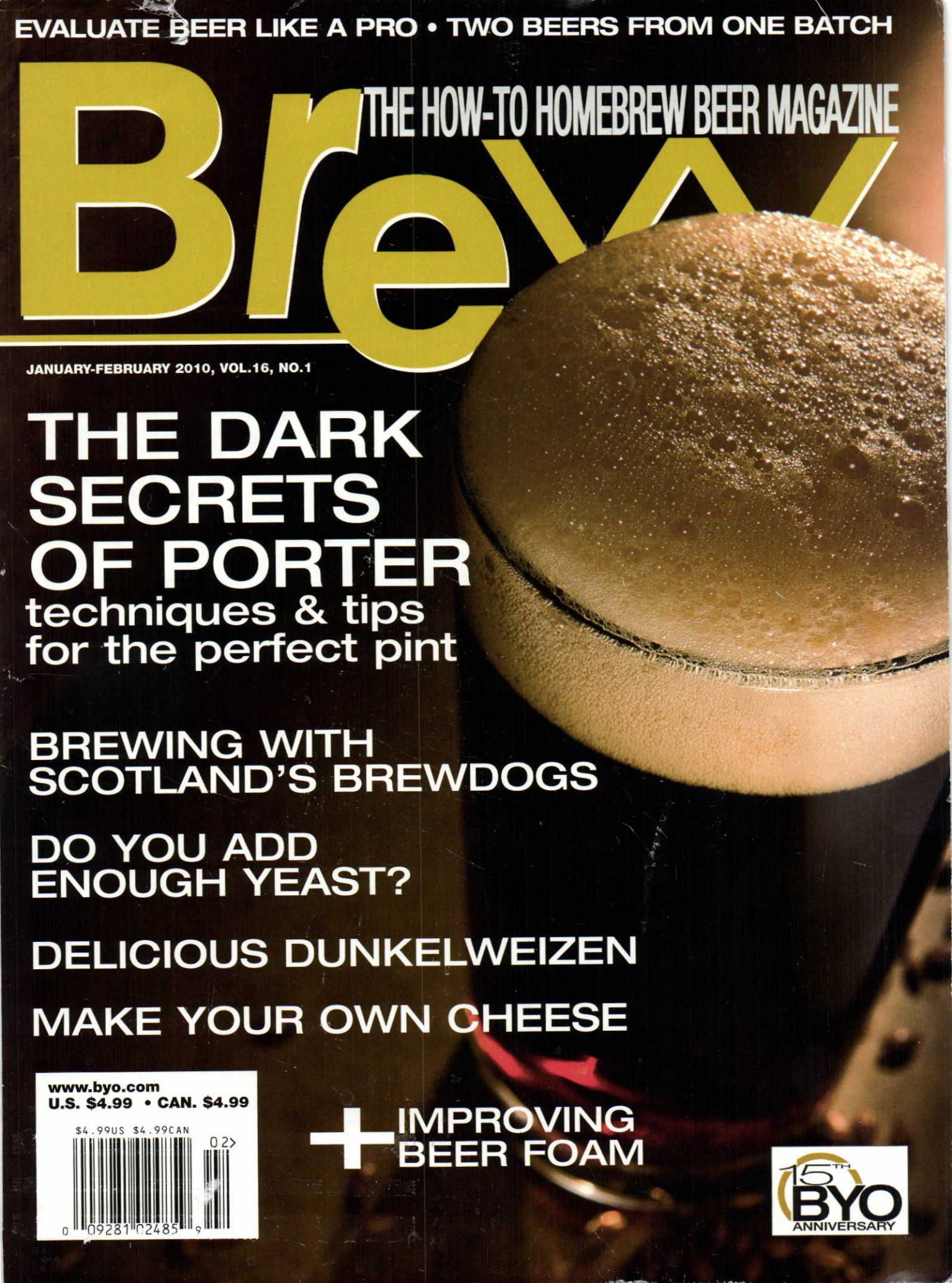
BrewY

THE HOW-TO HOMEBREW BEER MAGAZINE

JANUARY-FEBRUARY 2010, VOL.16, NO.1



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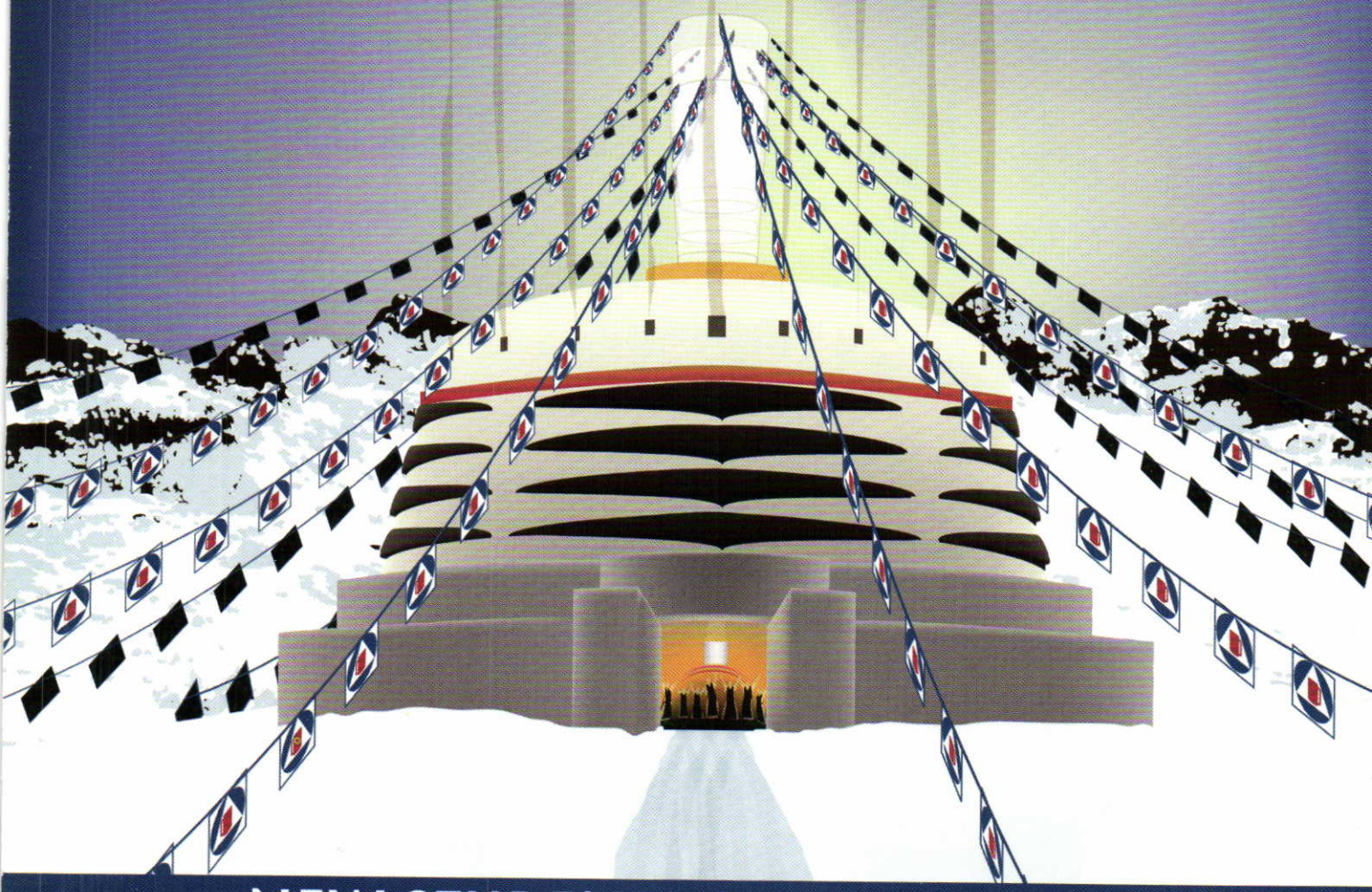

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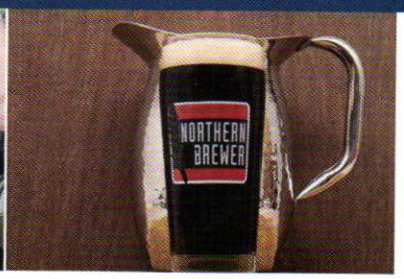

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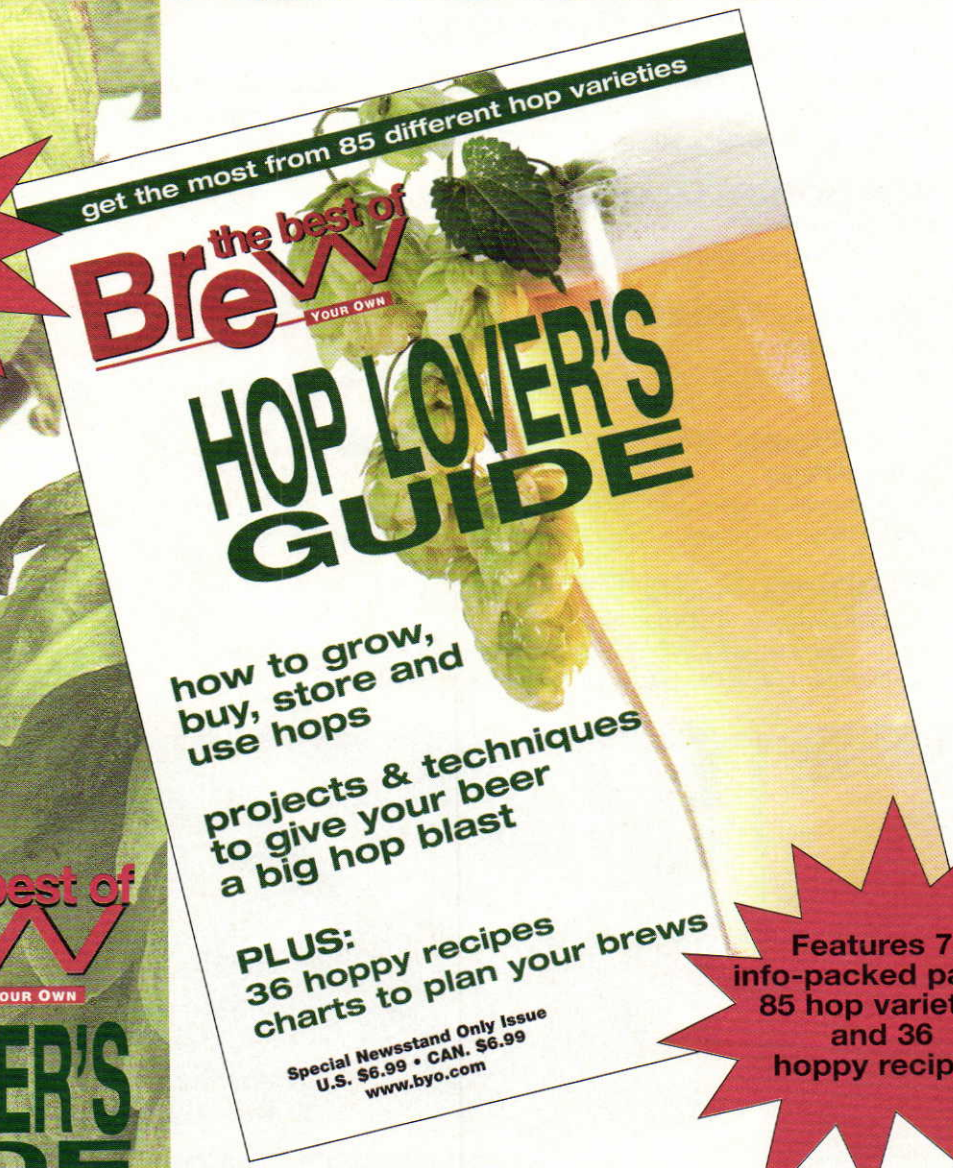

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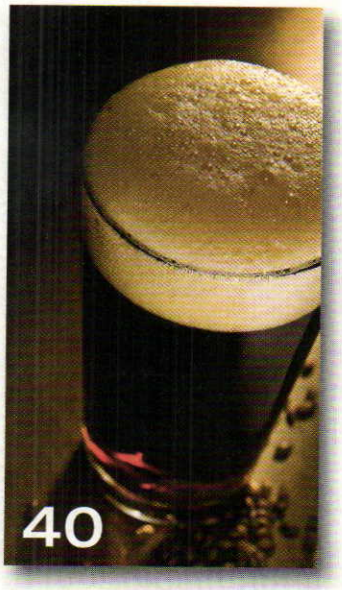
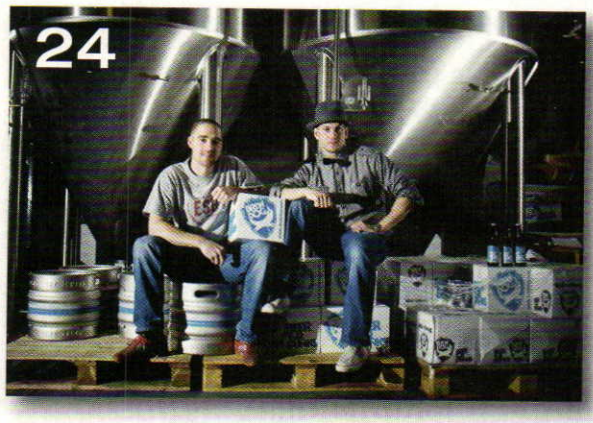
Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

JANUARY-FEBRUARY 2010
Volume 16 Number 1

Features





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RECIPE INDEX

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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

Candi Coated Question

I just finished reading and enjoying my December 2009 issue of *BYO*. I am interested in using the Dogfish Head Raisin D'etre recipe on page 45, but have a question. The recipe calls for 0.5 lbs. (0.23 kg) of candi sugar, but in the Step by Step it says add honey. Am I to use candi sugar, or doesn't it matter which I use?

Frank Beebe
Golden, Colorado

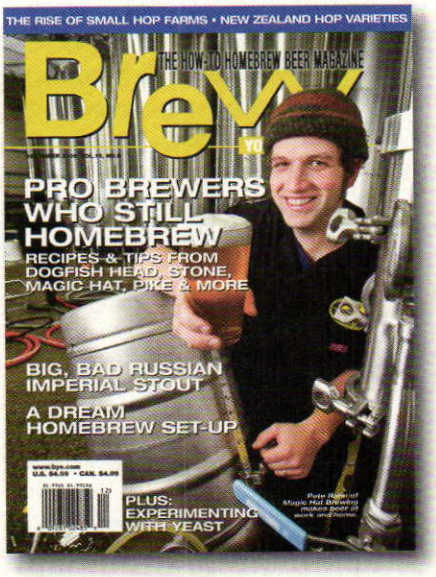
Use candi sugar. The reference to honey was an error. There is actually some debate among homebrewers over different sources of simple sugars. Some argue that each kind of sugar lends a unique taste to beer. This is especially true, they argue, for dark sugars or sources like honey that have associated flavors and aromas. Other homebrewers argue that, once fermented, you are unlikely to taste the difference between different types of sugar. This is especially true, they would argue, when you consider lightly-colored sugars and when the sugar is added in relatively small amounts. Homebrewers in the latter camp frequently opt to use cane sugar, which is inexpensive, for any addition of simple sugars.

If you have a recipe you enjoy, and it calls for a sugar addition in the kettle, you can see for yourself if different types of sugar make a difference. Brew the beer twice — perhaps by splitting the ingredients down the middle and making two half-sized batches — and use a different kind of sugar in each batch. For example, candi sugar or honey in one and cane sugar in the other. Keep all other brewing details unchanged between the two batches. Then, have a friend help you conduct a triangle test.

To perform a triangle test, take two bottles of beer, one from each batch, and three beer glasses. In another room, have your friend pour two samples from one bottle and a third sample from the other bottle. Have him or her try to pour the samples the same size and don't, for example, have yeast from the bottle end up in one of the samples. The idea is to have three glasses filled with a couple ounces of beer — two from one bottle and the third from another bottle. Taste the three samples, without being told which is which, and see if you can detect any differences. If the type of sugar does make a difference, you should be able to pick out the beer that is unlike the other two.

Note that, if you do detect a difference, the sugar could be the reason. But, it could also be due to the unavoidable differences that arise batch to batch in small-scale brewing. You'll have to use your own judgement as to the source of the difference. (Or, you could brew four batches, two of each type, taste one sample of each blindly and see if you can arrange the four beers into two pairs.)

Glad you liked the December issue and sorry for the error in the recipe.



Attack of the Acronyms

I am very new to homebrewing and have taken to your magazine for some inspiration and learning. I notice for a lot of the recipes that you list specifications such as OG, IBU and SRM (I know what ABV is!).

Could you please provide some guidance as to what these parameters mean, how they are taken and to what is usually acceptable tolerances to these values if any?

Liam Hodges
Windsor, United Kingdom

Each Brew Your Own *recipe lists five measures of the beer, OG, FG, IBU, SRM and ABV. As you know, ABV is alcohol by volume. This is always given as a volume to volume (V/V) percentage.*

OG and FG are the original gravity and final gravity of the beer. The original specific gravity (OG) of the beer is the specific gravity of the wort after it has been cooled, but before fermentation. The final specific gravity (FG) is the specific gravity of the beer upon completion of fermentation. Specific gravity is the density of a solution relative to water. Water, by definition, has a specific gravity of 1. Because wort has sugars dissolved in it, its specific gravity is greater than one and, in brewing, is usually expressed as a "1" followed by three digits; for example, 1.060. The hydrometers sold to

Contributors

ASHTON LEWIS is the Process Engineer for Paul Mueller Company in Springfield, Missouri and Master Brewer at their brewpub, the Springfield Brewing Company. *Brew Your Own* readers know Ashton as Mr. Wizard, a role he has undertaken since 1995. He is also the author of "The Homebrewer's Answer Book" (1997, Storey) and *BYO*'s Technical Editor. Ashton has recently begun blogging on *BYO*'s website (www.byo.com). His entries will cover any and all beer and brewing related topics from the viewpoint of a professional brewer with an intimate knowledge of homebrewing.

TERRY FOSTER was born in London and holds a PhD in chemistry from the University of London. He now lives part of every year in the United States. He is known to many homebrewers as the author of the "Pale Ale" and "Porter" books in the Classic Beer Style Series (Brewers Publications) as well as many articles in *Brew Your Own*. In this issue, on page 24, he profiles Scotland's Brewdog Brewery and also joins the *Brew Your Own* columnist team as our new "Techniques" author. In the first installment of his column, found on page 52, he discusses parti-gyle brewing.

BETSY PARKS, Associate Editor of *Brew Your Own*, gathers the materials for Homebrew Nation, edits the regular columns in the magazine and is the author of "Beginner's Block" and "Tips from the Pros" in each issue.

In this issue, she also interviewed five commercial brewers to discover "The Dark Secrets of Porter." That story starts on page 40. In addition, she brings her culinary skills to her introduction to soft cheesemaking, "Making Mozzarella," found on page 34.

homebrewers measure in this scale, although there are other useful scales (°Plato) as well.

IBU stands for International Bitter Units, a scale by which beer bitterness is ranked. One IBU is roughly equal to 1 mg/L of iso-alpha acids — the molecules extracted (and isomerised) from boiled hops, that make beer bitter. American-style Pilsners can exhibit levels of bitterness as low as 8 IBUs. In contrast, most popular American-syle IPAs are ranked at 60 IBUs or higher.

SRM is a measure of color. The letters stand for Standard Reference Method. Pale beers measure in the single digits, whereas stouts and porters reach 30–40 SRM.

When brewing a recipe, the numbers given are a description of how the beer is meant to turn out. If you brew the beer and the numbers don't describe the resulting beer — for example, if the OG was high or low or the level of bitterness seemed high or low — you should adjust the recipe next time you brew it to account for the individual differences every homebrewer and homebrewery brings to the brewing process.

How close a beer must come to the numbers to be acceptable is a matter of personal preference. If you are a couple "points" high or low on your OG, the difference is not going to be very noticeable, compared to what it should have been. We would suggest that the point of homebrewing is to have an enjoyable pastime. To the extent that the numbers help you improve your brewing, make better beers and derive more pleasure from the hobby, they are a good thing. If you are brewing beers that taste great, but your numbers are off slightly, don't worry so much about them.

Brute Fermenter Meets Bike Tube

Thanks for the excellent project idea for a fermenter using a Rubbermaid Brute trash can. I put mine together earlier this week with one modification: instead of using a lubricant to enhance the seal, I bought a 24 inch bicycle tube. I cut out the valve and split the tube, washed out the sealant, and put it around the lip of the trash can to form a gasket between the can and the lid. With the spring clamps, it seals perfectly!

Thanks for the great article.

Drew A. Vermeire
Lake Saint Louis, Missouri

That sounds like a cool modification to the project. We'll have to try that on our fermenters.

One of the great things about homebrewing is seeing all the adaptations homebrewers have made to various devices to allow them to be used for brewing at our scale. If any reader has any homemade project that would benefit other homebrewers, let us know — we'd love to show it off in the pages of BYO.

Questions, concerns, comments?

Contact us!

BrewYour Own — The How-To Homebrew Beer Magazine

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15th Annual Homebrew LABEL CONTEST

BrewYOUR OWN THE HOW-TO HOMEBREW BEER MAGAZINE

Send us your best homebrew labels and you could win some great brewing prizes from **BYO** advertisers! Enter as often as you like, but you can only win one prize. Winners will see their artwork featured in the July-August issue of the magazine. **Deadline to enter is May 7, 2010.**

Rules: Entrants can send labels or labels already stuck to bottles. The bottles can be full of beer. No digital or electronic files will be accepted. All other rules are made up by the editors of *BYO* as we go along. Labels are judged in one category, open to graphic artists and amateurs alike, so ultimate bragging rights are on the line. When submitting your labels, tell us a bit about the artwork and its inspiration. Is it hand-drawn? Created on a computer? Send us your best labels, tell us how you made them, and good luck!

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DEADLINE: May 7, 2010

reader PROJECT: HOME BAR

Brian Williams

Greenwood, Indiana

When my wife and I decided to buy a house we had many ideas in mind for our dream home. The singular most important priority, though, was the answer to the question, "where can I build the bar?"

After the move-in date, before we had everything put in its place, before we had all the furniture — before we even had everything out of boxes — I was in that basement, paper, pen, and tape measure in hand, sketching out my dream bar. Only two days after being in the house, I was painting, ripping out carpet, brainstorming and laying hammer to nail.

I decided on a five-tap set up and an L-shaped bar that would best make use of the space, while offering comfortable seating for six. I framed, skinned and topped that bar completely from scratch. No plans, no experience, no problem.

I decided go big or go home. I utilized a small closet just outside of the bar room to house my keezer with a collar built on to house six kegs. This gave me great freedom for the actual bar itself. I ended up with a finished bar that goes out 8 feet (2.4 m) from the wall on the long side, and 3.5 feet (1.2 m) on the short side of the L. It enabled me to build a full lower/working countertop underneath the 8-foot (2.4-m) section of the bartop for drink mixing, glassware, etc. and shelves underneath the 3.5-foot (1.2-m) section for music and entertainment centerpieces.

The only problem this brought up was how to keep the beer cold from the keezer to the bar? I remedied this by using an empty Corney keg inside of the keezer full of a glycol/water mixture and a pond pump. The five beer lines are wrapped around half-foot lines sending glycol from the freezer to the tap station and then returning back into the keezer and into the glycol keg. The whole trunk line is then wrapped in several layers of insulation to keep what's cold, cold, and also eliminate condensation.

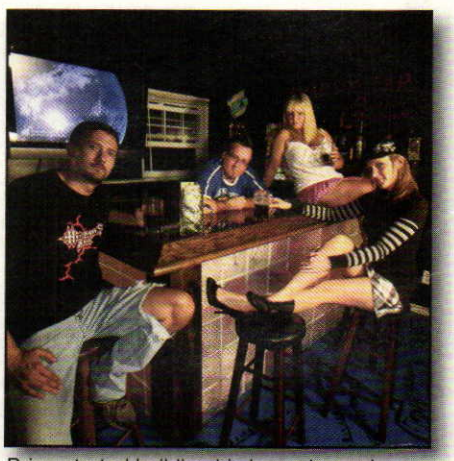
Being a lover of art and music, I decided to completely cover one of the lower walls in LP records. There are more than 175 records collaged on the wall spanning several decades and many genres of music. The wall behind the bar is also covered with an eclectic mix of album covers.

Adding to this theme of reconditioned "trash" turned to treasure, more than 1,600 bottle caps line the bartop. It took four coats of epoxy resin at one gallon (3.8 L) per coat to completely encase the caps, but was well worth it. The result is beautiful, and tons of fun to just sit and admire all the interesting caps.

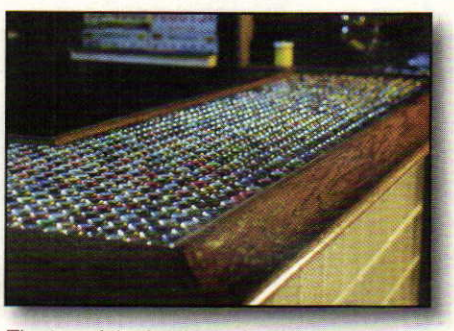
I framed my tap box out of 4x4s, covered it in license plates collected by my father-in-law through the years and finished it with five shiny Perlick faucets. The finishing touches to the bar were the end case, holding five beer mugs for "honored brothers" and the glass blocks with rope lights behind them on the face of the bar.

It took me around two months of straight planning and building, around two hundred trips back and forth to the home improvement store and a lot of help from my friends, but now we all pull up to the bar, relax, pull a pint of my haus beer "Death by Dunkel," and admire the fruits of our labor.

For more photos of Brian's home bar, visit www.byo.com/photos/category/4.



Brian started building his home bar only days after moving into his new house.



The top of the bar is made with more than 1,600 bottle caps and gallons of epoxy.

The front of the bar features glass paneling with rope lights illuminating from the back.

reader PROFILE
Andrew Parsons
Portsmouth, England

Andrew Parsons is a homebrewer and second officer in the UK Merchant Navy.

When I first started brewing, I couldn't resist brewing many different styles. But nowadays I stick to styles that I really enjoy drinking. I got sick of having a loft and shed full of Belgian beers, chocolate beers, porters, stouts, kriek beer, wheat beers and others when all I really enjoy drinking are quality pale ales and bitters. At one stage there was so much beer bottled and stored in the loft that a surveyor told my wife and I the roof had started to bow!

My wife Vicky is a science teacher and I'm second officer in the Merchant Navy on an Offshore Support Vessel called F.D. Incredible. I call my brews Parsonification Ales, brewed at The Percy Road Brewery.

I brew from extract. I've had a few small problems in my day, but nothing more major than heavy-duty leaks. Full fermenters emptying themselves during the night over the floor of my shed . . . boo. My biggest problems have occurred after drinking the ales and falling down stairs, but it's nothing a few stitches can't solve!

When Vicky and I were married I took it upon myself to brew up a large enough batch of beer to keep the entire wedding party happy. No easy task. I have four decent, sturdy plastic kegs for dispensing, but for the wedding I bottled all of the beers in 320 brown pint bottles. It was some undertaking, believe me. Preparation involved accruing the bottles, which involved family and friends drinking lots of beer and giving me their empties. It was a task that they surprisingly didn't have a problem with.

To have enough for the wedding, I needed to brew eight 5-gallon (19-L) batches. Due to the broad spectrum of guest tastes and logistical requirements, I decided that I would brew two styles, four batches of each. My favorite beer is my best bitter, which is a classic English bitter. I dry hop it heavily with Fuggles to give it a lovely aroma and fresh taste. It ended up being one of the beers served on the "big day." The other beer was Pilsner-style ale, which I have brewed many times.

The wedding went incredibly well — and more importantly my homemade beer went down in a storm. Our following honeymoon in Morocco was also very amusing, especially in hindsight. I remember being chased down the street by a performing monkey — but that is another story . . .

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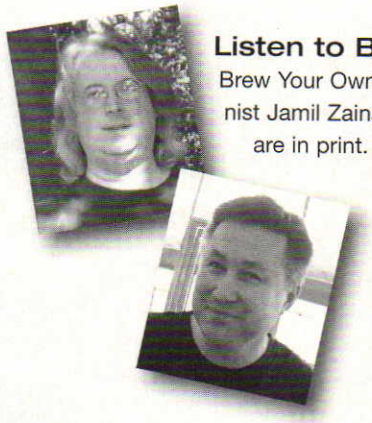

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Yes, occasionally 47% Yes, frequently 26%
No, but I plan to 21% No, I'm not interested 6%

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replicator
by **Marc Martin**

Dear Replicator,

Last winter one of my neighbors toured some breweries in California and his favorite was Black Diamond Brewing. He brought back a couple of bottles of their Winter Ale and claimed this was his favorite. I agreed it was very good and tried to brew something similar but failed both times. I just can't seem to nail down that malt profile and the slight spicy finish. He claims that if I brew him this beer he will mow my lawn.

David Wilborne
St. Louis, Missouri

I thought that I was fairly knowledgeable about all of the West Coast breweries but I must confess this one had somehow escaped me. I recently became very familiar with their beers when their national account and marketing manager, Mike Pierce, hosted a tasting event at the Green Dragon Pub and Bistro in Portland, Oregon. All four of their beers were very good but, like your neighbor, I found the Winter Ale to be my favorite.

This is a brewery that truly had unique beginnings. It first opened in 1994 as a brewpub in Walnut Creek. While most start small and experience progressive growth, this one started large and elegant. The goal was to separate themselves from the flock of other brewpubs that were beginning to populate the San Francisco Bay area. A very upscale facility was created through the use of dark woods, marble and high end furnishings. The fifteen-barrel brewhouse, very large for a beginning establishment, provided plenty of capacity for their excellent beers. Likewise, the kitchen was upscale and featured many gourmet entrees.

By 2004 the Black Diamond Brewpub was a very popular destination but the attraction had become more about the food and less about their beers. The owners, wanting to focus solely on high quality beers, decided it was time to close the brewpub and build a production-only brewery a few miles northeast in Concord, California. The brewery opened only selling draft beer but high demand dictated that a bottling line be added in 2007. Now their beers are distributed throughout California, part of Oregon, northern Nevada and a launch into Washington is

planned for spring. Mike, in conjunction with Greg Spohn the sales director, now manage the day-to-day operations.

My call to the brewery was fielded by their brewmaster, Derek Smith, who has a background that is almost as unique as the brewery. His first homebrew was an English Pale Ale made in the kitchen of the famous White Horse Pub in London where he would frequently see Michael Jackson. He worked there for 1½ years as a cellarman before returning to the US to become an assistant brewer at Two Rows Brewing in Texas. He is a 2005 graduate of the Master Brewers program at UC-Davis. As brewmaster for the past four years he produces his beers on the original, Liquid Assets, fifteen-barrel system.

Derek describes the Winter Ale (sometimes known as "Elfs Ale") as a rich Abbey Dubbel. A distinct spiciness comes through in the finish even though no real spices are added. This is developed through the use of the Trappist yeast strain and fermentation temperatures. He recommends the process of a strong, longer boil to increase the carmelization of the wort. He also utilizes a lower temperature mash to develop maximum attenuation creating a drier finish. A longer conditioning period is also advised.

In my sampling I found this to be a classic example of the style. The color is deep brown with a hint of garnet. The aroma exudes plum, cherries and raisins with a slight coriander background. A dense, off white head tops the beer and lasts down to the bottom of the glass. This is an all around excellent ale and perfect for the season.

David, now you will be able to relax and have a homebrew while your neighbor mows because you were able to "Brew Your Own." For further information about the brewery and their other fine beers visit the website www.bdbrewing.com or call them at 925-356-0120.

Black Diamond Brewing Winter Ale

(5 gallons/ 19 L, extract with grains)

OG = 1.067 FG = 1.011
IBU = 21 SRM = 23 ABV = 7.2 %

Ingredients

6.6 lbs. (3 kg) Briess light, unhopped, liquid malt extract
1.25 lb. (0.56 kg) dark Belgian candy sugar
14 oz. (0.39 kg) special B malt (120 °L)
8 oz. (0.22 kg) aromatic malt (25 °L)
8 oz. (0.22 kg) cara-vienna malt (20 °L)
4 oz. (0.11 kg) chocolate malt (350 °L)
5.6 AAU Magnum pellet hops (75 min.) (0.4 oz./11.3 g of 14% alpha acid)
1 AAU Hallertauer pellet hops (10 min.) (0.25 oz./ 7 g of 4% alpha acid)
1.13 AAU Tettnanger pellet hops (10 min.) (0.25 oz./ 7 g of 4.5% alpha acid)
½ tsp. yeast nutrient (last 15 min.)
White Labs WLP 500 (Trappist Ale) or Wyeast 3787 (Trappist High Gravity Ale) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 1.5 gallons (5.6 L) of water at 150 °F (66 °C) for 30 minutes. Remove grains and rinse with 2 quarts (1.8 L) of hot water. Add the malt extract and boil for 75 minutes. While boiling, add the hops and yeast nutrient as per the schedule. Add the wort to 2 gallons (7.6 L) of cold water in a sanitized fermenter and top off with cold water up to 5 gallons (19 L). Cool the wort to 75 °F (24 °C), pitch the yeast and aerate heavily. Allow the beer to cool to 68 °F (20 °C). Hold at 68 °F (20 °C) until fermentation is complete. Transfer to a carboy, avoiding any splashing to prevent aerating the beer. Condition for one week and bottle or keg. Carbonate and age for four weeks.

All-grain option:

This is a single step infusion mash using 10 lbs. (4.5 kg) 2-row pale malt. Mix the crushed grains with 3.75 gallons (14 L) of 168 °F (76 °C) water to stabilize at 150 °F (66° 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 75-minute hop addition to 0.3 oz. (8.5 g) Magnum pellet hops to allow for the higher utilization factor of a full wort boil. Follow the remainder of the extract with grain recipe.

Homebrew CALENDAR

January 11: Deadline
Meadlenium XII
Orlando, Florida
One of the nation's premier, mead-only competitions, organized by the Central Florida Home Brewers. Competition is open to all homebrewers but restricted to non-commercial homemade mead. Entries should be categorized following the 2008 AHA/BJCP style guidelines for categories 24, 25 and 26. Judging will take place on January 30. More information is available on the Web at http://www.cfhb.org/.

February 12
2009 Great Northern Brew-Ha-Ha
Duluth, Minnesota
The second stop on the Midwest Homebrewer of the Year circuit. Organized by the Northern Ale Stars homebrew club. Competition is open to any homebrewer from within the United States. Homebrewers may not use homebrewing facilities other than their own, unless brewed with the help of the owner of other homebrewing facilities. Deadline is February 12. More information is available at http://www.northernalestars.org/greatnorthernbrewhaha.html.

February 20
War of the Worts
Montgomeryville, Pennsylvania
The annual homebrew competition organized by the Keystone Hops Homebrew Club. Deadline is February 7. All entries must be noncommercial in nature and produced at home. Prizes and awards will be given for beers placing first, second, and third in each category, and for Best of Show. Dropoff locations and more information available at http://keystonehops.org/wotw/.

BEGINNER'S block

Smoked Beers

by Betsy Parks

Smoky flavors are perennial winter favorites. Smoked meats, seafood, cheese — and of course, beer — are made tastier (and last longer) when exposed to a little smoke.

Smoky start

Before you set out to brew a smoked beer, taste a variety of commercial smoked beers. There are some classic examples of smoked beers, including a variety of rauchbiers from Germany. The Schlenkerla and Spezial breweries in Bamburg, Germany brew some of the most well-known examples. Many new-world craft brewers also produce different styles of smoked beer, such as Alaskan Smoked Porter from the Alaskan Brewing Company, Rogue's Smoked Ale and The Vermont Pub & Brewery's Mick's Smoked Stout.

Malt

The difference between a smoked beer and a non-smoked beer is including some percentage of smoked malts in the recipe. Smoked malts are regular malts that are dried in the presence of smoke. The most common smoked malts available in North America are Weyermann rauchmalz and peat-smoked malts from Hugh Baird, Thomas Fawcett or Simpsons.

While both beech-smoked and peat-smoked malts share the fact they are smoked, the similarities end there. Peat-smoked malts are traditionally used in the production of Scotch whiskey and beech-smoked malts are used to brew German rauchbiers. Beers made with peated malt have a very characteristic medicinal/phenolic aroma from the peated malt.

If you can't find smoked malts at your local homebrew supplier, ask if they can be special ordered or look online. If you develop a taste for smoked beers, you can even consider smoking your own malt. Weyermann does make a smoked rauchmalz extract. However, it is not widely available in the US, so most extract brewers will need to brew with some steeped smoked grains or else brew a kit that contains smoked malt extract. (For a "nearly all extract" smoked rauchbier beer recipe, go to www.byo.com/component/resource/article/1765.)

Grain ratio

Depending on the smoked malt your recipe calls for, percentages of malt can vary pretty widely. If you're using peat-smoked malt, the percentage of the grain should only be around 1–5% of the total grist. Anything more than that and the smoke flavor would completely overwhelm the beer. For rauchmalz, which is much more forgiving, the percentage can be anywhere between 1% and 75%. There are even beers, like the famous rauchbier from Schlenkerla, brewed with 100% rauchmalz. For your first few tries, however, ease into smoked flavors by starting with small percentages.

Water

Always brew your smoked beer with non-chlorinated water as the phenols in smoke react with chlorine, resulting in off flavors. You can either purchase distilled or spring water or you can treat your regular water with potassium metabisulfite Campden tablets, which will produce SO_2 gas that reacts with chlorine to neutralize it. Add one tablet to every 20 gallons (76 L) of water and let it stand overnight.

Other ingredients

Ferment smoked beers at cool temperatures with yeasts that don't add many additional flavors of their own. Strains like Wyeast 1056 or White Labs WLP001 ale yeasts or German-style lager yeast, such as Wyeast 2206 or White Labs WLP830 will allow your smoke flavors to stand alone, which for your first smoked beers will help you train your palate for smoked malts.

Choose hop additions with moderate bitterness and mellow aromas as more intense hops tend to clash with the smoked malt. Think of the classic examples, German rauchbiers, which rely on noble hop varieties.

Evaluating Beer

Training your tasting skills

by Betsy Parks

Entering your homebrew in a competition is a great way to get feedback on your beers. But winning a competition is pretty nice, too! To make better beer, learn to evaluate beers and identify their flaws before they leave the homebrewery. In this issue, three professional beer tasters share some of their techniques.

MICHELLE BROWN, Sensory Technician and Lab Manager at Firestone Walker Brewing Company in Paso Robles, California. She holds a B.S. in food science and nutrition and has worked in the fermentation industry for five years, working with Crème Fraîche, wine and beer. She completed the Sensory Panel Management course at Siebel Institute in August 2009.

Beer is best evaluated with an understanding how raw materials and processing steps affect finished product. Knowing how to evaluate beer can improve a brewer's skills because there is an awareness of how raw materials such as water, malt, hops and yeast as well as time- and temperature-sensitive brewing steps will influence the final product. Often overlooked, sanitation and bottling practices have a great influence on the flavor of the finished product as well. Most off flavors in beer are preventable with good brewing and packaging procedures, some are not always off flavors, but desirable at low levels only for certain styles.

The most important factor when evaluating beer is to be consistent with your method as you evaluate each beer. Two ounces of beer in a covered brandy snifter is a good example of a sample. This type of glassware is preferred because it is stemmed, allowing for gentle swirling to release volatile compounds, and most wide in the bowl to capture the volatile compounds at the top. At Firestone Walker we evaluate beer at 55 °F (13 °C), recommended by the American Society of Brewing Chemists (ASBC) for full flavor perception of the sample. We evaluate each sample by first having a sip of beer to "calibrate the palate" for beer and cleansing with water and unsalted crackers during evaluation. Take organized notes when evaluating a sample using the same template for each evaluation.

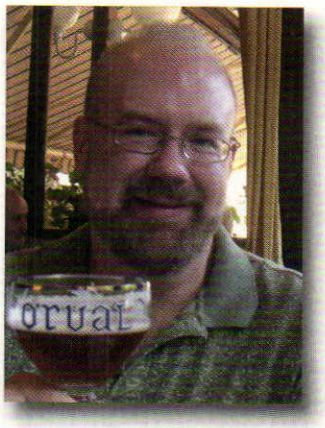
Three ways to improve your evaluating skills are to develop your senses, increase flavor awareness and evaluate regularly. Start with a single style or a couple styles of beers that you like and really try to learn about them. What are the characteristics of the style? What are the strengths and weaknesses of each beer? Once you have a good understanding of the style, move on to another style and develop your understanding of as many beer styles as possible.

STEVE PARKES, Owner and Lead Instructor of the American Brewers Guild in Salisbury, Vermont. Steve was also the Brewmaster for Wolaver's Organic Ales and Otter Creek Brewing, both located in Middlebury, Vermont. In 2009 The Brewers Association presented Steve with the Russell Schehrer Award for Innovation in Brewing.

An understanding of how the senses work, what their limits are and how they are affected by outside influences is crucial if a brewer intends to rely on sensory evaluation as their only quality tool. That pretty much describes the homebrewer. The physical effect a cold or allergy reaction can have on the senses is one thing, but the effect of suggestion, and inference can lead to confusion of characteristics.

Drinking a beer should be a multi-faceted experience. The pleasure in seeing a beer poured correctly and looking clear and bright in a glass with a great foam on top raises the expectations of the experience to come. The aroma should be pleasing with delicate esters and several elements of hop aromatics. The first sip should provide most of the information about the beer lacking any obvious flaws. If there are no immediately evident off flavors don't waste time looking for them and move onto picking out the nuances of what is right about the beer. The hop bitterness should be clean, not harsh or lingering, there should be some bready malt character and the hop flavors and aromas should be balanced and appropriate for the style.

There are some obvious flaws in brewing that can sometimes ruin an experience. A big issue homebrewers face is in controlling yeast performance with wildly fluctuating pitching rates and yeast health issues. The aroma and flavor of autolysed (dead) yeast is unpleasant but often ends up dominating the flavor of homemade beer. Transferring the beer after primary fermentation to a separate vessel for aging and a third vessel for serving can avoid this. Diacetyl (a buttery or sweet butterscotch taste) is a symptom of either incorrect maturation or bacterial contamination and is entirely avoidable. DMS (sweet corn) is a symptom of poor wort boiling and can also be avoided with good brewing techniques. Sourness is a sign of bacterial spoilage and is never good unless the style demands it. Phenolic or clovelike character is sign that a wild yeast has been at work. Nail polish aroma is a sign that your fermentation temperature got way too high. Some of these flavors and aromas are, however, characteristics of certain commercial beer and beer styles.



GORDON STRONG, Beer Judge Certification Program (BJCP) President and the only Grand Master V Judge. Gordon led the development of the 2004 and 2008 BJCP Style Guidelines. He is a Ninkasi award-winner and has spoken on brewing, judging and beer styles at both American Homebrew Association (AHA) and Masters Championship of Amateur Brewing conferences.

Most brewers have a certain outcome in mind when they make a beer. Being able to evaluate beer means that you can determine for yourself whether you met that goal. You don't have to wait for a competition; you can judge it yourself. If it doesn't meet your expectations, good beer evaluation skills can help you diagnose the problems. You can't really begin to fix problems with your beer if you don't understand what's wrong.

The standard BJCP scoresheet lists the basic categories: aroma, appearance, flavor, mouthfeel and overall impression. These categories walk you through the whole sensory experience of evaluating a beer. I often recommend that new judges take a look at the checklist version of the BJCP scoresheet, which is what is used in the second round of the AHA national homebrew competition. This sheet contains much more detail about possible perceptual characteristics that may be present. New judges can use this sheet to learn how to give a thorough evaluation.

I think a complete beer evaluation should contain three major elements: identifying and quantifying all perceptions about the beer, assessing how well the beer meets style expectations, and identifying and diagnosing any technical flaws. The brewer has an advantage over other beer judges: the brewer knows the recipe and the process. This reduces the amount of speculation involved compared to feedback from most competitions.

Studying for the BJCP exam does give you the best background for beer evaluation. Even if you don't take the exam, you can still learn a lot by taking a judging class or judging with BJCP judges in a competition setting. Once you have basic skills, you can hone them by trying to develop discrimination between similar flavors or aromas. Start by evaluating samples that are quite different, and move towards those that are more similar. You can do this with different samples, or with different intensities of the same sample. Do blind triangle tests. Prepare three cups of two different samples and see if you can pick out the one that is different and why. It's fun to do this with a group. If you don't want to use an off-flavor kit or doctor your own beers, try blending some of your own beers and evaluate them. Add IPA to different styles to see how you like a higher level of bitterness.

Brewing for Health

Sanitizing with heat, calculating carbonation

"Help Me, Mr. Wizard"

by Ashton Lewis

Muscle brew?

Recently I have been on a health kick. I've been working out, taking multivitamins, and drinking protein shakes. This brings me around to an idea I have. For muscle building you need carbohydrates and protein. I know all health experts say alcohol is bad for you, but beer has carbohydrates. What would be a good way to add protein to beer to make it a muscle beer with protein and carbs? Just an idea; so after a hard workout I can grab a homebrew and say it's for my health.

Adam Best
Cincinnati, Ohio

I am sure there are many opinions about how to answer your question. You could add all sorts of additives to a beer to make some sort of beer/protein booster drink, but the outcome would probably taste like a Frankenbrew. Personally, I suggest consuming your health kick food-stuffs as they are and not trying to blend them with beer.

The reason I chose to answer this question, however, was not to suggest ideas of how to add protein powders and carbohydrate sources to your next batch of pale ale, but to comment on what "all health experts" say. I assure you that not all experts believe alcohol is bad for you. Quite the contrary, most health experts these days believe that moderate consumption of alcohol is good for you. The television show *60 Minutes* first reported on the "French Paradox" in 1991 and anecdotal evidence suggested that the consumption of wine by the French counteracted a diet known for rich dishes. Following this report the wine industry used such studies to market their products. Unfortunately many of the assertions about population data proved to be incorrect with these studies, but better research followed.

More recent data shows that alcoholic beverages, not just wine as some would like consumers to believe, do indeed have positive effects on the cardiovascular system. Some of the positive effects are credited to antioxidants, such as polyphenols found in beer and wine, and some of the effects are credited to alcohol itself.

Most informed dietary professionals now believe that consuming alcohol in moderation, not exceeding two drinks per day for most people, is part of a healthy diet. The bottom line is that your interest in diet and exercise does not mean that you cannot and should not drink beer. Epidemiological data shows that people who drink no alcohol at all have a higher incidence of cardiovascular disease compared to moderate drinkers. I encourage you to research this topic yourself. After all, I am a brewer and not a health expert. I have heard very interesting presentations at several brewing meetings given by health researchers. There is a large body of data on this subject and the data is convincing. I would say that drinking a homebrew or two at the end of the day is a good thing, and clever excuses are not required to make you feel better.

Steam sanitation

I use a half barrel, with the center tube removed, for a fermenter. I like to fill the keg completely with water and then boil it for twenty minutes to sanitize it. Do I need to fill the keg completely with water, or can I boil a partially filled keg, letting the steam sanitize the rest of the surfaces? Which way would be more efficient or effective?

Jeremy Ruetz
Rhinelander, Wisconsin

Heat, especially moist heat, is an excellent way to sanitize and even sterilize brewing equipment. If you partially fill your keg with water, bring it to a boil and restrict the flow of steam out of the kettle you will indeed be steam sterilizing the surfaces above the water level. An easy way to create a little back pressure in your keg would be to insert a rubber stopper with a very small hole drilled through the middle into the hole in the top of your keg. This restriction will build a small pressure in the keg and help to vent air from the keg and create a head space full of steam. Twenty minutes is a common set point in heat sanitation techniques.

Heat sanitation works very well, but it's not commonly used in breweries. Most of these methods are expensive because of the energy required, present certain safety challenges and can damage equipment if conducted improperly. Some of the more dramatic failures caused by heat sanitation are a result of a vacuum that forms when hot vessels are cooled. If the vessel, for example a big and expensive fermenter, is not properly vented during cooling the result is vessel collapse. This whole cooling issue is another reason that heat sanitation is not commonly used because cooling requires time and energy and most brewers want to put their wort or beer into a cool vessel.

With this being said, we use hot water at Springfield Brewing Company to heat sanitize our wort cooler, wort lines to the fermentation cellar and our filter. The reason we use heat for these areas is that it works very well. I had a very active role in designing this brewery and I decided to use hot water in these areas of the brewery and designed the process piping to permit this method to easily and safely be used. Other brewers use heat in these same areas. It's also common to heat sterilize yeast propagation equipment. I use the term sterilize here because yeast equipment is truly designed to be sterilized with steam, similar to pharmaceutical equipment. The funny thing with this comparison is that brewers were the ones who led the way in pure culture growth on large scales and much of what is done today in the biopharmaceutical industry came from brewing technology.

If you like using this method and find it effective, then use it. I do offer three suggestions: 1) use a thermometer to verify that your temperature goal is met (we use 180 °F/83 °C minimum for our filter and measure this at the discharge), 2) use a timer to make sure you have held it for the proper duration, and 3) exercise caution

since hot water and steam can be dangerous when not respected.

Better bottling

We have a basement that maintains a fairly constant temperature of 64–68 °F (18–20 °C). This should be good for ales. As a matter of habit I place my 6 ½-gallon (25-L) carboy on a desk off the floor for one week then rack to a secondary 5-gallon (19-L) carboy again on the desk for another week. One week later I add ¾ cup priming sugar and bottle. I place the bottles on a table for two weeks (it takes patience to wait) then try a beer. Sometimes they all are carbonated fine, other times I will have some to half of them flat. I once had an entire batch flat. I have to take them to my second story bathroom for the first week where the temperature can get as high as 75 °F (24 °C) for more warmth but I worry about off flavors. I sanitize my bottles and equipment with iodophor and no longer use bleach. When I use liquid yeast I do a yeast starter. I have a paddle-type aerator using a power drill (power tools good!) and usually have a low lag time from three to twelve hours, depending on the beer and the yeast used. My homebrew rule is "there is no such thing as a bad beer, just some are better than others." A flat beer tests that rule pretty hard. Do you have any advice?

Joe Sorg
Ft. Wayne, Indiana

When I first began brewing I followed the bottle conditioning instructions found in homebrew books and never thought much about it. Sometimes the beer turned out to be just right with respect to carbonation, but more often something seemed to be wrong . . . too much carbonation, not enough carbonation, inconsistent carbonation and so on. It sounds like you are beginning with good yeast and are aggressively aerating your wort. Your cellar temperature is not too cool and you are being patient. So, why do you at times have these problems?

In my experience many brewers neglect to focus on the obvious when tackling a problem. When you prepare to bottle condition your beer there are really three things that are critical to the process. The first is determining how much beer you have in your fermenter or bottling bucket. The second is to determine how much sugar or alternate priming solution is required to achieve some level of carbonation in the volume of beer you plan on bottling. The third is assessing your yeast.

Now it's time for a bit of tough love. If you don't know how much beer you are planning on packaging you have failed to make it to first base. This requires no fancy tools or time-intensive DIY projects. All you need is a roll of masking tape, a permanent marking pen and a calibrated measuring device. I'm a metric brewer and my calibrations would be made in 1-liter increments because calculations are so much easier using the metric system. Patience is a virtue and carefully adding a

liter at a time to your fermenter or bottling bucket, then marking the level on the outside of the fermenter is worth the trouble.

OK, now to make it past second base. I absolutely detest rules of thumb like ¾ cup of priming sugar per batch. This rule begins with the poor assumption that all batches of homebrew have the same volume when it comes time for bottling. Then a second lousy assumption is made and that is that all styles should be carbonated to the same level. A more precise approach is to pick a target and then add according to the plan . . . and if you invest in a small kitchen scale then you can add your priming by weight and not volume using some arcane measurement that has nothing to do with easy calculations.

Now it's time to complete the plan and the last step is to assess the yeast. I can hear the questions now. "What do you mean assess the yeast?" "Can't you see the stuff at the bottom of the carboy? That's the yeast and it's going to turn the sugar into carbon dioxide."

If you think, hope or assume that the yeast in the fermenter is up for the task of bottle conditioning then you will continue to have inconsistent results. Just because the yeast was vigorous when pitched into your well-aerated wort does not mean that it is still in the rearing-to-go condition when you are ready to bottle your beer. A few key things to consider are beer strength, elapsed time since the end of primary fermentation and flocculation properties of your yeast. If your batch is normal strength ale with a short aging period and fermented with a yeast strain with moderate flocculation characteristics you may be fine. However, if this batch began with high gravity wort and has been aging for several weeks since the primary fermentation conducted with that very flocculent strain you wanted to use, then you may be in store for major disappointment. To assess the yeast you don't need a lab, just a review of what you likely have in your beer.

You really want about 1 million yeast cells per milliliter of beer when it is time to bottle. This is about a tenth of the amount required for fermentation. Without a microscope it is difficult to know how much yeast is in your beer, and even if you know the cell density you still would not know cell vitality. Adding fresh yeast at bottling

makes sense. You can use dried yeast or liquid if you think you need to add more yeast to your bottles. This yeast is used to produce carbon dioxide and does not affect flavor as does yeast used for primary fermentation. If you want to use a different strain for bottle conditioning, for reasons of convenience, for example, you will be fine. I also think you are fine if you store your beer anywhere between 65 °F and 75 °F (18 and 24 °C) during the conditioning step.

If you pay attention to these three important factors your bottle conditioned beers should be more consistent and more to your liking. OK, now for a bit of simple metric math. Assume that you have approximately 16.5 liters (as determined by the strip with 1-liter hash marks on the side of your carboy) of fermented pale ale and want to add enough sugar to provide a final carbonation level of 2.8 volumes of carbon dioxide. How much sugar should be added? To properly answer this question you need to know how much carbon dioxide is already in your beer. The fact is that without a way of measuring you don't really know, but 1.2 volumes is a safe assumption. So you want to increase the carbonation level by 1.6 volumes during carbonation. Here are the steps to doing the math:

1. Convert 1.6 volumes to grams of carbon dioxide per liter by multiplying by 2. This tells you that you want to add 3.2 grams of carbon dioxide per liter of beer.

2. Multiply 3.2 g/L by 16.5 liters; this indicates that 52.8 grams of carbon dioxide need to be added to the beer during bottle conditioning.

3. If you are going to use glucose (aka dextrose) for your priming sugar you can calculate that 1 gram of glucose yields 0.49 grams of carbon dioxide when completely fermented (glucose weighs 180 grams per mole and when converted to alcohol and carbon dioxide this one mole of glucose yields two moles of carbon dioxide, weighing 88 grams).

4. 52.8 g(CO_2) ÷ 0.49 g(CO_2)/g(glucose) = 108 grams glucose required. The bulk density of glucose powder is about 36 pounds per cubic foot. This translates to about 137 grams per cup and 108 grams of glucose equals about 0.80 cups.

Hopefully this helps with your carbonation issues. I also agree that a flat pint of beer is pretty hard to swallow!

Brew Your Own Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard since 1995. 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!

Dunkelweizen

Malty, spicy and balanced

by Jamil Zainasheff

My favorite German-style wheat beer is dunkelweizen. The other German wheat beer styles are good too, but they are not styles that I would want for my everyday beer. Weizenbock is too big and rich and I would get fat. Weizen or Weissbier is a little too light and simple and I would get bored. Berliner Weisse has too much acid for day-in and day-out and my stomach would complain. Dunkelweizen, however, is ideal; I could drink dunkelweizen every day. The melanoidin-rich malt character, the touch of caramel, the spicy/fruity fermentation profile, and the balanced finish would keep me entertained, fit, and my old-man stomach happy.

DUNKELWEIZEN by the numbers

OG:	1.044–1.056 (11–13.8 °P)
FG:	1.010–1.014 (2.6–3.6 °P)
SRM:	14–23
IBU:	10–18
ABV:	4.3–5.6%

Dunkelweizen has the same spicy/fruity character of a hefeweizen, but it also has a rich Munich malt character, similar to, but not as intense as a Munich dunkel. Dunkelweizen is often hazy, ranging in color from light copper to a dark mahogany-brown, and topped with a large, dense, creamy off-white head. The aroma of a good dunkelweizen includes moderate spicy notes and fruity esters, usually described as clove and banana. However, one of the most common mistakes in homebrewed weizen-style beers is having too much clove and banana character. Brewers might point to the fact that the BJCP style guide says these phenolic and estery compounds can range up to "strong," but don't think for a minute that means a clove/banana bomb is acceptable. It does not mean that these fermentation compounds should overwhelm the other characteristics of the beer. It is critical that a brewer keeps these compounds restrained and that they blend in with the overall harmony of the beer, especially the malts. For new brewers especially, it might be better to think of the word "strong" as meaning "clearly evident." You should be able to smell and taste wheat, caramel and melanoidin rich malts like Munich in this beer along with the clove and banana. Target low to moderate phenols and esters and you will have more than enough character for the style.

Like most weizen-style beers, dunkelweizen has a grainy, bready flavor underlying the beer. Slight, soft caramel notes and toasty, bread crust-like melanoidin character from Munich malt should be present in moderate levels. While it has a rich color, there are no roasted flavors or aromas. Hop character is minimal or non-existent. The balance between bittering and sweetness is usually even, though some examples can have an initial sweetness up

Continued on page 22

RECIPE

Dunkelweizen

(5 gallons/19 L, all-grain)

OG = 1.050 (12.4 °P)
FG = 1.012 (3.1 °P)
IBU = 15 SRM = 18 ABV = 5.0%

Ingredients

6.6 lb. (3 kg) Great Western wheat malt (2 °L) or similar
3.3 lb. (1.5 kg) Durst Munich malt (8°L) or similar
8.8 oz. (250 g) Briess CaraMunich (60 °L) or similar
2.6 oz. (75 g) Weyermann Carafa® Special II (430 °L)
2.96 AAU Hallertau pellet hops (0.74 oz./21 g at 4% alpha acids) (60 min.)
Wyeast 3068 (Weihenstephan Weizen) or White Labs WLP300 (Hefeweizen Ale) yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 154 °F (68 °C). Hold the mash at 154 °F (68 °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 1.039 (9.7 °P).

The total wort boil time is 90 minutes, which helps reduce the S-methyl methionine (SMM) present in the lightly kilned pilsner malt and results in less dimethyl sulfide (DMS) in the finished beer. Add the bittering hops with 60 minutes remaining in the boil. I skip using kettle finings in this beer. Chill the wort rapidly to 62 °F (17 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly. The

proper pitch rate is 9 grams of properly rehydrated dry yeast, two packages of liquid yeast or one package of liquid yeast in a 1.5-liter starter.

Ferment at 62 °F (17 °C) until the beer attenuates fully. With healthy yeast, fermentation should be complete in a week, but don't rush it. The cooler than average ale fermentation temperature can extend the time it takes for complete attenuation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2.5 to 3 volumes.

Dunkelweizen

(5 gallons/19 L, extract with grains)

OG = 1.051 (12.7 °P)
FG = 1.013 (3.2 °P)
IBU = 15 SRM = 15 ABV = 5.1%

Ingredients

4.4 lb. (2 kg) wheat liquid malt extract (4 °L)
2.2 lb. (1 kg) Weyermann Munich Amber liquid malt extract (8 °L)
8.8 oz. (250 g) Briess CaraMunich malt (60 °L) or similar
2.6 oz. (75 g) Weyermann Carafa Special II (430 °L)
3.12 AAU Hallertau pellet hops (0.78 oz./22 at 4% alpha acids) (60 min.)
Wyeast 3068 (Weihenstephan Weizen) or White Labs WLP300 (Hefeweizen Ale) yeast

Step by Step

I have used a number of wheat and Munich malt extracts with good results. Always choose the freshest extract that fits the beer style. If you can't get fresh liquid malt extract, it is better to use an appropriate amount of dried malt extract (DME) instead.

Mill or coarsely crack the specialty malt and place loosely in a grain bag. Avoid packing the grains too tightly in the bag, using more bags if needed. Steep the bag in about 0.5 gallon (~2 liters) of water at roughly 170 °F (77 °C) for about 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags. Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 5.9 gallons (22.3 L) and a gravity of 1.043 (10.8 °P). Stir thoroughly to help dissolve the extract and bring to a boil.

The total wort boil time is 60 minutes. Add the bittering hops with 60 minutes remaining in the boil. I skip kettle finings for this beer. Chill the wort rapidly to 62 °F (17 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly. The proper pitch rate is 9 grams of properly rehydrated dry yeast, two packages of liquid yeast or one package of liquid yeast in a 1.5-liter starter.

Follow the remainder of the all-grain version of this recipe.

Trigo Oscuro

(5 gallons/19 L, all-grain)

OG = 1.056 (13.8 °P)
FG = 1.014 (3.5 °P)
IBU = 16 SRM = 17 ABV = 5.6%

Many people expect a darker beer to be bigger and richer, even though that is not always the case. This recipe is on the bigger end of the style, with a rich caramel note.

Ingredients

6.2 lb. (2.8 kg) Great Western wheat malt (2 °L) or similar
2.6 lb. (1.2 kg) Durst or Weyermann Munich malt (8 °L) or similar
1.9 lb. (850 g) Durst or Weyermann continental Pilsner malt (1.8 °L) or similar
5.3 oz. (150 g) Dingemans Special B malt (120 °L) or similar
5.3 oz. (150 g) Briess crystal malt (40 °L) or similar
2.6 oz. (75 g) Weyermann Carafa Special II (430 °L)
3.36 AAU Hallertau pellet hops (0.84 oz./24 g at 4% alpha acids) (60 min.)
Wyeast 3068 (Weihenstephan Weizen) or White Labs WLP300 (Hefeweizen Ale) yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (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 1.043 (10.8 °P).

The total wort boil time is 90 minutes, which helps reduce the SMM present in the lightly kilned Pilsner malt and results in less DMS in the finished beer. Add the bittering hops with 60 minutes remaining in the boil. I skip kettle finings in this beer. Chill the wort rapidly to 62 °F (17 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly. The proper pitch rate is 10 grams of properly rehydrated dry yeast, two packages of liquid yeast or one package of liquid yeast in a 2-liter starter.

Ferment at 62 °F (17 °C) until the beer attenuates fully. With healthy yeast, fermentation should be complete in a week, but don't rush it. The cooler than average ale fermentation temperature can extend the time it takes for complete attenuation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2.5 to 3 volumes.

Trigo Oscuro

(5 gallons/19 L, extract with grains)

OG = 1.056 (13.8 °P)
FG = 1.014 (3.5 °P)
IBU = 16 SRM = 17 ABV = 5.6%

Ingredients

5.0 lb. (2.3 kg) wheat liquid malt

extract (4 °L)
2.2 lb. (1 kg) Weyermann Munich Amber liquid malt extract (8 °L)
5.3 oz. (150 g) Dingemans Special B malt (120 °L) or similar
5.3 oz. (150 g) Briess crystal malt (40 °L) or similar
2.6 oz. (75 g) Weyermann Carafa Special II (430 °L)
3.36 AAU Hallertau pellet hops (0.84 oz./24 g at 4% alpha acids) (60 min.)
Wyeast 3068 (Weihenstephan Weizen) or White Labs WLP300 (Hefeweizen Ale) yeast

Step by Step

I have used a number of wheat and Munich malt extracts with good results. Always choose the freshest extract that fits the beer style. If you can't get fresh liquid malt extract, it is better to use an appropriate amount of dried malt extract (DME) instead.

Mill or coarsely crack the specialty malt and place loosely in a grain bag. Avoid packing the grains too tightly in the bag, using more bags if needed. Steep the bag in about ½ gallon (~2 liters) of water at roughly 170 °F (77 °C) for about 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags. Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 5.9 gallons (22.3 L) and a gravity of 1.047 (11.8 °P). Stir thoroughly and bring to a boil.

The total wort boil time is 60 minutes. Add the bittering hops with 60 minutes remaining in the boil. I skip kettle finings for this beer. Chill the wort rapidly to 62 °F (17 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly. The proper pitch rate is 10 grams of properly rehydrated dry yeast, two packages of liquid yeast or one package of liquid yeast in a 2-liter starter. Follow the remainder of the all-grain version of this recipe.

Continued from page 19

front. While I don't think an acidic or tart character is indicative of great dunkelweizen, I do think proper attenuation, pH and hop/malt balance keeps this style refreshing and balanced with any malty sweetness. I think the BJCP style guide captures this style's overall impression well by describing it as, "a moderately dark, spicy, fruity, malty, refreshing wheat-based ale. Reflecting the best yeast and wheat character of a hefeweizen blended with the malty richness of a Munich dunkel." Malty richness balanced with the spicy/fruity character is what it is all about.

A traditional dunkelweizen would be 50 to 70% wheat malt, 30 to 50% dark Munich malt and a small amount of mid-color caramel malt. By German law, at least 50% of the grist must be malted wheat. The Munich malt adds a rich, grainy, bready malt character and the caramel malt adds a gentle note of caramel sweetness.

Alternatively, a blend of wheat, Munich and Pilsner malt along with a heavier hand on the specialty grains seems to do well in competition. Greater use of specialty malts does make it easier to develop a rich color and add a touch of caramel flavor, but as always make sure what you are planning is balanced. A little caramel malt (5 to 10%) adds some color and hints of caramel flavor. If crafting a more traditional recipe, I prefer CaraMunich (60 °L). Another option is to split the caramel malt addition into a lower color and higher color malt, to develop some complexity. In either case, don't add so much that the beer has a bold caramel flavor or the balance becomes too sweet. It does not take a lot and too much can be overwhelming.

To develop color without adding roasty flavors a little debittered black malt does the trick. My preference is for Weyermann Carafa® Special, a huskless, roasted malt. The lack of a husk means far less bitter roasted flavors, which would be inappropriate in roggenbier. Weyermann also makes Carafa®, which does have a husk and a lot more roasted character, so make sure you're getting the huskless variety, Carafa® Special. Weyermann also makes Sinamar®, a liquid extract of Carafa® Special, made in accordance with the Reinheitsgebot. It is easy to use and provides as good a result as using the grain itself. Just add it to the boil kettle. One ounce by weight (28 g) of Sinamar® in

5 gallons (19 L) of liquid adds 6 SRM of color and little in the way of roasted flavor. The problem with Sinamar® is that it can be harder to find than Carafa® Special.

The ideal extract for this style does not exist. The ideal extract would be at least 50% wheat malt and the rest dark Munich malt. Most wheat extracts and Munich extracts are approximately half Pilsner or two-row malt, which is more Pilsner malt than desired. If you are interested in giving all-grain a try, the brew in a bag method is an easy way to get started as it is very similar to steeping grain in a bag. You can find lots of good information on this technique by searching for "brew in a bag method" on the Internet. If you decide to stick with extract, use any high quality wheat extract and Munich extract.

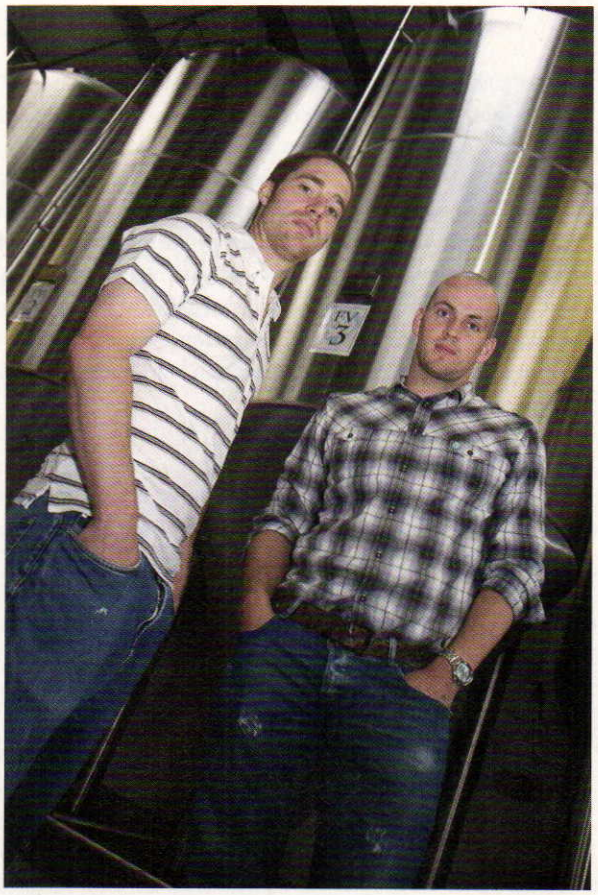
Historically, like most weizen-type beers, dunkelweizen would have been decoction mashed. While a decoction mash might induce more Maillard reactions, the rich malt flavors provided by today's Munich and Pilsner malts is more than adequate and a single infusion or step mash works well. Dunkelweizen has a medium-light to medium-full body. Target a mash temperature range of 152 to 156 °F (67 to 69 °C). If you are making a lower gravity beer, use the higher end of this temperature range to leave the beer with a bit more body. If you are making a bigger beer, use the lower end of the range to avoid too full of a body, which can limit drinkability. Keep in mind wheat malt is huskless, so if your equipment is prone to stuck mashes, you might want to add a volume of rice hulls equal to the volume of wheat malt.

Always try to use German hops for German beers, such as Hallertau, Spalt, Tettnang, Perle, Magnum or Tradition. Liberty or Mount Hood can be acceptable substitutes if you cannot source one of the others. Balance the beer with enough hop bitterness to be evident, but not enough to overcome the malt sweetness of the beer. The balance should be even or maybe slightly sweet, but not more. Target a bitterness-to-starting gravity ratio (IBU divided by OG) between 0.2 and 0.4. The bulk of the hopping should be as a bittering addition at 60 minutes. Limit late hop additions, if used at all, to a small addition of noble hops near the end of the boil.

While the traditional weizen fermentation esters and phenols should be obvious in dunkelweizen, keep in mind that the clove and banana fermentation character should blend well with the rest of the beer. While brewers like to pitch a reduced cell count to increase weizen fermentation characteristics, I'm not a big fan of that technique. Instead, pitching rates should be the same as other ales. My favorite yeasts for all weizen-type beers is White Labs WLP300 Hefeweizen Ale and Wyeast 3068 Weihenstephan Weizen, but feel free to try other weizen-type yeasts. A restrained fermentation temperature of 62 °F (17 °C) creates a beautiful balance of fermentation flavors and helps keep some unpleasant flavors in check. It is very important to follow the recommended fermentation temperature for this beer.

Jamil Zainasheff writes "Style Profile" in every issue of Brew Your Own.


BREW DOG
www.brewdog.com
BEER FOR PUNKS



JAMES WATT and MARTIN DICKIE founded Brewdog in 2007, when they were both 24. Bored with the British beer scene, they decided their Scottish brewery would produce "hardcore" beers, influenced by the US craft brewing scene.

by **TERRY FOSTER**

BREWING WITH BREWDOG

We're talking of a stout aged in a whisky cask, of beers called Trashy Blonde and Punk IPA another at 150 IBU, and of Amarillo, Chinook, Simcoe and Galena hops. So where are we? Must be the West Coast, surely? Nope. No, this brewery is on the East Coast, which is an area where you might expect the brewers to have formulated their beers with restraint and decorum. In fact, it is on the East Coast of the United Kingdom, where you might expect even more restraint and decorum! The brewery I am describing, Brewdog, is actually in Scotland, way way up in the east, close to the North Sea at Fraserburgh, north of Aberdeen, and not very far from the northern tip of Scotland.

Microbreweries in Britain

Brewdog is an unusual British microbrewery in many ways, apart from its remote location. In 2002, the British government introduced a substantial cut in beer duty for those brewers producing less than 18,300 barrels (about 25,500 U.S. barrels) annually, and this allowance was increased to 37,000 barrels (51,600 U.S. barrels) in 2004. Since then there has been a substantial increase in the number of micros. But, most of these have produced only cask beers, and the majority have concentrated on producing "mainstream" beers in the 3.5–5.0% ABV range, many of them being of the ubiquitous bitter style.

Brewdog, which started only in 2007, took a completely different view. You might think, given their location, that they would brew Scottish-style ales. But, that is not the case and indeed their beers are more highly attenuated, and often more highly hopped, than is traditional in Scottish brewing. As their website says "We are unique and individual," and that is exactly what their beers are. And not just because their beers are not run of the mill, but also because a good deal of their production goes into bottle, with a smaller amount in cask.

The head brewer, Stewart Bowman, freely admits that the founders, Martin Dickie and James Watt, were heavily influenced by the approach of American craft brewers. Indeed, their beers are distributed in the United States, and they have recently brewed a batch of Belgian beer in collaboration with Stone Brewing. They are the biggest independent brewer in Scotland, and have grown rapidly since their foundation on the back of a lease and some "scary bank loans." They brew 17 U.S. barrels (530 gallons/2,000 L) at a time, and at a maximum could turn out around 13,000 U.S. barrels annually, and they are about to double capacity! That would require brewing up to 15 times a week, which explains why there are three brewers under Stewart, as well as an intern from the United States.

The Brewery

At first sight the brewing equipment is straightforward, starting with the single-temperature infusion mash tun. The kettle is a little unusual, for it is electrically heated, rather than by steam as is common practice in the United States. In fact, I have seen such a set-up in a number of English micros in the last few years, where the wort is heated with a multi-pronged electric element. It could be argued that such elements result in more boil caramelization than is the case with steam, but those brewers who use such set-ups do not find this to be a problem. Indeed, I cannot brew outside and do not wish to use a gas burner inside my basement brewing area, so I have used electrically heated boilers for some years with very satisfactory results.

Brewdog do not have a whirlpool in the kettle, for they use only whole hop cones, with bittering, middle and late additions for hop flavor and character. Traditional practice with whole hop cones is to use a hop jack (a small vessel taking the run-off from the kettle, and filtering out the hops), but Brewdog do not use one, preferring to dry-hop in the fermenters for those beers requiring more hop aroma and flavor.

The fermenter installation is amazing, and shows a lot of foresight on the part of the founders. Lack of fermentation capacity is a common fault in many new breweries, largely due to capital considerations. A lack of fermenters is the bottleneck in many breweries, since this stage is the one which takes the longest time in the process. It particularly hinders matters when you want to brew a range of specialty beers. Brewdog have not made this mistake and have a whole series of conical fermenters, starting with no less than eight 17-U.S.-barrel vessels. This is followed by three 34-barrel, eight 85-barrel and two 170-barrel vessels, giving them tremendous flexibility in fermentation and storage capacity. You may find this startling, as many homebrewers need only one fermenter, and a couple of storage vessels, given the frequency with which they brew, but just ask your local craft brewer and I bet you will find that the first thing he wants to change is to add another fermenter or two!

Multiple Yeast Strains

As to fermentation, Brewdog uses no less than five yeast strains. They have a robust English ale strain for beers up to about 9% ABV, while for anything up to 12% ABV they employ an American ale yeast. In each case they are looking for a crisp, clean finish and high attenuation (up to 80% apparent attenuation). For stronger beers, such as Tokyo (an oak-aged stout at 18% ABV) Stewart uses the American ale yeast, followed by a Champagne yeast, a combi-

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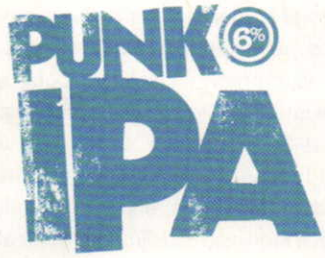
"They are the biggest independent brewer in Scotland, and have grown rapidly since their foundation."

BREWDOG CLONE RECIPES



post modern classic pale ale

Punk IPA clone

(5.0 gallons/19 L, all-grain)

OG = 1.060 FG = 1.014
IBU = 62 SRM = 8 ABV = 6.0%

Ingredients

12.5 lbs. (5.7 kg) Maris Otter pale malt
16 AAU Columbus hop pellets (90 mins) (1.5 oz./43 g at 11% alpha acids)
8.0 AAU Ahtanum hop pellets (0 mins) (1.0 oz./28 g at 8.0% alpha acids)
1.0 oz. (28 g) Amarillo hop pellets (dry hop)
White Labs WLP007 (Dry English Ale) yeast (1-qt./1-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mash grains at 149 °F (65 °C) for 1 hour, and sparge to collect about 6.0 gallons (23 L) of wort. Boil for 90 minutes with Columbus hops at start and Ahtanum at knock-out. Cool, and add yeast as a 1-quart (1 L) starter prepared 2–3 days earlier. Oxygenate well and let ferment for 3–5 days. Rack into a secondary fermenter and add Amarillo hops in a sanitized muslin bag. Rack after one to two weeks, and bottle or keg as desired.

Punk IPA clone

(5.0 gallons/19 L, extract with grains)

OG = 1.060 FG = 1.014
IBU = 62 SRM = 8 ABV = 6.0%

Ingredients

2.0 lbs. (0.91 kg) Maris Otter pale malt
3.0 lbs. (1.4 kg) Muntons Extra Light dried malt extract
3.3 lbs. (1.5 kg) Muntons Extra Light liquid malt extract (late addition)
16 AAU Columbus hop pellets (90 mins) (1.5 oz/43 g at 11.0% alpha acids)
8.0 AAU Ahtanum hop pellets (0 mins) (1 oz/28 g at 8.0% alpha acids)
1.0 oz. (28 g) Amarillo hop pellets (dry hop)
White Labs WLP007 (Dry English Ale) yeast (1-qt./1-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

To get an acceptable level of hop utilization, and the correct amount of bitterness in your beer, you must be able to boil at least 3.5 gallons (13 L) of wort. In a large kitchen pot, steep crushed pale malt in 3.0 qts. (2.8 L) of water at 149 °F (65 °C) for 45 minutes. While grains are steeping, begin heating 2.75 gallons (10 L) of water in your brewpot. Lift grain bag, place in a collander and slowly rinse grains with 1.5 qt. (1.4 L) of water at 169 °F (76 °C). Add "grain tea" from steep and dried malt extract to your brewpot to make at least 3.5 gallons (13 L) of wort. Boil wort for 90 minutes, adding Columbus hops at the start and Ahtanum hops at knock-out. Stir in liquid malt extract for the final 15 minutes of the boil. (Keep a pot of boiling water handy and add water if brewpot volume drops below 3.5 gallons/13 L). Cool wort, transfer to fermenter and top up to 5.0 gallons (19 L) with cool water Add yeast from 1-quart (1-L) yeast starter prepared 2–3 days earlier. Oxygenate well and let ferment for 3–5 days. Rack into a secondary fermenter and add Amarillo hops in a sterilized muslin bag. Rack after one to two weeks, and bottle or keg as desired.

Hardcore IPA clone

(5.0 gallons/19 L, all-grain)

OG = 1.084 FG = 1.020
IBU = 150 SRM = 11 ABV = 8.5%

Ingredients

17.5 lbs. (8.0 kg) Maris Otter pale malt
20 AAU Simcoe hop pellets (90 mins)
(1.7 oz./48 g at 12% alpha acids)
20 AAU Warrior hop pellets (90 mins)
(1.3 oz./37 g at 15% alpha acids)
13 AAU Chinook hop pellets (0 mins)
(1.0 oz./28 g at 13% alpha acids)
2.0 oz. (56 g) Amarillo hop pellets
(dry hop)
Wyeast 1056 (American Ale),
White Labs WLP001 (California Ale)
or Safale US-05 yeast
(1.5 qt./~1.5 L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mash grain at 149 °F (65 °C) for 1 hour, and sparge to collect about 6.0 gallons (23 L) of wort. Boil for 90 minutes with Simcoe and Warrior hops added at the start and Chinook hops at knock-out. Cool wort, transfer to fermenter and add yeast as a 1.5-qt. (1.5-L) starter prepared 2–3 days earlier. Oxygenate well and let ferment for 3–5 days. Rack the beer into a secondary fermenter and add Amarillo hops in a sanitized muslin bag. Rack after one to two weeks, and bottle or keg as desired.

Hardcore IPA clone

(5.0 gallons/19 L, extract with grains)

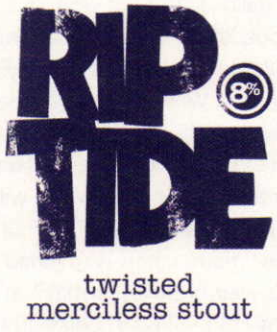
OG = 1.084 FG = 1.020
IBU = 150 SRM = 11 ABV = 8.5%

Ingredients

2.0 lbs. (0.91 kg) Maris Otter pale malt
8.25 lbs. (3.7 kg) Coopers Light dried malt extract
20 AAU Simcoe hop pellets (90 mins)
(1.7 oz./48 g at 12% alpha acids)
20 AAU Warrior hop pellets (90 mins)
(1.3 oz./37 g at 15% alpha acids)
13 AAU Chinook hop pellets (0 mins)
(1.0 oz./28 g at 13% alpha acids)
2.0 oz. (56 g) Amarillo hop pellets
(dry hop)
Wyeast 1056 (American Ale),
White Labs WLP001 (California Ale)
or Safale US-05 yeast
(1.5 qt./~1.5 L yeast starter)
1 cup corn sugar (for priming)

Step by Step

To get the proper level of bitterness in your beer, you must be able to boil your full wort. Steep crushed pale malt in 3.0 qts. (2.8 L) of water at 149 °F (65 °C) for 45 minutes. Rinse grains with 1.5 qt. (1.4 L) of water at 169 °F (76 °C). Add "grain tea" and malt extract to 5.25 gallons (20 L) of boiling water in your kettle. Boil for 90 minutes with Simcoe and Warrior hops added at the start and Chinook at knock-out. Cool, and add yeast as a 1.5-qt. (1.5-L) starter prepared 2–3 days earlier. Oxygenate well and let ferment for 3–5 days. Rack into a secondary fermenter and add Amarillo hops in a sanitized muslin bag. Rack the beer after one to two weeks, and bottle or keg as desired.



Rip Tide clone (Imperial stout)

(5.0 gallons/19 L, all-grain)

OG = 1.075 FG = 1.015
IBU = 65 SRM = 58 ABV = 8.0%

Ingredients

10.6 lbs. (4.8 kg) 2-row pale malt
1.5 lbs. (0.68 kg) Caramalt
1.0 lbs (0.45 kg) dark crystal malt (80 °L)
0.50 lb. (0.23 kg) chocolate malt
0.40 lb. (0.18 kg) roasted barley
1.0 lb. (0.45 kg) dark brown sugar
17 AAU Galena pellet hops (90 mins)
(1.3 oz./37 g at 13% alpha acids)
5 AAU English Fuggles hop pellets
(0 minutes)
(1 oz./28 g at 5.0% alpha acids)
Wyeast 1028 (London Ale) yeast
(1-qt./~1-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mash grains at 150 °F (65 ° C) for 90 minutes, then run off and sparge to collect about 6.0 gallons (23 L) of wort. Boil for 90 minutes with Galena hops at start and Fuggles at knock-out; stir in the sugar 10 minutes before end of boil, taking care that it is properly dissolved. Cool, and add yeast as a 1-quart (1 L) starter prepared 2–3 days earlier. Oxygenate well and let ferment for 3–5 days. Rack into a secondary fermenter and add Amarillo hops in a sterilized muslin bag. Rack after one to two weeks, and bottle or keg as desired.

Rip Tide clone (Imperial stout)

(5.0 gallons/19 L, partial mash)

OG = 1.075 FG = 1.015
IBU = 65 SRM = 56 ABV = 8.0%

Ingredients

0.6 lb (0.27 kg) 2-row pale malt
1.5 lb (0.7 kg) Caramalt
1.0 lb (0.45 kg) Dark crystal malt (80 °L)
0.5 lb (0.22 kg) chocolate malt
0.4 lb (0.18 kg) roasted barley
3.0 lbs. (1.4 kg) Briess Light dried malt extract
3.3 lbs. (1.5 kg) Briess Light liquid malt extract (late addition)
1 lb (0.45 kg) dark brown sugar
17 AAU Galena pellet hops (90 mins)
(1.3 oz./37 g at 13% alpha acids)
5 AAU English Fuggles hop pellets
(0 minutes)
(1 oz./28 g at 5.0% alpha acids)
Wyeast 1028 (London Ale) yeast
(1-qt./~1-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mash grains at 150 °F (65 °C) for 90 minutes, then run off and sparge to collect about 2.0 gallons (7.8 L) of wort. Combine wth 2.0 gallons (7.8 L) of boiling water in kettle. Boil for 90 minutes, adding hops at indicated times; stir in the sugar 10 minutes before end of boil. Follow the remaining instructions in the all-grain recipe.

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nation about which Stewart is very positive as being the way to go for very high gravity beers. For their lager, he goes for (what else?) a normal lager yeast, although they are about to change to another strain. Finally, they also carry a new Belgian yeast strain for the latest addition to their portfolio.

The English and American strains are highly attenuating, and any attempt at cloning these beers will need a yeast capable of achieving low finishing gravities. I would suggest Wyeast 1028 (London Ale), or White Labs WLP007 (Dry English Ale) yeast for the English yeast. Candidates for the American strain would be Wyeast 1056 (American Ale) and White Labs WLP060 (American Ale Blend). And remember that good attenuation of a given wort is best achieved by using a good active starter, and by thoroughly oxygenating (rather than just aerating) the wort.

Their Beers

Brewdog lists eight beers on the website, and I know they have brewed at least three others (if you want all the details, go to Brewdog.com). Aside from those given here in the recipe section, I have to mention some of their more unusual beers. First among these would be Dogma, a beer infused with Scottish heather honey, poppy, kola nut and guarana! Then there's Tokyo, at 18.2% ABV, a stout brewed with jasmine and cranberries aged on oak chips, and Paradox, a 10% ABV imperial stout, which although it has no unconventional ingredients, is aged for 6 months in a Scotch malt whisky cask. Last, but not least, comes their Hardcore IPA at 9% ABV, with a nominal 150 IBU (see later), and claimed to have more hops and bitterness than any other beer brewed in the United Kingdom.

Maris Otter and Specialty Malts

With the exception of the lager, all these beers are based on Maris Otter malt, which is good as both the malt and a syrup extract made from it are available to homebrewers. However, I should point out that the samples of Maris Otter I have seen recently in our brewpub, BruRm@Bar in New Haven, Connecticut, have not been of the quality we have had in the past. Maris Otter malt is quoted as being a notably plump grain, giving a good malty and full flavor. Recent samples have appeared to be no plumper and not significantly different in flavor to any other 2-row pale malt, British or American. I have stuck with it in the recipes I have given merely for the sake of authenticity, so feel free to substitute any other good quality 2-row pale, or any pale extract made from such malt. If you are all-grain mashing you should shoot for a mash temperature of 149–150 °F (65–65.5 °C), so as to give a wort relatively low in unfermentables, which will attenuate well during fermentation.

Brewdog uses a variety of other malts, such as Munich, Caramalt (a light crystal malt), crystal, dark crystal, chocolate and roast barley, though these are used in various combinations in the darker, stronger beers. Since these also use other, often exotic additives, I have chosen firstly to give clone recipes for the two

"Some British craft brewers have been influenced by what is happening on this side of the pond."

IPAs they brew. That is because both employ only pale malt which simplifies matters for the extract brewer. I have also thrown in a recipe for Rip Tide, their imperial stout which includes specialty grains which only need steeping for extract-based brewing. It also includes dark muscovado sugar which you might not be able to obtain here, but you can use the darkest sugar you can find and that will serve just as well.

Mosty American Hops

Brewdog uses mainly American hops, such as Amarillo, Chinook, Ahtanum, Bramling Cross, Galena and Simcoe. The exceptions are First Gold (the first English dwarf hop), and Nelson Sauvin, a New Zealand hop. Since neither of these appears to be available in North America to any significant extent, I stuck to American hops in the recipes, except for one addition of English Fuggles as a substitute for First Gold.

Brewdog makes some hoppy beers, and not just by Scottish or British standards. Their Hardcore IPA is listed at 150 IBUs. However, the IBU number quoted is a nominal one based on a calculation making assumptions about iso-alpha acid solubility, as well as alpha-acid utilization. In fact, the brewing literature suggests that 100 IBU is about the maximum solubility of iso-alpha acids, although I am not aware that there has been any such testing with beers at 8–9% ABV and above. Therefore, in this recipe I gave hop additions which would give 150 IBU assuming that the standard calculation does hold for this beer.

Although Brewdog uses only whole hops, I've formulated the clone recipes using pellets simply because these are more widely available to the homebrewer. If you wish to use whole hops, feel free to do so, but factor in a roughly 10% decrease in hop utilization.

Brewdog is quickly becoming one of the most prominent breweries in the British craft brewing scene.

Conclusion

I have had the privilege of being a part of a homebrewing revolution followed by a craft-brewing revolution in both Britain and the United States. When North American craft brewers started out many took their cues from the traditional beer styles of places like Britain. They then began to experiment with these styles. The result is that experiment is the norm in the U.S., for both private and commercial brewers, and "extreme" beers are not in the least unusual. Now it has come around so that some British craft brewers have been influenced by what is happening on this side of the pond, and Brewdog is one of the most notable for approaching brewing with the same open-minded, inventive approach as is so common among North American homebrewers and craft brewers.

Terry Foster is a frequent contributor to BYO.

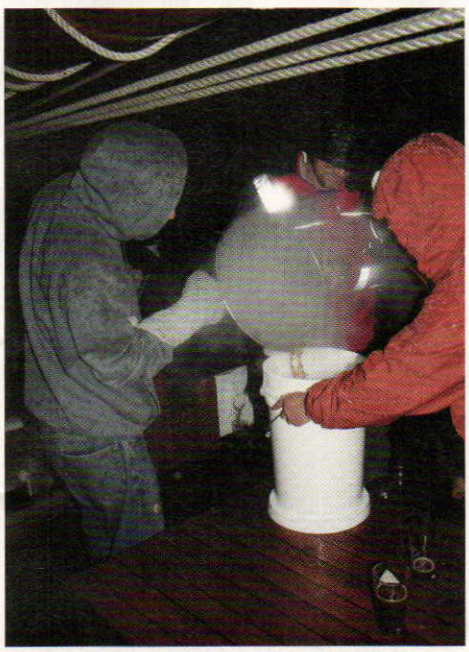
by **BRAD RING**

It had to be the first brew day ever interrupted by a radar repair. Midway through our mash on the deck of the 1924 wooden tall ship Schooner Zodiac in mid-October, crew member and homebrewer Jeff Carlson needed to climb the rigging to work on a marine radar system mounted high up on one of the masts. "You don't see that every time you make beer," Jeff said after coming down. "This could be the most expensive batch of homebrew made if the cost of a new radar is factored in."

SCHOONER BREW

By the time we were boiling after the radar work and one mooring change later, bad weather had set in with wind and rain hitting the San Juan Islands in Washington. Foul weather gear met beer during the nighttime 60-minute boil. You can forget that other Pacific Northwest ocean-based reality television series. We were homebrew heroes battling Mother Nature on board a ship at sea brewing "The Deadliest Batch" (or at least that's what it felt like in my mind being just a landlocked guy from Vermont.)

Making an IPA on the deck of the 127-foot Zodiac based out of Bellingham, Washington, is a truly unique homebrewing experience. The on-deck brewing was part of the Zodiac's four-day brewery cruise through the San Juan Islands and Puget Sound where we sailed to dif-



ferent brewpubs each day and also had on-board beer tastings and seminars led by two Seattle-area commercial breweries. You sleep right on board in bunks, work hauling lines to raise the sails and are rewarded with a great hands-on sailing and beer experience on a beautifully restored classic tall ship.

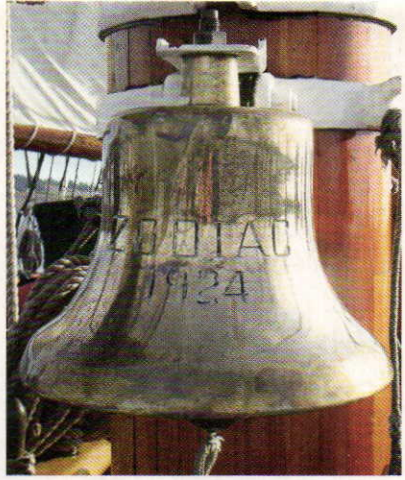
The four days were a fun mix of beer and sailing. Along with almost 40 other people on the trip I learned how to read nautical charts, haul and then coil plenty of line and in an incredible leap of faith on the crew's part actually man the helm and successfully avoided steering into one of the many islands dotting the area. I also had every beer lover's dream of spending four days touring and tasting at new breweries, sampling beers with the brewers who made them and talking beer and brewing all day long. There was also plenty of homebrew on board to try as well as some special limited release Pike Brewing offerings brought by Pike brewer Kelly Wiese, who was one of the passengers. Even the ship's cook added to the overall beer experience baking bread in the galley from scratch using the spent grain from the brewing session and using beer regularly as a cooking ingredient for the meals. "How can you not love the idea of being on this schooner drinking great beer for four days?" Kelly Wiese said pint glass in hand as we spotted a seal playing off the side of Zodiac.

The idea for this new brewery cruise came about simply enough because most of the crew really likes beer. "A lot of us are homebrewers and here we are sailing a beautiful schooner in a beautiful part of the world, but also in a region that has become world renowned for beer," Chris Erickson explained. "Plus, this gave us a really good excuse to brew on board during a trip."

And the crew's beer recipe for this trip lived up to all stereotypes about hop-heavy Pacific Northwest beers – an IPA that brought a mouth-puckering 123 IBU rating on a brewing calculator with a blend of Green Bullet, Chinook, Centennial and Willamette hop varieties. "We live in the Pacific Northwest. We like hops," Chris said smiling in the understatement of the trip.

After battling the elements during the boil, the wort was allowed to cool before being brought down below deck in a carboy to the large wooden table in the main bunk lounge. And it was here that another lesson was learned from my first time brewing on a ship – the rocking motion of being on the water must aerate the wort pretty well. It wasn't long after the British Ale yeast was added in the bunkroom that a strong fementation started up. It was fun to check the carboy for the rest of the trip while walking past the galley seeing the IPA bubble away nestled in a large milk crate.

I received a follow-up phone call from the crew as they had a first taste of that IPA we made during the trip. "It's really good," Chris said while sipping it on the Zodiac's deck a few feet from where it was brewed one month earlier. "But I think it could use some more hops."



Schooner Rat IPA

(5 gallons/19 L, all-grain)

OG =1.057 FG = 1.015
IBU = 123 (remember - it was brewed in the Pacific Northwest)
SRM = 29 ABV = 5.5%

Ingredients

8 lb. (3.63 kg) Briess 2-Row Pale Malt
2 lb. (91 kg) Crystal 60° Malt
2 lb. (91 kg) Caramunich Malt
1 New Radar System
26.4 AAU Green Bullet hops (2 oz./57 g at 13.2% alpha acids) (60 min)
13.1 AAU Chinook hops (1 oz./28 g at 13.1 % alpha acids) (15 min)
9.4 AAU Centennial hops (1 oz./28 g at 9.4% alpha acids) (0 min)
4.0 AAU Williamette hops (1 oz./28 g at 4% alpha acids) (0 min)
Wyeast 1098 British Ale yeast

Step by Step

Bring water to 145 °F (63 °C) and slowly stir in grains. Raise temperature to 150° F (66 °C) and hold for 30 minutes. Raise temperature to 160 °F (71 °C) and hold for 35 minutes or until you have enough time to climb the rigging up the mast and work on the radar system. Finally raise temperature to 170 °F (77 °C) for 20 minutes. Begin runoff and sparge. After runoff is complete, hoist the anchor and change schooner's mooring location to quieter bay and bring to a boil. Add Green Bullet hops at start of the 60 minute boil. Put on foul weather gear as rain and wind pick up. Add Chinook hops with 15 minutes left. At end of boil, remove from heat and add Centennial and Willamette hops. Cool and aerate with a rolling wave-like motion. Add yeast and ferment at 70 °F (21 °C). Bottle with ¾ cup corn sugar or keg.

Brad Ring is the Publisher of Brew Your Own. *For more information about the Schooner Zodiac and their 2010 schedule, check out their website at schoonerzodiac.com.*

by **BETSY PARKS**

MAKING MOZZARELLA

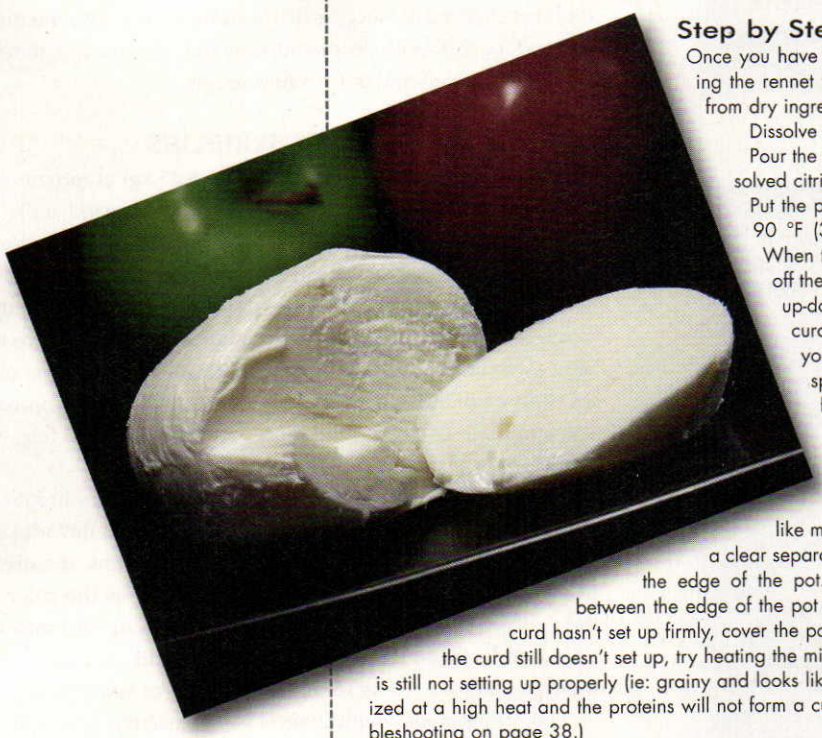
A PRIMER ON MAKING CHEESE AT HOME

THERE ARE FEW CHEESES AS VERSATILE AS FRESH MOZZARELLA. SLICED UP AND SERVED WITH FRESH TOMATOES AND BASIL, MELTED ON A FLATBREAD PIZZA, TOSSED WITH PASTA AND OLIVE OIL, SERVED ON A BURGER, OR EVEN BY ITSELF ACCOMPANIED BY YOUR FAVORITE HOMEBREW, FRESH MOZZARELLA CAN MAKE ANY MEAL SEEM A LITTLE MORE SEASONAL. BUT IF YOU WANT TO MAKE A DISH THAT IS TRULY HOMEMADE, DON'T GO TO THE GROCERY STORE AND BUY A PIECE OF CHEESE — TRY PUTTING TOGETHER YOUR OWN BATCH OF FRESH MOZZARELLA.

RECIPE

Ingredients

1 gallon (3.8 L) of whole, low-fat or skim milk (not ultra pasteurized)
1 ½ tsp. citric acid
¼ – ½ rennet tablet or ¼ tsp. liquid rennet
1 ¼ cup water (cool, non-chlorinated)
salt
icewater bath



Step by Step

Once you have all your materials together, start by dissolving the rennet tablet in ¼ cup of the water (if you started from dry ingredients).

Dissolve the citric acid in the remaining cup of water. Pour the milk into the large stock pot and add the dissolved citric acid. Stir well.

Put the pot of milk on the stove and heat the milk to 90 °F (32 °C). Continue to stir as the milk heats. When the milk reaches 90 °F (32 °C), take the pot off the stove and very gently stir in the rennet in an up-down motion for 15 seconds. It is crucial to the curd that you don't over stir during this step as you may inadvertently cut the curd with your spoon, which can prevent your initial curd from setting up properly. Cover the pot and allow it to sit very still for about five minutes.

After five minutes have passed, remove the lid and check on the cheese curd. The curd should have set up in a solid, custard-like mass in the pot and you should be able to see a clear separation between the curd and the whey around the edge of the pot. You can put your spoon into the pot in between the edge of the pot and the curd and pull the curd away. If the curd hasn't set up firmly, cover the pot again and let it sit for up to 15 minutes. If the curd still doesn't set up, try heating the milk to 95 or 100 °F (35 or 38 °C). If the curd is still not setting up properly (ie: grainy and looks like ricotta), your milk may have been pasteurized at a high heat and the proteins will not form a curd. (If this happens, see the section on troubleshooting on page 38.)

Assuming your curd set up properly, the next step is cutting the curd. Take your knife and cut the curd in a checkerboard pattern from top to bottom and side-to-side, making cubes of about ⅜ of an inch. The curd should resemble a firm yogurt.

Once you've cut the curd, put the pot back on the heat, warm the curds and whey up to 110 °F (43 °C) and remove from the heat again and gently stir the curds for two to five minutes. This allows the curd to firm up a little bit more. The longer you stir, the firmer the finished cheese.

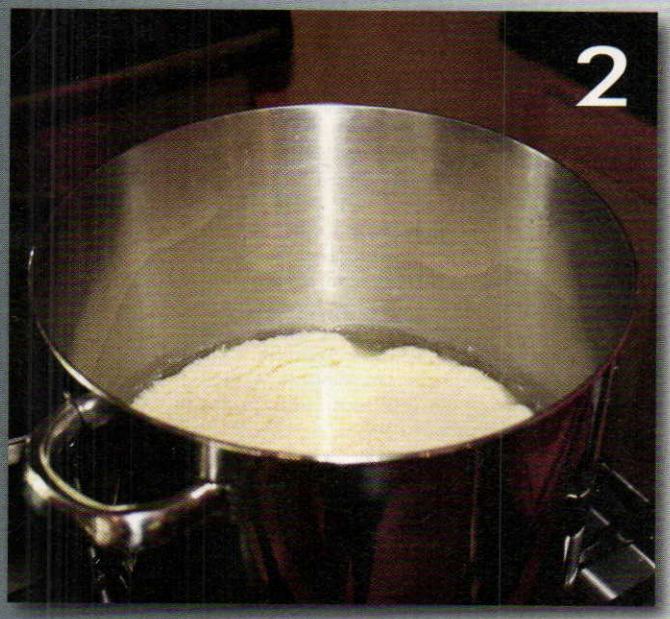
Now ladle your curds into the strainer to separate them from the whey. If you have a purpose for using the whey, such as making a batch of ricotta, reserve it to the side and store for another time. Otherwise discard the whey.

In the smaller sauce pan, heat a few quarts of water to 185 °F (85 °C). You may salt the water if you would like your finished cheese to be a little salty. Dip the colander of curds into the hot water bath, heating them up to about 135 °F (57 °C) or until they become gooey and stretchable. If you have a pair of rubber gloves, this is a good time to put them on as you will be working the hot curds with your hands.

When the curds get stretchy, start out by kneading them like a piece of bread dough on a clean surface, working gently at first. When the curd cools down and becomes less pliable, put it back in the colander and dip it in the water bath again. After a few cycles, you will see the cheese starting to get smooth and shiny. Drain off the whey as you work the cheese. At this point you can start stretching it like taffy instead of kneading. Alternately stretch the cheese and bring it back together until it becomes white and shiny, dipping back in the hot water bath as needed. You can add salt during the stretching process, as well as herbs or spices, if desired.

When you achieve a good stretchiness and a shiny look, form the mozzarella into a ball and plunge it into a cold water bath to cool and set for about ten minutes.

After the cheese is cooled and set, you can slice it up and enjoy it right away or wrap it in plastic wrap and store it in the refrigerator for up to three to five days. Mozzarella also freezes well in an airtight plastic bag with the air removed.



BEFORE YOU START

A quick search of the Internet or cheesemaking references will result in lots of varying recipes for making fresh mozzarella. This is no cause for concern as there are many recipes and methods for making mozzarella — and most are successful. You can use the recipe in this article, or choose another that suits you. Do not, however, combine recipes or swap out ingredients or measurements. Unlike adding a dash of "this and that" or making substitutions when cooking, cheese recipes are written to replicate certain conditions, and following the directions for a set recipe will give you the best chances for success. If, for some reason, your recipe doesn't produce the results you want, only then should you go back and tweak the ingredients or try a new recipe.

INGREDIENTS AND SUPPLIES

To make roughly ¾ to 1 pound (0.34 to 0.45 kg) of mozzarella, you will need a gallon (3.8 L) of non-ultra pasteurized milk, rennet (either animal-based or vegetarian), citric acid, salt and a source of non-chlorinated water. (See recipe on page 35 for the amounts). You can use a gallon of normally pasteurized, store-bought whole or low-fat milk, but be sure to check the label to make sure it is not ultra pasteurized. Ultra pasteurizing heats milk proteins too high for cheesemaking purposes and your curd will not set properly. As a general rule of thumb, the more local the milk, the less likely it will be ultra pasteurized.

Milk can be whole, low fat or skim, however lower fat content in the milk will make cheese that is dryer and less flavorful. Also, if you purchase your citric acid or rennet in dry forms, dissolving the ingredients in non-chlorinated water is a must as the chlorine will break down the enzymes in the rennet and your curd may not set up properly. If you are using dried rennet and citric acid, dissolve them in water according to the manufacturer's instructions.

For equipment, you will need a non-reactive, 6–8 quart (~6–8 L) stock pot (stainless steel or enamel is best), a non-reactive slotted spoon (plastic or stainless steel are best), a quick-read or cheese thermometer that can measure between 80 and 120 °F (27 and 49 °C), a stainless steel or plastic colander, a knife (preferably serrated) that reaches the bottom of the stock pot, a non-reactive 4–6 quart (4–6 L) sauce pan that can accommodate your colander, a 2-cup (473-mL) liquid measuring cup and a set of US measuring spoons (Photo 1). A pair of rubber gloves is also helpful.

CLEAN AND SANITIZE

Just like brewing, cheesemaking requires clean, sanitized equipment and surfaces. When making an unripened cheese like mozzarella, unwanted bacteria will not necessarily ruin your cheese but it can most definitely make someone sick. If you decide to go on to making other cheeses in the future, especially ripened cheese, bacterial contamination could not only make someone sick, they can also ruin your cheese, so carry your brewing cleaning and sanitation practices over when you make cheese. Treat your equipment and work area as you would if you were handling any other food — avoid any bacterial contamination. Wash all your surfaces and equipment with soap and water and follow up with an antimicrobial sanitizer. Bleach diluted in water works fine for cheesemaking. Keep a cup of it handy for re-sanitizing your spoon or thermometer should they become contaminated for any reason.

Continued on page 38

MOZZARELLA PREPARATION PHOTOS

1. (Top of page 36) All the ingredients — milk, citric acid and rennet — and all the equipment you need for making mozzarella cheese at home.

2. The milk and citric acid are heated to 90 °F (32 °C), then the rennet is folded in. The rennet causes the curd to coagulate. At the side of the pot, you can see the curd pulling away from the whey.

3. Once the curd begins to set, it is cut with a large knife into cubes with roughly ⅜ inch (~1 cm) sides.

4. (top of this page) The cubed curds and whey are heated to 110 °F (43 °C).

5. The curds are transferred to a colander, separating them from the whey. They should be heated, in the hot water bath, to around 135 °F (57 °C) before kneading.

6. (Top of 38) The curds are then kneaded and later stretched to develop the cheese.

7. Once the cheese has been kneaded and stretched until it reaches the proper consistency, it is made into a ball and submerged in a cold water bath for cooling.

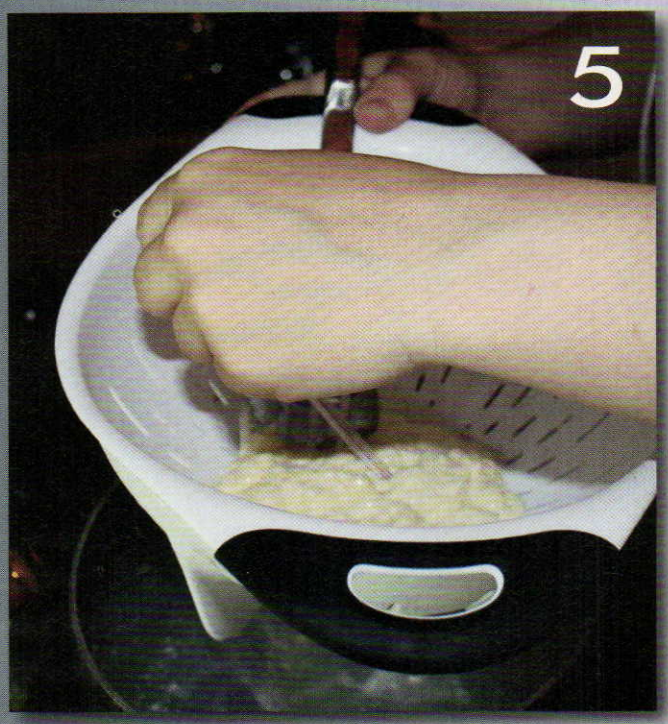
8. The finished product, ready for cooking — or just slicing and enjoying with a nice glass of beer.

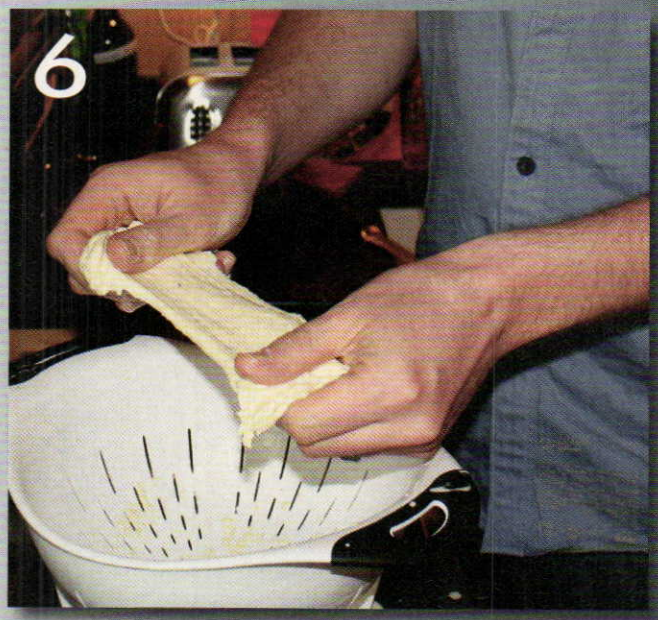
Books on Cheesemaking

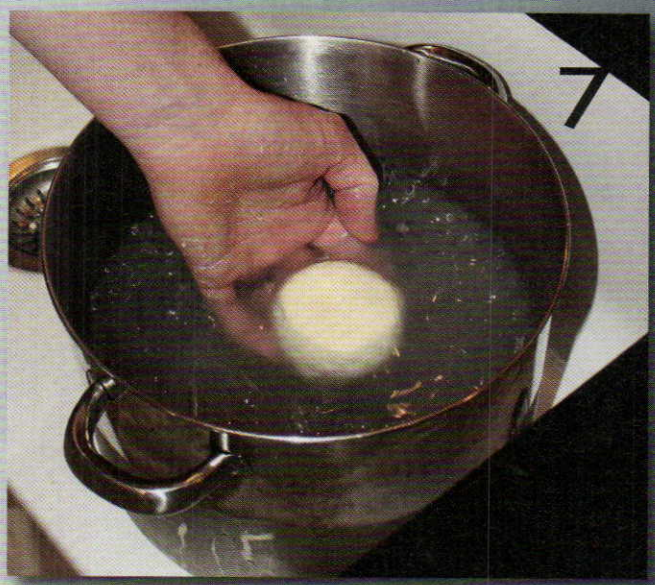
Home Cheese Making, Ricki Carroll (2002, Storey Books)

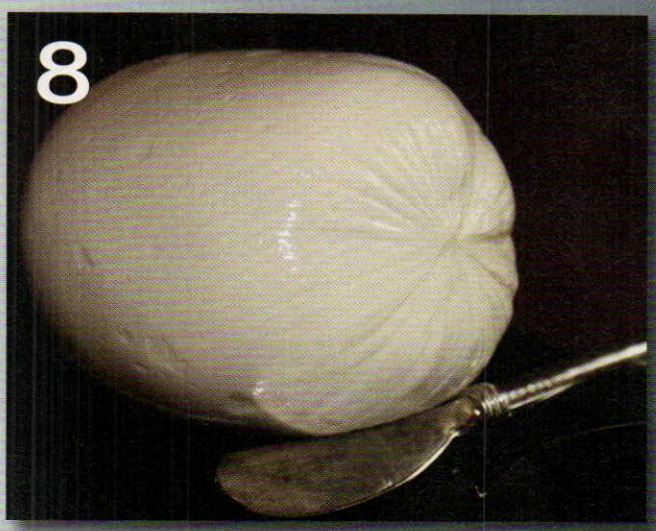
The Cheesemaker's Manual, Margaret Morris (2003)

Making Artisan Cheese, Tim Smith (2005, Quarry Books)









For this story, I ordered a "30 Minute Mozzarella" kit from The New England Cheesemaking Supply Company in Ashfield, Massachusetts, which contains powdered ingredients, a thermometer and a simple recipe, (adapted on page 35). A kit will make gathering your ingredients much easier, although you can purchase rennet and citric acid separately at any store that stocks cheesemaking supplies.

TROUBLESHOOTING

As simple as this recipe is, it's safe to say that making mozzarella takes a little practice to get the hang of, so don't feel bad about a funny batch or two. You will start to get the feel of what to look for when the curd sets up, how long to leave them in the rennet and how to stretch and form the curds as you become a more experienced cheesemaker. If you are very timid, try to find a local cheesemaker or cheesemaking supplier that can walk you through the process the first time. Just like brewing, cheese takes a little experimentation to get it just right.

If you find that you are having a lot of trouble getting the initial curd to set up, even after a few tries, you will probably have to try a different brand of milk. More local milk tends to be less pasteurized, and you can try buying milk from a local dairy if you're really having trouble. This recipe should work for store-bought, homogenized milk, though, so try another brand first. Another problem may be that the water you used to dissolve the rennet and citric acid could be chlorinated, which will break down the enzymes in the rennet. Use bottled water next time as most bottled waters are not chlorinated. The curd may also not set up because you could be stirring the milk too much after adding the rennet. Be sure to only stir in the rennet for about 15 seconds just to incorporate it before allowing the milk to sit very still.

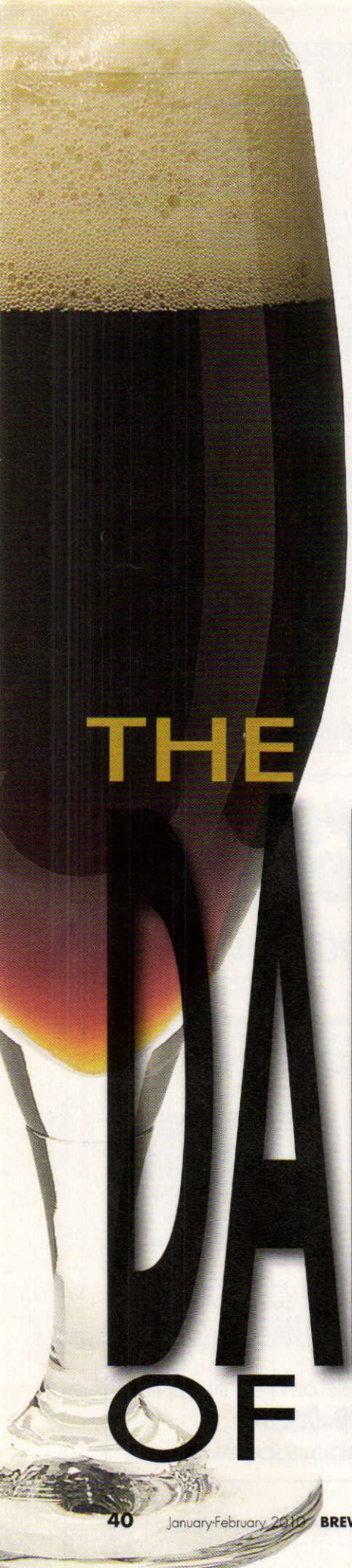
If you are having trouble stretching the cheese, you may need to warm it up a little bit more by re-dipping in the water bath. If you're still having trouble stretching, try using more citric acid in your next batch. The cheese's acidity is what makes it pliable and stretchy, allowing you to work the curds into cheese. Too much acidity, however, can turn the cheese into a big mess. If you're having trouble stretching the cheese with the amount of citric acid in this recipe, try increasing it by another 1 ½ teaspoons.

If your cheese seems dry, and you are using something other than whole milk, consider trying whole milk next time. If you're using whole milk and the cheese is still too dry for you, skip the heating and stirring step after cutting the curd. You could also try adding a little bit less citric acid to the milk (about ¼ tsp.) or stretching the cheese less before chilling it down in the ice bath.

YOUR CHEESY FUTURE

If you enjoy your first attempts at cheesemaking and would like to learn more, there are a lot of pathways to explore. In addition to soft cheeses, like mozzarella, there are also hard cheeses, cheeses ripened by mold or bacteria and a nearly endless variety of specialty cheeses. In the future, when someone asks you how your latest batch is aging, you may have to ask, "beer or cheese?"

Betsy Parks is the Associate Editor of Brew Your Own *and a graduate of the New England Culinary Institute in Montpelier, Vermont.*



PROFESSIONAL BREWERS of AWARD-WINNING PORTERS share their TIPS and ADVICE for crafting the PERFECT PORTER

THE DARK SECRETS OF PORTER

by **BETSY PARKS**

Is there a way to make a glass of porter spill its secrets? What malts, yeasts and techniques combine to make award-winning examples of this dark style? Since the porters aren't talking, we asked these five award-winning brewers what it takes to make the perfect porter.

BREWERS:

PAUL PHILIPPON, The Duck-Rabbit Craft Brewery
LARRY SIDOR, Deschutes Brewery
JASON OLIVER, Devils Backbone Brewing Company
JASON GOMPF, Great Lakes Brewing Company
DOUG ODELL, Odell Brewing Company

THE HEART OF ANY PORTER IS THE DARKLY-ROASTED MALTS AND GRAINS. WHAT MALTS/GRAINS DO YOU LIKE IN A PORTER?

Paul Philippon, The Duck-Rabbit Craft Brewery

Obviously, I want some roasted grains. I don't tend to use any unmalted barley like I would in our stouts. What I want in a porter — especially in a standard porter — is an acrid bitterness that you can get from very highly roasted grains, although I don't look for this as much in our Baltic porter.

Larry Sidor, Deschutes Brewery

The thing I love about porters is to bring out as much caramel as possible, and for that I use chocolate malt. Some crystal malt is called for, but the real key is chocolate malt.

Jason Oliver, Devils Backbone Brewing Company

In a British-style porter, I like to include a combination of English crystal, brown and chocolate malts in addition to the pale ale or 2-row malt. Sometimes I add a touch of torrefied wheat for head retention and palate softness. In our Baltic porter, I use more Germanic/Continental malts. These would be a portion of dark Munich for richness of character and de-husked Carafa II Special from Weyermann for color and flavor.

Jason Gompf, Great Lakes Brewing Company

I prefer the chocolate and bitter black malts, roasted barley, sometimes, maybe some special roast, crystal malt or maybe some Munich to get a little body.

Doug Odell, Odell Brewing Company

We use a combination of pale ale malt, crystal malt, chocolate malt and roasted barley.

DO YOU MIX MULTIPLE DARK MALTS OR GRAINS TO GET THE DARK GRAIN CHARACTER YOU DESIRE, OR DO YOU RELY ON A SINGLE DARK MALT OR GRAIN?

Paul Philippon, The Duck-Rabbit Craft Brewery

I want a kind of depth of roasty character in a porter, not just one note, so I use a range of grains to achieve a depth of character. Whenever you use roasty grains, I find that layering a couple of different varieties of malts makes the beer more complex.

Larry Sidor, Deschutes Brewery

I think we have four different crystallized/caramelized chocolate malts in our blend.

Jason Oliver, Devils Backbone Brewing Company

We definitely use a mix. If one type of malt could get me the flavor I want, I would use only one dark malt. Some porter recipes from long ago call for using 90–100% brown malt. You would be hard pressed to make a palatable beer today if you used all brown malt as

malts have changed over time. The brown malt of today is different from the brown malt of old.

OTHER THAN THE DARK MALTS, DO YOU ADD ANY OTHER SPECIALTY GRAINS TO THE GRIST? WHAT DO THESE ADD TO THE BEER?

Paul Philippon, The Duck-Rabbit Craft Brewery

We do use caramel malts to get more of that sweet malty backbone — not just roasty. I want to support that roastiness with a good body. In our standard porter, we use oats. I find that adding a little bit of oats in the grist gives a silkiness to the mouthfeel that I think goes great with that acrid roast bitterness.

Jason Oliver, Devils Backbone Brewing Co.

In English-style beers, I occasionally use torrefied wheat or flaked barley in conjunction with the malt. Small portions of these can improve head retention. I think wheat can soften the palate of the beer, allowing for some of the complexities of the specialty malts and yeast character to show through.

Jason Gompf, Great Lakes Brewing Company

Sometimes I might throw some oats in there to smooth out the flavor. Most of the time we use some crystal or Munich malts to round it all out. It's a delicate mixture of malts.

HOW MUCH BITTERNESS SHOULD ONE HAVE IN A PORTER? WHAT IS THE ROLE OF BITTERNESS IN A PORTER?

Paul Philippon, The Duck-Rabbit Craft Brewery

We brew porter in the English style, which is traditionally not dominated by hops. The bitterness needs to be there and be in balance, but the main source of the bitterness in a porter comes from the malts rather than lots of hops.

Larry Sidor, Deschutes Brewery

We run right at 50 IBUS in our porter and we tend to use hops that aren't significantly flavor or aroma forward including Willamette. We tend to have front-end hopping so the majority of the hopping is done in the first and seconds and just a little bit of hopping in the back end. The roast and chocolate malts kind of hide the hop aromas and flavors, so if you try to strive for high hop aromas, the beer can get muddled up and that's not the goal of a porter for us.

Doug Odell, Odell Brewing Company

The role in any beer is to balance the sweetness of the malt. How much bitterness is a personal preference or brewery style. I think in many porters, to get the full body, there is a higher residual sugar than, say, a pale ale. When there is a higher residual sugar, it takes more bitterness to balance that. Bitterness level is appropriate if it balances the sweetness of the malt and fits the style.

DO LATE HOP ADDITIONS — FOR FLAVOR AND AROMA— BENEFIT A PORTER? IF SO, WHAT HOP VARIETIES DO YOU PREFER?

Paul Philippon, The Duck-Rabbit Craft Brewery

I think that they do, but again, you don't want to go overboard with the hops. Late hop additions add complexity and aroma. We add hops in the whirlpool. I myself really love Fuggles, but lots of varieties could work. You get a little bit of a black pepper character from the Fuggles, which I think goes well in a porter.

Larry Sidor, Deschutes Brewery

We use just a small amount. Willamette. We tend to use Nugget on the front end.

Jason Oliver, Devils Backbone Brewing Company

I think a token hop addition for flavor at 15–20 minutes before boil end is OK. I keep the addition very, very small. I prefer Fuggles for English porter and Saaz or Lublin for Baltic porter. I think aroma additions are totally inappropriate for these beers and can detract from the rich malt notes that these beers are famous for.

WHAT YEAST STRAINS WORK WELL IN A PORTER?

Larry Sidor, Deschutes Brewery

We have our own yeast strain — we're pretty much a British ale type of brewery and our house strain came from an English brewery and it's up to the task of producing a porter.

Jason Oliver, Devils Backbone Brewing Company

For English-style porter, I like Fermentis Safale S-04. It is a dry English yeast strain that provides great English ester character and it flocculates well. For Baltic porter, I use my house lager yeast, but the classic Weihenstephan 3470 lager yeast works very well.

Jason Gompf, Great Lakes Brewing Company

We use Wyeast 1028 (London Ale) for all of our ales. This yeast gives off a very clean aroma and flavor.

Doug Odell, Odell Brewing Co.

Traditionally porter is of English origin, so an English ale yeast is best, and even more specifically, I recommend using a London ale yeast.

WHAT TEMPERATURES DO YOU FERMENT AT, AND DO YOU THINK ESTERS PLAY A ROLE IN A PORTER'S PROFILE?

Larry Sidor, Deschutes Brewery

We ferment at 63 °F (17 °C). I think esters absolutely play a part. The variety of yeast we use produces no sulfur, so the predominant attribute of the yeast is the higher esters.

Jason Oliver, Devils Backbone Brewing Co.

Yes, for traditional porter. English ester characteristics can add a pleasant wine-y character that adds complexity to the beer. I ferment at 68 °F (20 °C) for English porter. For my Baltic porter, I ferment roughly at normal lager temperature.

Jason Gompf, Great Lakes Brewing Co.

We usually keep our ales at 65 °F (18 °C). We're not looking for esters in this beer and want it to be clean smelling, no fruitiness. I want to smell the malt, I don't want to smell any esters coming off the yeast.

Sometimes you may get some esters in there if you're experimenting, which is the great thing about brewing, but when making a straight porter, I personally wouldn't want esters in there at all.

Doug Odell,
Odell Brewing Company
In our porter we're not looking for a highly-estered flavor. Look at your yeast strain and go lower in temperature if you want less esters and higher if you want more.

THE DARK ROASTY CHARACTER OF PORTER LENDS ITSELF WELL TO OTHER FLAVORINGS. DO YOU HAVE ANY ADVICE ON MAKING FLAVORED PORTERS?

Larry Sidor,
Deschutes Brewery
We used a significant amount of coffee in a double Black Butte porter we called Double Black Butte Porter XX and XXI. We put in about a pound per barrel of coarsely ground coffee. We worked with a local coffee roaster to come up with the right source of coffee geographically and how it was roasted. I think adding flavors is just one big experiment.

Jason Gompf,
Great Lakes Brewing Company
If you're going to do that kind of stuff you have to make sure whatever you do it is really subtle because too much can ruin the beer. One of our former chefs made real vanilla extract and it was a great way to infuse the beers. Go all natural — use coffee beans, use real vanilla extract — and make sure what you're doing is not overwhelming. If you're going to make anything great, it is going to take time. You don't want to stamp your name on something that you don't agree with yourself.

Doug Odell,
Odell Brewing Company
We have red currants growing outside our brewery and once I made a keg of red currant porter — I think the flavor and residual sweetness works well as would raspberry. Right now we also have a vanilla porter. The style lends itself well to anything with a dessert flavor — fruit, chocolate, vanilla.

DO YOU MASH FOR A HIGH OR LOW DEGREE OF FERMENTABILITY?

Paul Philippon,
The Duck-Rabbit Craft Brewery
We aim for a medium degree of fermentability. The beer is relatively high alcohol with lots of grain and I don't want it to go overboard.

Larry Sidor, Deschutes Brewery
I would say fairly low. We're shooting for about 50–57% [real attenuation], which is pretty low. Most IPAs are in the 64% area. I see a real tendency for people to overmash their sugar conversion program and I think you need to be very patient on that. You want to have a lot of residual sweetness in the mash that the yeast is not going to ferment.

Jason Oliver, Devils Backbone Brewing Company
I go for medium fermentability in the English porter and high for the Baltic because I will have a lot of residual sugar and body regardless so I try to manage it. I do not want too much and have a cloyingly sweet beer.

Jason Gompf,
Great Lakes Brewing Co.
We go for a pretty high fermentability because your malts are going to dictate to you what the style is going to be. If you're not going to do that, or have a real basic recipe, I would try for a little bit higher temperature for more residual sugars. Our mash is 150 °F (66 °C) like most of our other beers. Probably 148 °F (64 °C) is the lowest we'll go for say, an IPA. You want it to ferment out. I like residual 4.4–4.5 [°Plato] for a porter. Anything sweeter and I would try to balance that out with more hops.

Doug Odell,
Odell Brewing Company
We tend to go on the lower side than say our pale ales.

GIVEN THE DEEP COLOR OF A PORTER, DO YOU TREAT THE BEER AS YOU WOULD YOUR PALER BEERS WITH RESPECT TO STEPS TAKEN TO PROMOTE CLARITY (KETTLE FININGS, FILTRATION, ETC.)?

Paul Philippon,
The Duck-Rabbit Craft Brewery
We don't actually brew anything much lighter than an amber, but yes, we treat the porters the same way we would the rest of our beers with kettle finings and we do filter.

Larry Sidor, Deschutes Brewery
Every brew we make we have a test where we determine the finings to put in. The goal of that is to have a compact trub in the whirlpool and in the cold break. I would say in general we treat the porter at about the same level as a pale. We never filter our porter.

Jason Oliver, Devils Backbone Brewing Company
Generally, I do not filter my porters.

Jason Gompf,
Great Lakes Brewing Co.
We treat the beers all the same — but delicately. Overall, we treat them like any other ale we have.

Doug Odell,
Odell Brewing Company
The kettle finings we use are the same. We've played with filtering and not filtering, but we do filter our porter.

ARE THERE ANY SPECIAL ACTIONS THAT NEED TO BE TAKEN WHEN FERMENTING A PORTER?

Larry Sidor, Deschutes Brewery
Porter is one of our least complex fermentations. The yeast love it. The key is to watch the amount of diacetyl generation, which is dependent on the amount of yeast and oxygen. Taste the beer during fermentation and see how much diacetyl is in it.

Jason Oliver, Devils Backbone Brewing Company
Get rid of the yeast as often as you can. The lower pH from the dark malts can increase the risk of yeast autolysis. If you do not need it, get rid of it. Rack off the yeast cake at the end of fermentation.

Stronger beers are more of a risk for autolysis as well.

Jason Gompf,
Great Lakes Brewing Co.
Make sure you don't crash cool them, because the yeast won't have time to digest the diacetyl. Let it sit at about 65 °F (18 °C) after it finishes, then bring it down to 40 to 38 °F (4 to 3 °C) and leave it there for a while.

WHAT LEVEL OF CARBONATION DO YOU SHOOT FOR IN YOUR PORTER? WHY?

Paul Philippon,
The Duck-Rabbit Craft Brewery
We carbonate at around 2.4 [volumes of CO_2], simply because I like it that way.

Larry Sidor,
Deschutes Brewery
We shoot for 2.2 volumes and we expect our kräusen will take us up to about 2.5. I think that's a pretty medium to low carbonation.

Jason Gompf,
Great Lakes Brewing Co.
All our beers are about 2.7 for bottles and around 2.5 for kegs. You don't want it flat and you don't want it super-carbonated. I don't like drinking stuff flat or over-carbonated, that's my style . . . the middle of the road.

Doug Odell,
Odell Brewing Company
Ours is about 2.6. We also make a nitro version of our Cutthroat Porter. We'll take ten barrels off of our regular run and nitrogenate. What's interesting is even beers from the very same batch that are carbonated differently show a significant difference in mouthfeel and flavor.

WHAT FOODS DO PORTERS PAIR WELL WITH?

Paul Philippon,
The Duck-Rabbit Craft Brewery
We've had great luck with roast meats like roast turkey. Roast beef goes great with a porter. The kind of fire flavors you get in roast meats go really well with the roast flavors in porter.

Doug Odell,
Odell Brewing Company
Most dessert type foods work well, such as chocolate, crème brulee — anything with a caramel character. I also say it works well with chili, beef stew and good meat marinade. Porter also pairs well with richer meat entrees — something like a porter/raspberry glaze on roast pork is quite nice.

WHEN YOU THINK OF THE PERFECT PORTER, WHAT IS IT LIKE?

Paul Philippon,
The Duck-Rabbit Craft Brewery
It's delicious, roasty and reminiscent of espresso. It is full bodied, fairly robust, but nothing that ought to scare anybody away. If a person is a fan of good coffee I don't see any reason why they couldn't be a fan of good porter.

Larry Sidor, Deschutes Brewery
It's a melding of chocolate and roast attributes — a comfort beer for drinking in front of the fireplace.

Jason Oliver, Devils Backbone Brewing Company
I think of a dark rich blanket of flavor that warms and soothes the soul.

Jason Gompf,
Great Lakes Brewing Co.
The aroma must have some nice chocolate aroma, a little bit of caramel, a little coffee, a real nice roasted aroma — it's kind of like when you smell good brewed coffee. The flavor is not too bitter but you also want to taste those malts. It is not too sweet either — a nice balance between malts and hops, not too astringent from the dark malts with small tiny CO_2 bubbles — not overwhelming.

Doug Odell,
Odell Brewing Company
I like a rich mouthfeel and I like an appropriate level of roast character. I've had some stouts in particular that I thought were overdone with roast character — you can go overboard. I like to see a relatively light-colored head, and an overall flavorful experience that's well balanced.

Betsy Parks is BYO's Assistant Editor.

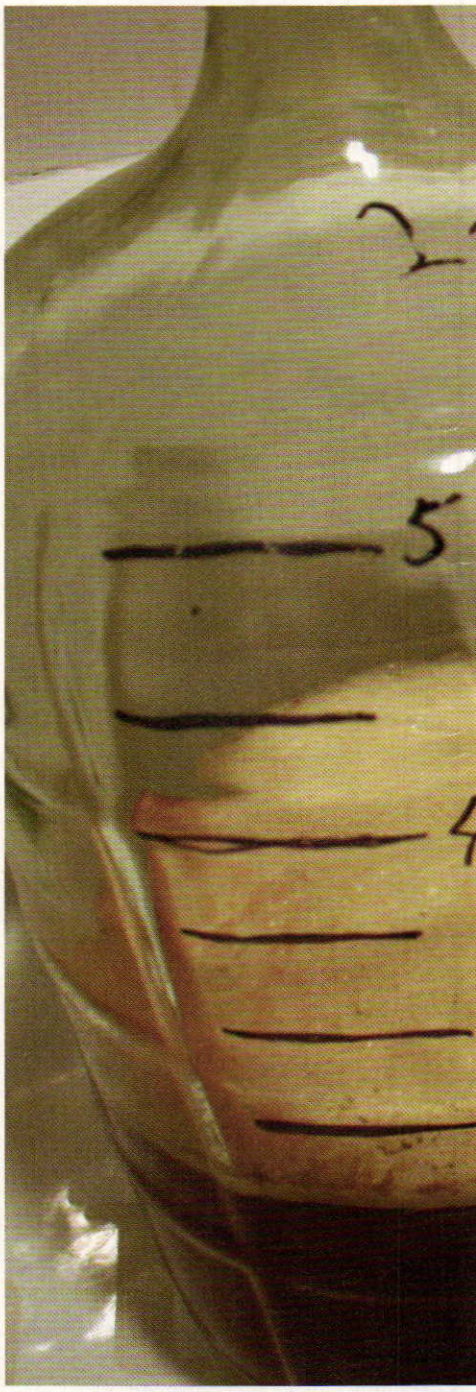
by **CHRIS COLBY & JAMES SPENCER**

HOW DOES YEAST PITCHING RATE AFFECT YOUR BEER?

THE SECOND **BYO/BBR** COLLABORATIVE EXPERIMENT

This is the second installment in the Brew Your Own/Basic Brewing Radio Collaborative Experiment series. Our aim is to scientifically test various aspects of brewing at a small scale, allowing homebrewers to make better decisions when it comes to choosing one method versus another. By enlisting the help of multiple homebrewers in our experiments, we hope to gather data that is shown to be repeatable by the independent results of multiple brewers. In this installment, our experimental question is: how does yeast pitching rate affect your beer? Common wisdom tells us that a lower pitching rate results in a slower fermentation, lower attenuation and more esters. Very low pitching rates are also said to provide a window for contamination to take hold, because the yeast does not quickly colonize the wort and produce enough alcohol to inhibit other microbial competitors.

Higher pitching rates are said to result in faster fermentations, higher attenuation and cleaner beers. Exceptionally high pitching rates are said to impart an unpleasant character called "yeast bite." Our experiment focuses on the expected differences and will attempt to test the degree to which these factors are really influenced by pitch rate.



What We Did

To test this hypothesis, we designed a simple experiment. We suggested that our experimenters brew 6.0 gallons (23 L) of wort, to be split evenly between three fermenters. Ideally, the three fermenters would all be of the same size and shape. One wort would be pitched with the recommended amount of yeast. We'll call this the 1X trial. The other two fermenters would be pitched with ¼X and 4X amounts of yeast, respectively. In other words, a quarter of the recommended dose of yeast and four times the recommended dose.

To arrive at the standard pitching rate, we recommended using Jamil Zainasheff's pitching calculator, found at mrmalty.com. For simplicity, we recommended using dried yeast so that each amount of yeast could be weighed. Pitching the liquid from yeast starters would have involved diluting the wort a progressively greater amount as the pitching rate increased. Assuming that a given weight of dried yeast will repeatably contain roughly the

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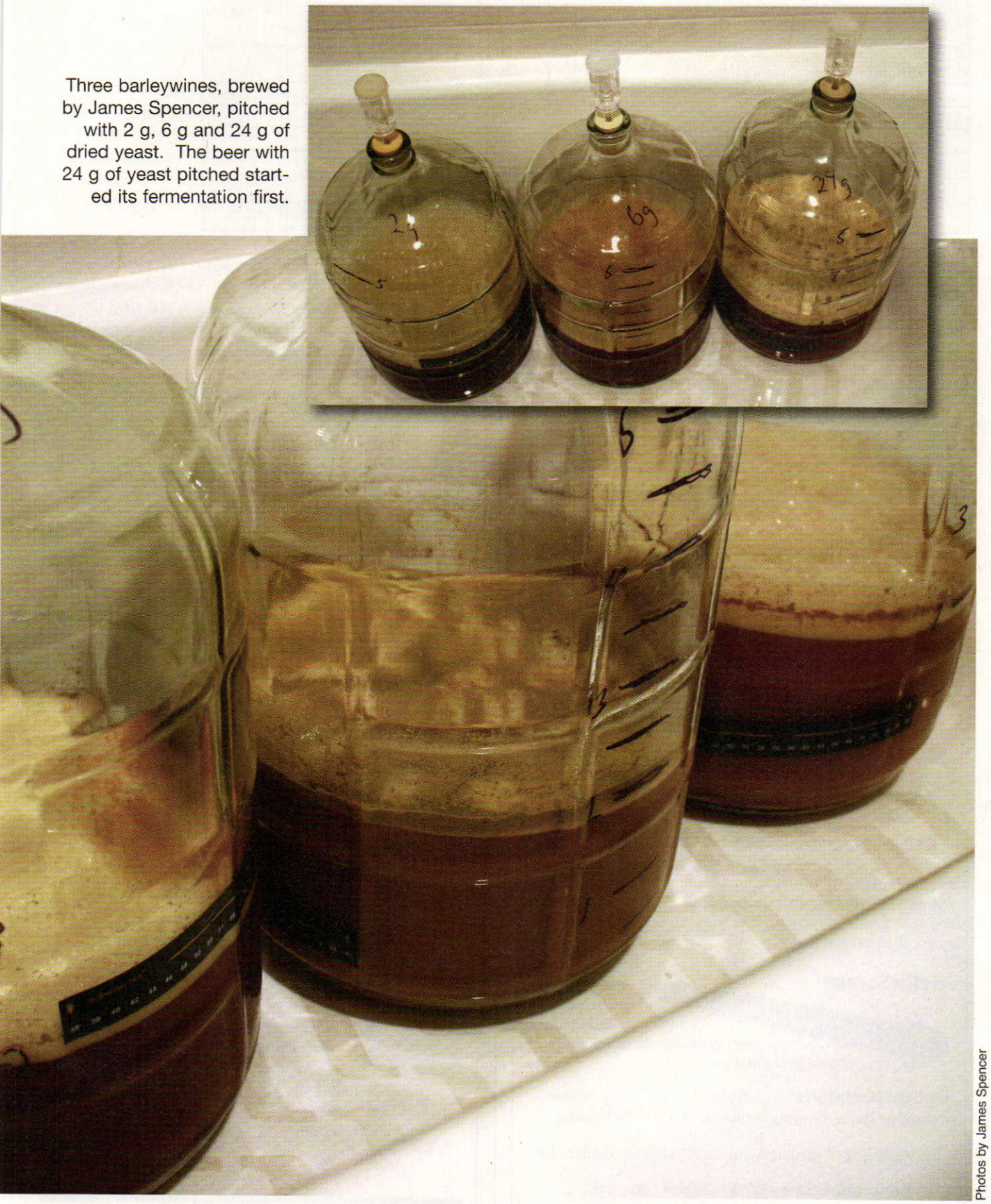


Three barleywines, brewed by James Spencer, pitched with 2 g, 6 g and 24 g of dried yeast. The beer with 24 g of yeast pitched started its fermentation first.

Photos by James Spencer

Original Gravities and Finishing Gravities

NAME	BEER STYLE	OG	FG ¼X	FG ½X	FG 1X	FG 2X	FG 4X
Tim Harris	Ordinary Bitter	1.032	1.009		1.009		1.009
Jerry Marowsky	Barleywine	1.078	1.015		1.015		1.017
Mark A. Smith	German Pilsner	1.047	1.011		1.009		1.007
Adam Ross	American Pale Ale	1.056	1.005		1.007		1.009
John Chubick	IPA	1.065		1.011		1.009	
James Spencer	Barleywine	1.079		1.015	1.015		1.015
Chris Colby	American Pale Ale	1.045	1.005	1.007	1.007	1.008	1.009

Photos by Chris Colby

Five carboys in Colby's fermentation chamber, five hours after pitching. The 4X carboy (lower right) has a thick cover of kräusen.

same amount of viable yeast cells, this should have allowed us to get fairly close to the calculated rates. At a minimum, the relative yeast amounts should be correct. As an example of the pitching rates involved, for beers with a 1.048–1.056 original gravity (OG), 4 grams of dried yeast was recommended to pitch 2.0 gallons (7.6 L) of ale.

Experimental options included reserving a small amount of unpitched wort as a control or pitching at ½X, 1X and 2X. And, of course, as in all our collaborative experiments, individual experimenters were free to try different experimental designs.

So, the basic experiment involved three (or more) identical worts, each of them pitched with a differing amount of yeast. To the best of the experimenters' ability, all other variables should have been held constant.

We asked that each experimenter collect a variety of data, both objective and subjective. Pitching rate is said to affect the rate of fermentation, so — for each of the three fermenters — we asked experimenters to record the time until fermentation starts and the time until fermentation is complete. When fermentations start and

finish can be hard to judge. For this reason, we suggested picking an arbitrary set of criteria and applying it to all the fermenters. For example, we defined the beginning of fermentation as the time when the top of the wort was completely covered with kräusen.

Likewise, we said that fermentation has finished when the final gravity is reached. We recommended taping an index card or other piece of paper to each fermenter for keeping records as the experiment progresses. This would also serve as a label indicating the pitching rate employed in that fermenter. We also asked experimenters for the final gravity (FG) of each of their beers.

Once the beers were packaged and conditioned, it was time to collect the tasting data. Pitching rate is said to affect ester production. Esters contribute the "fruity" aromas to beers and are especially evident in ales. So, we asked experimenters to smell and taste each beer and rate them according to how fruity they appeared. Likewise, we asked experimenters if they detected any differences in the body or sweetness of the beer.

Finally, we asked experimenters to record any other differences they found between the beers. These could include flavors or aromas that were only found in one of the beers or other observations, including differences in clarity, color or foam. Finally, we asked if the experimenters found the beers to be overall fairly similar and which beer or beers they preferred.

James Spencer brewed a barleywine and split it into 3 carboys, pitched at ½X, 1X and 4X. Once his beers were packaged, he mailed them to Chris Colby and they tasted them while connected online via Skype. Andy Sparks and Mark Smith joined James in the tasting. Chris Colby brewed an American pale ale and split it into 5 batches (¼X, ½X, 1X, 2X and 4X). His initial beer was contaminated, so he rebrewed the experiment. Unfortunately, his second round of beers was not packaged and ready to be tasted in time for their tasting. His results with regards to timing and FG are included here, however.

Six hours after pitching, the layer in the 2X carboy (upper right) is thick. The 1X, ½X and ¼X carboys show no signs of action.

Sixteen hours after pitching, the 1X carboy (lower left) is "foamy" and the ½X has some "spots" on top. The 4X carboy (lower right) has almost finished.

Seventeen hours after pitching, the ½X — the middle of the upper three — begins to shows more signs of life.

The vigor of the fermentation also varied with pitching rate, as did the time in active fermentation.

What We Found

Different experimenters chose different ways of assessing when fermentation had started and ended, so we can't compare the absolute numbers given in any meaningful fashion. However, the relative sequences were completely consistent. In all seven cases, the beers started fermenting in an order determined by pitch rate. Higher pitching rate trials (4X and 2X) began fermenting before 1X trails and, in all cases, the lowest pitching rates (½X and ¼X) trials started last. Start times varied from as low as 4 hours in three cases for the 4X pitch rate to 52 hours in one case for a wort pitched at ¼X. (Most ¼X start times fell between 24 and 48 hours.)

Overall fermentation times — from pitching to finish — followed the same pattern. In all seven experiments beers that began fermenting first, ended first. The remaining beers finished their fermentation according to their pitch rate. It is interesting to note that, although the start times varied quite a bit — with ¼X fermentations taking up to 6 times as long to get started compared to 4X fermentations — the overall time of active fermentation (from start of fermentation to end) was less variable. On average, the active phase lasted only about 2–3 times longer for the ¼X fermentations compared to the 4X fermentations.

The results with regards to starting and finishing times confirmed what we expected. And, although differences in experimental procedures preclude us from comparing the numbers in a meaningful way, the relative order of events was absolutely consistent. Our results clearly show that, within the range of pitching rates we investigated, pitching more yeast leads to faster start times and shorter overall fermentations.

The best objective data in our study comes from the reported final gravities (FGs) from the experimenters. In all seven cases, the final gravity (FG) was reported as a specific gravity. In six cases, a hydrometer was used to measure this. In the seventh, a refractometer was used. (A corrective equation was applied to take the concentration

of alcohol into account.) Although we expected more highly pitched beers to show higher levels of attenuation, our data does not show this. In some series of beers, attenuation appeared to increase with higher pitching rates; in others, it appeared to decrease. The differences were small, however. And, given that a hydrometer can be off by a point or two, depending on the angle it is viewed at, we didn't take small differences in reported FG too seriously. Overall, in fact, it appeared that most beers finished at roughly the same final gravity, regardless of the pitching rate. Had we only brewed one experimental series of beer, we might be tempted to dismiss this finding as a fluke. However, given that seven series of beers — which showed clear differences in fermentation times — showed this pattern, we feel this is a repeatable result. If true, it would mean that a homebrewer's primary way to manipulate his or her FG would be through the fermentability of his or her wort, not the pitching rate.

The data on final gravity was unexpected. Likewise, the tasting data did not fall into our expected pattern. The full tasting session can be heard on the November 12th episode of Basic Brewing Radio, which is found at www.basicbrewing.com. The big result was that although the tasting panel easily detected differences between the beers, we did not detect a clear pattern of decreasing esters at higher pitch rates.

Conclusions

Our experiments yielded a variety of results, some entirely in line with standard brewing wisdom and others not. We did confirm that pitching rates affect fermentation times and lead to differing aromas and flavors in beer. Beyond that, our experiment failed to confirm some of the key predictions of the basic pitching rate model with respect to attenuation and ester production. Our next experiment will focus on extract beers. Check out Chris' blog and James' show for details.

Chris Colby is Editor of Brew Your Own *magazine and James Spencer is the host of the podcast* Basic Brewing Radio.

Nineteen hours after pitching, the ½X carboy (topmost) still had not started, although a few little islands of "foam" can be seen.

About 31 hours after pitching, the ½X has almost produced a full layer of kräusen. By then, the 2X carboy was already slowing.

Let's Parti-Gyle!

Two (or more) beers, one batch of grain

by Terry Foster

To start with a cliché, parti-gyle brewing is one of the oldest tricks in the book. Originally, it wasn't actually a trick, but an inherent procedure in old brewing methods. The traditional approach was to conduct separate mashes on a given parcel of grain. The first wort would be completely run off, then the grain re-mashed with hot water and the second wort completely run off, and so on for a third, and even sometimes a fourth mash. It was customary to make strong ale from the first wort (sometimes combined with the second), and to produce a much weaker "small beer" from the remaining worts. It seems that this practice may have changed in the first quarter of the 18th century, when porter came onto the English brewing stage. London brewers came round to the idea of combining all the worts from separate mashing so as to make one beer, known as "Entire," or "Entire-Butt," and later becoming porter. Ale brewers (that is those producing pale and amber ales) still pretty much stuck to making two or more beers from the same charge of grain. The practice of sparging the grains after mashing and continuous collection of wort to make one final beer is relatively modern, dating from the early 19th century. Even through that century it was common for brewers to make, say a pale ale, and a weaker "dinner ale" from the same batch of malt. Since the total product from a brew was known as a "gyle" (or "guile" in some older books), this technique came to be called parti-gyling.

Today, most beer is produced as an entire gyle, but there are a few commercial brewers who practice the parti-gyle approach for certain beers. I believe Harpoon does so for its 100-barrel series, and Woodforde's of Norwich in England does so, making a 7% ABV barleywine and a 4.3% ABV golden ale from one mash.

Why would a modern commercial brewer want to parti-gyle at all? Surely the technology is there now that he/she can produce whatever beer required in one shot, whether big or small? Well, it boils down (and that is a deliberate pun) to commercial demand. If the brewer wants to make, say, a barleywine or imperial stout, but sees only a limited market for it (and remember brewers have to sell their product to make a living), a normal full batch may be more than is required. And in order to get all the extract out of the malt that could mean that a long boil is required to get the wort down to the target OG. This may be uneconomical, or even impossible. But, if the brewer parti-gyles by taking the first runnings of the wort for the big beer, the brewer can hit his or her target gravity right away, with no need for a long boil, and with only a small, saleable volume of the beer. The rest of the runnings can then go to make another beer such as a regular bitter or stout that fits into the brewer's normal portfolio.

So how can this technique help the homebrewer? Well, when it comes to volume, since you may not want to make as much as 5 gallons (19-L) (or 10 gallons/38 L if you're brewing on an even bigger scale) of a very strong beer. Or perhaps your mash tun just won't hold enough grain for a full 5-gallon (19-L) brew length of an Imperial IPA. Or perhaps you are limited for brewing time and just want to brew two different beers on the same day without doing two mashes. Or perhaps you are just a homebrewer who likes to experiment (are there any other kinds of homebrewers?) and want to try out a traditional approach. And last but not least, there is another kind of parti-gyling you might want to try. That is to collect a single wort in the usual manner, split it into two, and brew two beers with different varieties or amounts of hops, or different hopping

Photo by Michael Pollio

Parti-gyle brewing is a technique that allows you to make two beers (one big, one small) from the same grains by re-mashing. For example, a barleywine and a golden ale.

schedules. Such a comparison is a great way to find out which might be the best variety for a particular beer style and how it might best be used to obtain the results that suit your taste. This approach can also be used to compare the performances of different yeast strains. But if you do such experiments take careful notes of what you have done!

Parti-gyling is a technique which can offer a great deal of flexibility to the homebrewer as there are other ways than the above in which you can use it. For example, let's say you do your first mash and collect the runnings for the bigger beer in the usual way. Then, instead of just doing a second mash to produce a beer weaker, but similar to the first, before mashing with more hot water you add in a small amount of specialty malt. You might add chocolate malt and/or roasted barley to turn a pale beer into a brown ale, or a dry stout. Or you might do something quite different by conducting the second mash, collecting the runnings and converting this wort to something else by adding malt extract towards the end of the boil. In this way you might start by making an Imperial IPA from the first wort and then adjust the second wort to give you a "regular" IPA, rather than keeping it as is to brew an ordinary bitter.

What are the downsides of parti-gyle brewing?

While this technique is obviously not for the extract brewer, it is also not for the inexperienced all-grain brewer, either. For a start you have to be well-organized up front as you may need extra collecting vessels, and allow for space in which to keep them where you won't knock them over when they are full of precious wort. You are going to have to conduct two separate boils, which can make for a long brew day if they both have to be done in the same vessel. It would be ideal to use two boilers (and, of course, two heating systems), so it would be good if you could borrow one from a friend. Even better, borrow the friend as well to make the whole thing less work. Please do not think you can make this procedure simpler by keeping the second wort overnight and boiling it the next day. Maybe you don't believe me because you have done this before and all was fine. Well, I must tell you that you might have gotten away with it that time, but you almost certainly won't the next time! I've tried this and found the next day that all I had was a bucket of foul-smelling acidic liquid fit only for throwing away.

You'll also obviously need to have two clean fermenters ready to go, and enough yeast to pitch both of them. I don't think you can parti-gyle unless you have at least a 1 qt (1 L) active yeast starter prepared in advance — remember one of these beers is big, and needs plenty of yeast to get the required attenuation.

Another reason why this technique is for the experienced brewer is that you are going to have to think on your feet and to use some mathematics. You have to think very clearly as to what two beers you are going to make, particularly what starting gravities you want to hit, and the level of IBUs you wish to achieve. You then need to calculate an appropriate grain bill for the mash, as well as suitable hop varieties and addition rates. The latter will come from style guidelines and your own taste, and the formula can be arrived at by the "total gravity points" concept. An experienced all-grain brewer should probably be aware of this type of calculation, and if you are not, you should be, as should any brewer looking to achieve consistency.

Working it out

For those not familiar with the "total gravity points" concept, or how it might work in the parti-gyle concept, let's look at an example. Let's say you want to brew 2 gallons (7.6 L) of a barleywine at OG 1.080, and 4 gallons (15 L) of a session bitter ale at 1.040. Then, taking only the significant numbers after the decimal point, we get:

Barleywine points = 2 x 80 = 160
Bitter ale points = 4 x 40 = 160
Total points = 160 x 2 = 320

Now, for the sake of simplicity, I am going to suppose that I use only pale malt for this beer and that as is normal with *BYO* recipes, which assume 65% extract efficiency, 1 lb. of pale malt in 1 gallon of water yields a wort of SG 1.024.

Total malt required = 320 ÷ 24 = 13 lb. So 13 lbs. (5.9 kg) of pale malt would be our grain bill for these two beers. Obviously, it is a simple adjustment if your extract efficiency is greater or less than

65%. It doesn't look quite so simple if you are going to include malts giving less extract than pale, such as crystal and roasted malts, but there's an easy way around that. Say you want to brew a dark barleywine/strong stout at OG 1.080, and a "drinking" dry stout at OG 1.040. Just decide up front how much roast malt you want to add; let's say we'll add one pound of black malt or roasted barley. This at our 65% extract efficiency will yield a wort of SG 1.016 in one gallon of water. So:

Points from roast malt = 16
Points required from
pale malt = 320 - 16 = 304
Total pale malt
required = 304 ÷24 = 12.7 lb

But you will probably not know exactly how much wort you are going to obtain, especially if your grain bill is a greater amount than you would normally have in your mash tun. So you must measure the gravity of the collected first wort right away, taking care to cool the sample to the appropriate temperature (usually 60 °F, or 15 °C). Then, using the "total gravity points" concept, you can calculate whether you need to adjust the volume up (by dilution) or down (by evaporation) to get your target gravity. For example, let's say you wanted 3 gallons (11.3 L) of wort at a starting gravity of 1.080, and you collected 2 gallons (7.6 L) at 1.100 SG. Then, ignoring the figure before the decimal point, you have 2 x 100 = 200 total gravity points. At target gravity of 1.080 you would then have 200 ÷ 80 = 2.5 gallons (9.5 L), so you need to dilute the wort down to this figure with water. Fine, that's simple enough, but the problem is you (or your brewing program) calculated the hops based on 3 gallons (11.3 L) of wort. So now you have to re-calculate hopping rates based on the new volume. Easy enough, just multiply the original weight by 2.5/3. But do note that if you decided to go the traditional way and to stay with the 2 gallons (7.6 L) at SG 1.100, that hop adjustments are a little more complicated. If you simply multiply the original weight you calculated by ⅔ the beer will likely be underhopped. That's because it will be higher in alcohol and rather sweeter than the beer you had intended to brew and hop utilization will probably be slightly less. You should therefore expect to add 10–20% more bittering hops, according to your own taste requirements. The second mash can be a lot of fun to play with. First of all, you do not have to do an actual mash at this stage. You can start sparging in the usual manner while collecting the first wort then simply continue to do so while you collect the second wort. But doing a second mash permits you to tinker by adding more malt. In the second wort, for example a dry stout, you might add a little chocolate malt for instance. In such a case you can simply add the extra malt, then hot water at about 170 °F (77 °C), and mix the mash thoroughly then allowing it to stand for 10–15 minutes to allow formation of the grain bed. The temperature of the water is not critical as you are really leaching out extract, rather than doing a real mash. Do not add too much

water so that you leach out undesirable materials, such as tannins. Just add what would be your normal sparge volume in a regular brew.

Or, if you got more extract in the first wort than you had expected, so your second wort is not going to hit target gravity, you may wish to add a couple of extra pounds of pale malt at this stage. If you do so the mash water should be at 160–165 °F (71–74 °C), and you should let the mash rest for 30–45 minutes before run off. A simpler approach would be to skip this, do the mash and adjust the wort gravity by addition of a little malt extract.

Again, with the second wort you may decide to take it just as it comes and make no adjustments to volume and gravity. In which case, do remember to allow for this in your bittering hop additions. If you don't, you may well end up with an unbalanced beer, which would be a disappointment after all that hard work!

Doing it for real

If you are confused by the above, here's what I got when I tried a brew using this technique. I was re-creating a recipe from the 18th century for Dublin Stout; I didn't want a lot so I calculated that 12 lb. (5.5 kg) of mild ale malt and 0.5 lb. (0.225 kg) of black malt would give me 2 gallons (7.6 L) of this stout at OG 1.090, with a second mash yielding about 4 gallons (15.1 L) at OG 1.040 (using a value for extract efficiency determined in my own brewery). The big stout I estimated from the original recipe should have around 90 IBU, using UK Target pellets at 11.5% alpha-acid. I figured that the smaller beer would be a dry stout, and would have around 40 IBU. I would mash as per usual, and sparge as soon as I ran off wort.

In fact, my actual numbers differed from the expected values. What I got for my first parti-gyle was 2 gallons (7.6 L) at OG 1.085, and I wondered if I should adjust this and the hopping rate. I didn't want to concentrate it, because 2 gallons (7.6 L) was as low as I wanted to go, so I decided to leave the gravity at this figure, and to do the same with the hop rate, as I was only guessing at IBUs in the original recipe. So I went ahead and boiled, hopped, and fermented this beer.

The second parti-gyle was about 3.75 gallons (14.2 L) at an OG of 1.038, both values a little lower than I had hoped. Also, the beer was paler than I expected and tasting the wort suggested there was not enough roast character for a dry stout. If I had done two mashes, instead of sparging right away, I could have added some extra roast malt. Or I might have brought the gravity up and deepened the color by adding malt extract, but I didn't have any such extract on hand that day. So I decided it had enough color to make a "pale" brown ale, and adjusted hop levels downwards to an estimated 28 IBU, then boiled and fermented the beer as normal. All in all it was a good and satisfying experiment with an interesting result, and two beers for the price of one.

Terry Foster is BYO's *new "Techniques" columnist and author of* Pale Ale, (1999, *Brewers Publications*).

Advanced Brewing

Foam Factors

The formation and stability of beer foam

by Chris Bible

Foam is a dispersion of a large amount of gas in a small amount of liquid. Foam can be thought of as a collection of gas bubbles separated from one another by thin liquid films. Each gas bubble is enclosed in a film of water and other liquid phase compounds that are derived from the bulk of the beer.

Many physical properties of beer foam can be measured including volume, density, stability, cling, bubble size distribution and color. There are, however, no universally accepted methods for measurement of these properties.

The birth of foam

Foam in beer is generated when dissolved carbon dioxide is rapidly released from solution and tries to rush out into the gas phase. Dissolved carbon dioxide exists within beer at an equilibrium concentration that is dependent upon the pressure and temperature of the beer/carbon dioxide mixture. More carbon dioxide can be dissolved in a given amount of beer if the mixture is at higher pressure, so higher pressure favors a higher equilibrium concentration of dissolved carbon dioxide.

Beer is typically stored in a closed container at higher than atmospheric pressure. When opened, the pressure is rapidly reduced to atmospheric pressure. When this happens, the dissolved carbon dioxide is no longer in equilibrium with the surroundings. The beer/carbon-dioxide solution becomes "supersaturated," having more carbon-dioxide dissolved within the beer than the beer is capable of retaining in solution. The carbon dioxide solute then rushes out of solution in order to restore equilibrium to the system at the new pressure conditions. This rapid rush of carbon dioxide from solution is responsible for the formation of the beautiful head of foam that rests atop a homebrew. Although the initial opening of the bottle or can, or opening of the cap, starts foam formation, there are many variables that affect initial foam formation.

Positive factors

The amount of dissolved CO_2 affects foam formation, but more is not alway better. If the dissolved CO_2 content is too high, gas is released too quickly for adsorption of surface-active colloids. If the dissolved CO_2 content is too low, there is not sufficient CO_2 available to be released and the CO_2 will remain in solution.

Violent or turbulent pouring, of course, increases foam as it releases dissolved CO_2 more rapidly by creating larger number of nucleation sites for bubble formation, and also entrains air. Higher temperatures are foam positive because CO_2 is less soluble at higher temperatures. So, the release of CO_2 from the beer is more rapid and more extensive as the system attempts to regain equilibrium.

The presence of bubble nucleation sites in the glass and in the beer act as bubble "seeding" points and increase the rate of CO_2 evolution. Some beer glasses, such as Duvel glasses and the new Sam Adams beer glasses, have etching on the bottom specifically to serve as nucleation sites. (The practice of pouring a small amount of salt into a beer also releases bubbles, although obviously this would also affect the flavor of the beer.)

Finally, the presence of foam-positive substances — proteins and other compounds — in beer increases foam. Some of these factors, including LPT1 and protein Z, are discussed in "Fabulous Foam" in the May–June 2008 issue of *BYO*.

Negative factors

The factors that negatively impact the initial formation of foam are simply the opposite of the positive factors. For example, quiet pouring releases dissolved CO_2 less rapidly because fewer nucleation sites for bubble formation are created and less air entrainment occurs. If the temper-

Figure 1: Beer Foam Structure

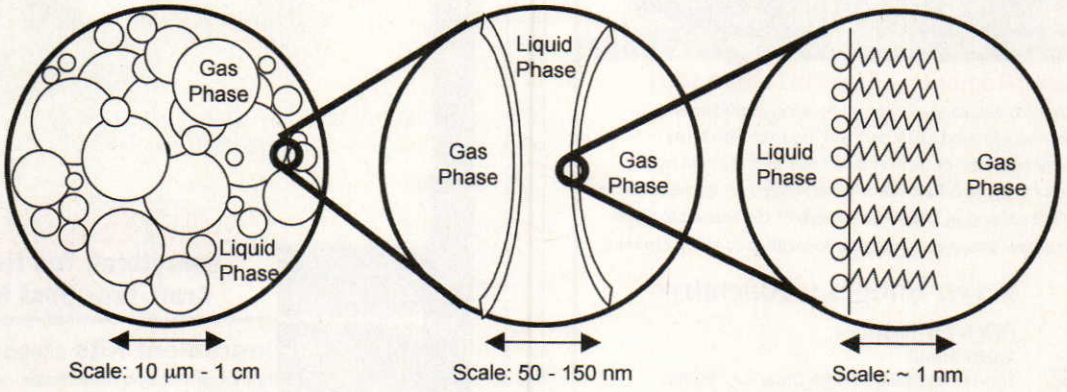


Illustration Courtesy of Chris Bible

ature is too low, CO_2 is more soluble at lower temperatures so as the system attempts to regain equilibrium the release of CO_2 from the beer is less rapid and less extensive. And, of course, if there is insufficient foam-positive materials in beer, foam stability will be poor.

Foam stability

Foam is an inherently unstable and dynamic system. The structure of a foam system evolves over time and ultimately the foam collapses. The amount of foam that initially forms does not determine how long the foam remains. A beer may pour with a big head, but that head may collapse quickly. Conversely, a beer may form only a small amount of foam upon pouring, but this may remain until the beer is almost finished. In addition, some of it may persistently cling to the side of the glass, a phenomena called Belgian lacing. Of course, some beers exhibit the best of both worlds in terms of foam — for example, the big, fluffy heads and long retention times seen on well-made hefeweizens. Conversely, many strong beers pour with only a bit of foam that quickly collapses. There are many physical and chemical factors that play a role in the stability of a foam system, and several of these are summarized in Tables 1 and 2.

Factors influencing the stability of foam, after it has formed, come from a wide variety of sources. These include beer ingredients, various beer characteristics (including alcoholic strength), brewing process variables, storage conditions and serving choices.

Although homebrewers frequently focus on a beer's grain bill when considering foam, the amount of hops in the beer and the timing of hop additions in the boil can also affect your foam. Iso-alpha acids are foam positive and, because of this, highly-hopped beers, such as IPAs, tend to have more stable foam compared to less hoppy brews.

What you do on brewday, or during fermentation and conditioning, can also affect your foam. Overly long boils and overly high fermentation temperatures can decrease the amount of foam in your beer. You can also consume foam positive elements in your beer if you allow it to produce foam before serving. For example, if

Table 1: Beer Foam Stability: Positive Factors

Factor Affecting Beer Foam Stability	Reason it is important
Highly kilned malt	Low proteolytic activity and the presence of melanoidins improves foam stability.
High beer viscosity (high final gravity)	Slows down the draining of liquid within the foam structure.
High hop rate	A high concentration of iso-alpha-acids means that interactions with polypeptides are increased.
Post-fermentation hopping	As before, a high concentration of iso-alpha-acids means that interactions with polypeptides are increased.
Presence of certain species of metal cations (e.g. manganese, aluminum and nickel)	These ions play a role in helping cross-link iso-alpha acids and strengthen bubble film.
Low beer temperature	Lower temperature increases beer viscosity. Increased beer viscosity slows down the draining of liquid within the foam structure.
Use of tall narrow glasses	Minimizes exposure to ambient air and makes it harder for CO_2 to escape from the foam bubble into the ambient air (mass transfer diffusional resistance is increased).
Use of yeast strain that produces fewer fusel oils	The presence of fusel oils within beer decreases the surface tension of the liquid. Lower surface tension means less foam stability.
Small bubble size	Smaller bubbles have less interfacial surface area contact with their neighbors. This reduces the rate of gaseous diffusion across the interface from the smaller (higher internal pressure) bubbles to the larger (lower internal pressure) bubbles.
Use of isinglass	Isinglass provides another source of foam-positive polypeptides.
Carbonating with nitrogen/CO_2 mixture	A small amount of gas that is less soluble in water (like nitrogen) will greatly reduce the rate of permeability of the gas mixture through the bubble films. Reduced gas permeability means slower foam coarsening, which means increased stability of the foam.
Low beer pH	Affects the molecular conformation geometry of other foam positive compounds.

Table 2: Beer Foam Stability: Negative Factors

Factor Affecting Beer Foam Stability	Reason it is important
Over-modified malt	Highly modified malts contain fewer polypeptides and non-starch polysaccharides.
Low malt kilning temperature	High proteolytic activity means fewer polypeptides and fewer melanoidins.
Excessive boiling of wort	Excessive boiling can destroy proteins and shorten chain lengths of organic "foam positive" substances. This leads to overall decreased beer viscosity.
Excessive use of adsorbents and filter-aids	May remove foam positive compounds.
High fermentation temperature	Excessive fusel oil production during fermentation. The presence of fusel oils within beer decreases the surface tension of the liquid. Lower surface tension means less foam stability.
Use of old hops	Old, degraded hops may have lower than desired concentration of iso-alpha-acids. Fewer iso-alpha-acids means that interaction with polypeptides is decreased.
Detergent or soap residues in beer glasses	Negatively impacts surface tension in beer. Bubbles can not exist if liquid surface tension is too low.
Lipids (e.g. oil or grease) in beer or glasses	Lipids decrease surface tension in beer. If liquid surface tension is too low, bubbles will not be stable, and may not form at all.
High beer temperature	Higher temperature decreases beer viscosity. Decreased beer viscosity speeds the draining of liquid within the foam structure.
Short, wide glasses	More foam surface area exposed to ambient air makes it easier for CO_2 to escape from the foam bubble into the air.
Large bubble sizes	Larger bubbles have greater interfacial surface area contact with their neighbors. This increases the rate of gaseous diffusion across the interface from the smaller bubbles to the larger bubbles (increases the rate of foam coarsening).
Contact of beer with autolyzing yeast	Yeast autolysis produces foam negative lipids. Lipids negatively impacts surface tension in beer. Bubbles cannot exist if liquid surface tension is too low.
High alcohol content	Alcohol lowers bubble surface tension and weakens bubble films.

you shake your keg during force carbonation, some foam will be generated. This foam will eventually sink into the beer and most of the molecules that formed that foam will not be able to participate in foam formation again.

Even your serving practices — beyond the dynamics of the pour — affect foam stability. A cold beer served in a tall glass is going to retain its foam longer than a warmer brew served in a wider-rimmed glass. And of course, dirty glassware can negate all your efforts to produce a fantastic layer of foam on your favorite brew.

Although the chemistry and physics of foam formation and stability are interesting, what most brewers are most interested in are the practical aspects — how do you brew a beer with great foam? The wide variety of factors known to affect foam formation and stability can be both a blessing and a curse. On the positive side, if you make one adjustment in order to improve your foam and it doesn't work, you have plenty of other options to try. On the other hand, the welter of possible variables can leave a brewer bewildered.

Keep in mind that some of these factors have a strong effect on foam, while others exert a much smaller influence. For example, even low levels of fats or oils on your glass will have a large negative impact on your foam. Conversely, the use of highly-kilned malt has a comparatively small effect (and, of course, isn't required to yield good foam). For any homebrewer who believes his or her foam is substandard, one of the obvious places to start is with the level of carbonation. If you bottle condition your beers, fixing your problem may be as simple as adding slightly more priming sugar, ensuring the priming sugar is evenly distributed throughout the beer and allowing for an adequate conditioning time — at a temperature warm enough for the yeast — before sampling the beer.

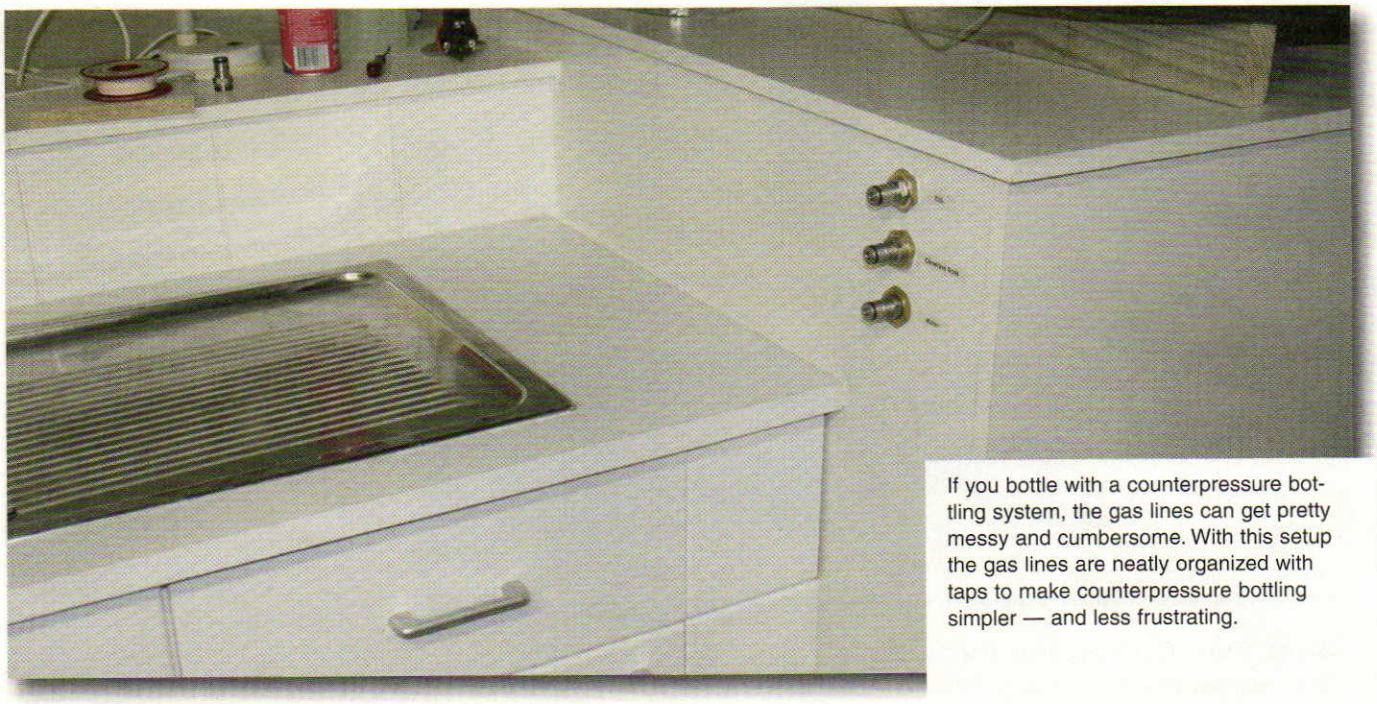
With the proper level of carbonation and a good pour, any well-brewed beer should form a nice layer of foam. (If not, Table 2 in this story can get you started in troubleshooting your problem.) However, all good things must come to an end. In the next installment of Advanced Brewing, we'll examine foam collapse.

Chris Bible is Brew Your Own's *Advanced Brewing columnist.*

Gas On Tap

Simplifying the brewhouse

Story and photos by Andrew Davison



If you bottle with a counterpressure bottling system, the gas lines can get pretty messy and cumbersome. With this setup the gas lines are neatly organized with taps to make counterpressure bottling simpler — and less frustrating.

I have been building a new brewhouse after doing some fairly elaborate backyard renovations, and after putting together the kitchenette I realized it was time to bottle up some of my lambic to enter into our state competition. Anything that could go wrong did, of course. For a start, my 22-kg CO_2 bottle is located on the other side of the room. "No problem," I thought, "I'll run some gas line across the room and have a manifold so that I can have easy access." So once I had the counterpressure filler setup and the capper ready I started to bottle.

Sure enough, the gas lines started getting messy and before long were knocking bottles over. I thought that there had to be a better way to mount the manifold. And then it came to me . . . what I really needed was a turret in the wall! The ease of using a ball lock quick disconnect (adjustable pressure valve) would make life so much easier, if only I could find a way to mount it in a wall . . .

It turns out that the interior diameter of a piece of ¾" parallel thread is almost exactly the bore size you want to create a ½" female thread, so I was in luck there. My next thought was to make a bulkhead fitting out of the parallel thread and hook the turret up to that. Here is how it all came together.

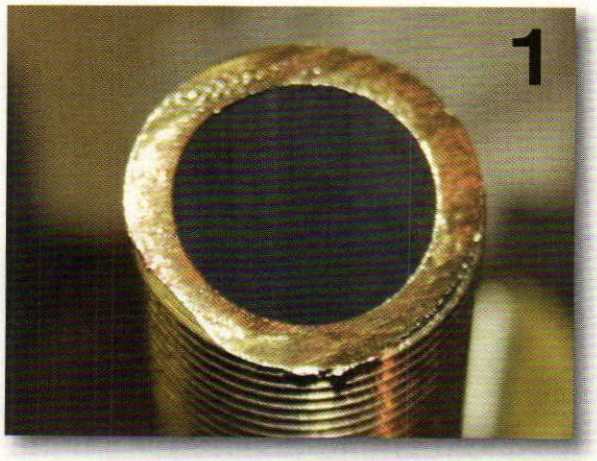
MATERIALS & TOOL LIST

Materials

- A gas turret from a Corney keg with male thread
- A length of ¾" parallel thread (if you're going to do this at home you will need to use brass)
- A hose barb with a male ½" thread
- Gas line
- 2 ¾" brass nuts

Tools

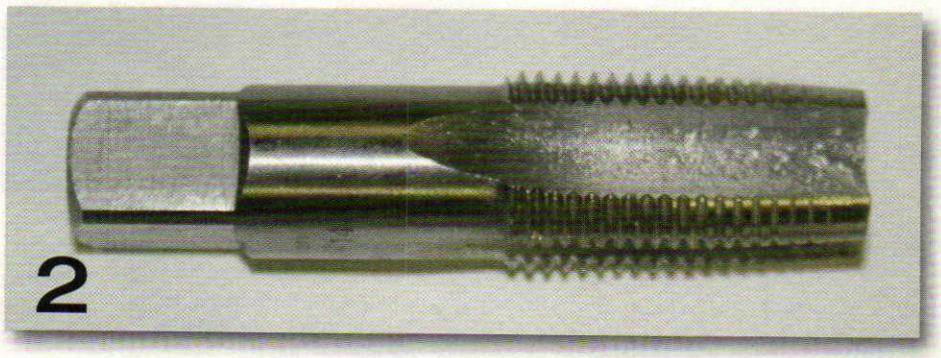
- A ½" BSP second thread tap (also known as a plug tap)
- A hack saw
- A fine metal file
- A can of rapid tap, or similar machining lubricant
- A large spanner (aka wrench) to fit the tap sink (the longer the better)
- A good heavy vice, preferably mounted in a bench top
- A few pieces of wood (to protect the thread in the vice)
- High density plumbing thread tape
- A power drill and a 25-mm spade bit



Step One: Preparation

Cut yourself enough parallel thread to penetrate the wall you're building into, leaving enough extra length for the nuts to get a good grip (for 16-mm melamine I used 35-mm lengths). Make sure you cut square and file off any rough edges.

Put your cut parallel thread into the vice pointed up and sandwiched between two pieces of hardwood (you will need to tighten this through the task as the thread will cut into the wood, loosening it (Photo 1).



Step Two: Cutting the thread

If you've never cut a thread before, here are a few tips:

- Use plenty of lubricant. This will make the job go much more easily and reduce wear on your thread tap. A tap this size is relatively expensive, so take care of it! (Photo 2)
- Make sure you get the alignment of the tap right — even a slight deviation from perpendicular will make the thread tap stall (smaller taps would break — this one will just stop turning as you get further down the job). The first couple of turns will determine the path of the tap for the rest of the cut — you cannot make adjustments once these first cuts are made.
- Make the initial cuts by turning the tap by hand or with a smaller spanner. At the early stages precision is more important than force.
- Once the tap is aligned and sitting well in the job, start using the larger spanner. Turn the tap half a turn, then go a quarter turn back to clean up the cut. You need to do this to clear out the cut debris. If you don't the tap will become jammed.
- Use more lubricant. Keep applying it throughout the cutting process.

Once the tap has passed all the way though the job (for small lengths), clean up the thread with a small bottle brush, some methylated spirits and paper towel (Photo 3). And, for good measure, run a ¾ die nut (or an ordinary nut if you don't have a die nut) along the whole length to make sure that the external thread hasn't been damaged.

Step Three: Assembly

With the thread cut and the hard work out of the way, it's time to assemble. I attached the gas turret and hose barb before mounting it in the wall to make life a bit simpler. Use plenty of high density thread tape (and possibly even some plumbers paste for good measure) — I don't want to have to pull it apart once it's mounted.

To cut the hole in the wall, I used a 25-mm spade bit, which is just a bit too small for the ¼" and allows you to cut a thread into the timber. The remaining parallel thread served well as a makeshift thread tap in the timber, allowing a snug fit for the finished bulkhead. Be careful not to cut yourself on the parallel thread through! (Photo 4). If you'd prefer, go for a 27-mm spade bit and use a couple of ¼" washers to tighten up against.

Step Four: Finishing up

One thing I needed to keep in mind was that I'm working in a wet area, so I need to make sure that the melamine is sealed. I used a white kitchen silicone to make sure that the raw timber was sealed from moisture in the work area (Photo 5).

The finished assembly looks pretty flashy and is solid as a rock, which is perfect. I've now got easy access to my gas when purging kegs, filling bottles or transferring liquid under CO_2 (Photo 6).

Of course it didn't stop there. I also made fittings for cleaning solution and water to make cleaning out lines and equipment significantly easier. Two kegs sit behind the wall filled with water and cleaning solution, ready to go.

Conclusion

This small addition has made working around the kitchenette much easier and less prone to breakage from straying gas/fluid lines. I hope it helps you out too!

Andrew Davison is the Chairman of the Australian National Homebrewing Conference and President of the Melbourne Brewers.

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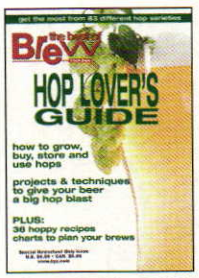

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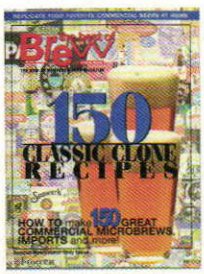

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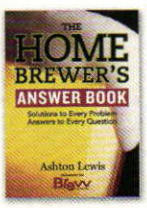

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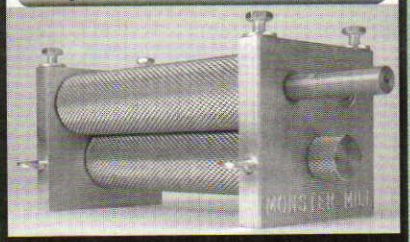

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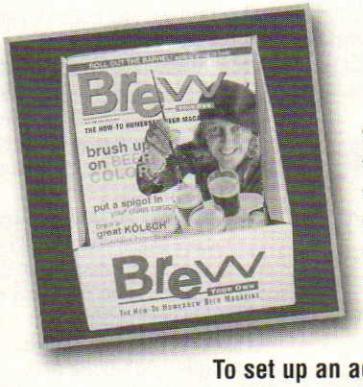

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Homebrewer Ben Miller (third from left), stands with Jim Koch (far left), Mike Robinson (second from left) and Jeremy White (far right) at the 2009 Samuel Adams LongShot awards.

"They announced the LongShot first," Ben said. "I essentially had a 50/50 chance, but I had a few months to prepare. It was awesome, but I kept it together."

Later in the festival however, when they announced the awards for the Pro-Am, the second win caused his excitement to bubble over.

"They announced the awards for third, second . . . and I thought, 'do I even dare hope?'" he said of possibly winning the Pro-Am. "When they did announce it I just lost it. I think all of the excitement I wanted to show at the LongShot awards came out just then. I was just in a complete haze for the rest of the day. I still kind of can't believe it."

A relatively new brewer, (he's been brewing for about two and a half years), Ben pulled off the Denver double crown with two different beers that came about in very different ways.

"That was the first time I ever brewed a barleywine," he said of the beer that took the prize at the LongShot competition. Working loosely with the recipe for barleywine from John Palmer and Jamil Zainasheff's book, *Brewing Classic Styles*, he formulated a simplified recipe of his own, pitched a good amount of his favorite Wyeast 1272 (American Ale II) and went for it. It was his 100th batch of homebrew, made to commemorate his two-year anniversary of homebrewing.

"I let it go for about two weeks and kegged it. It finished really high, which would have been fine but it tasted really sweet, so I figured it was my yeast," he said. He racked the barleywine back into a carboy and pitched another yeast starter. It didn't ferment much more, and only changed gravity-wise by a few points, but the resulting beer tasted less sweet.

"I didn't actually drink a whole lot of that first brewing — it was really heavy and really strong," he said. "But my friends just loved it so I entered it into a bunch of competitions."

When the barleywine scored well in local and regional contests, he decided to take a chance on the LongShot, Boston Beer Company's annual American Homebrew Contest, which sees some 1,500 entries each year.

"I figured they call it a 'long shot' for a reason," he said.

The winning Pro-Am beer on the other hand, Herbal Joe's Columbarillo IPA, had been in the works almost as long as Ben has been brewing.

"Ever since batch twenty-two I kind of became obsessed with tweaking that style," he said of formulating and reformulating the perfect IPA over the course of two years. "The one that ended up winning was actually a simplified version born out of frustration."

The winning brew included a fairly simple grain bill of regular 2-row and a small percentage of 5 °L crystal malt. He chose Columbus and Amarillo hops and mashed in at 146 °F (63 °C) to make it dry. He liked the results enough to enter it into the local Enchanted Brewing Challenge at Albuquerque's Chama River Brewing Company. Head Brewer Jeff Erway chose the IPA as the winner and brewed the recipe commercially, as well as collaborated with Ben to enter the GABF Pro-Am competition.

So what's next for this winning homebrewer and BJCP judge? More homebrewing — and maybe even a brewing career.

"I definitely would like to open up a brewpub," he said, however, "I still feel like I'm kind of new and want to still enjoy the homebrew phase."

Editor's note: Ben's barleywine will be available as part of Samuel Adams' LongShot variety six-pack, in stores in April.

Web extra:

Brew Ben Miller's winning barleywine and IPA recipes:

http://www.byo.com/component/resource/article/1990


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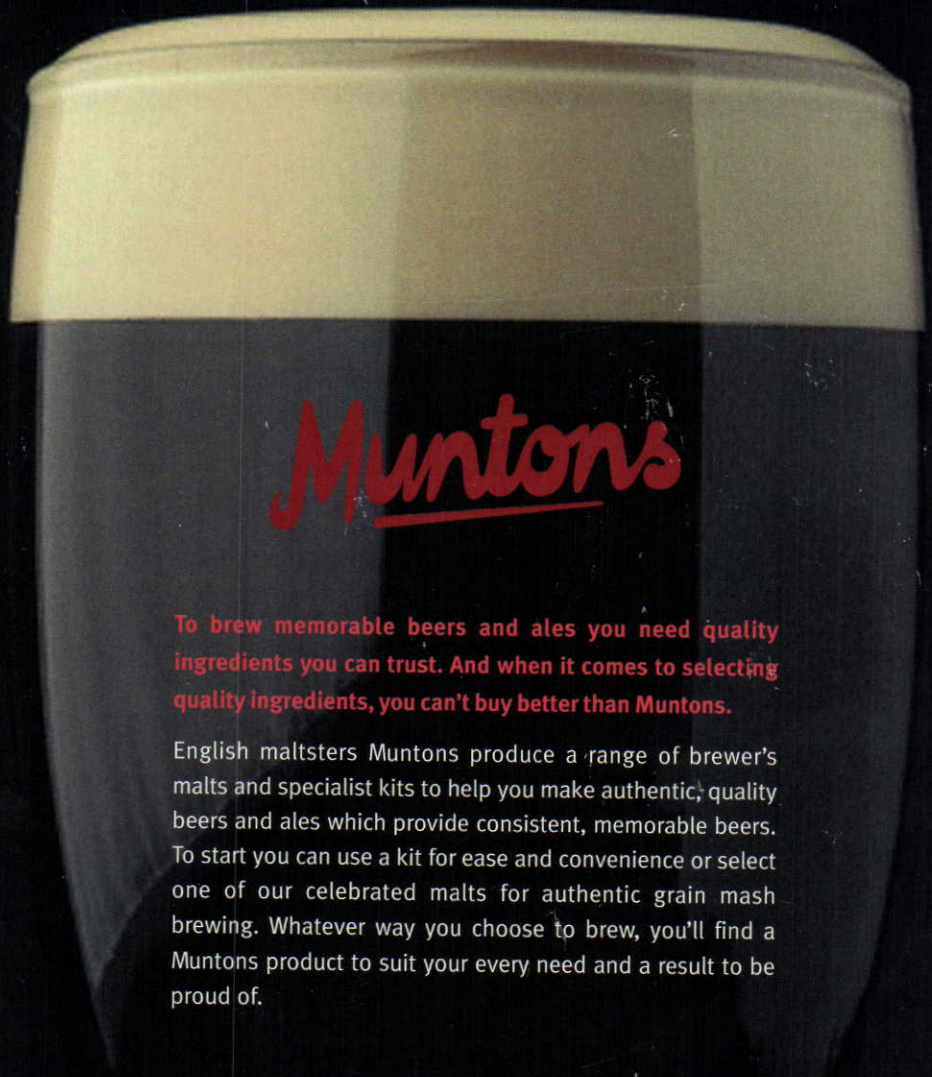

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