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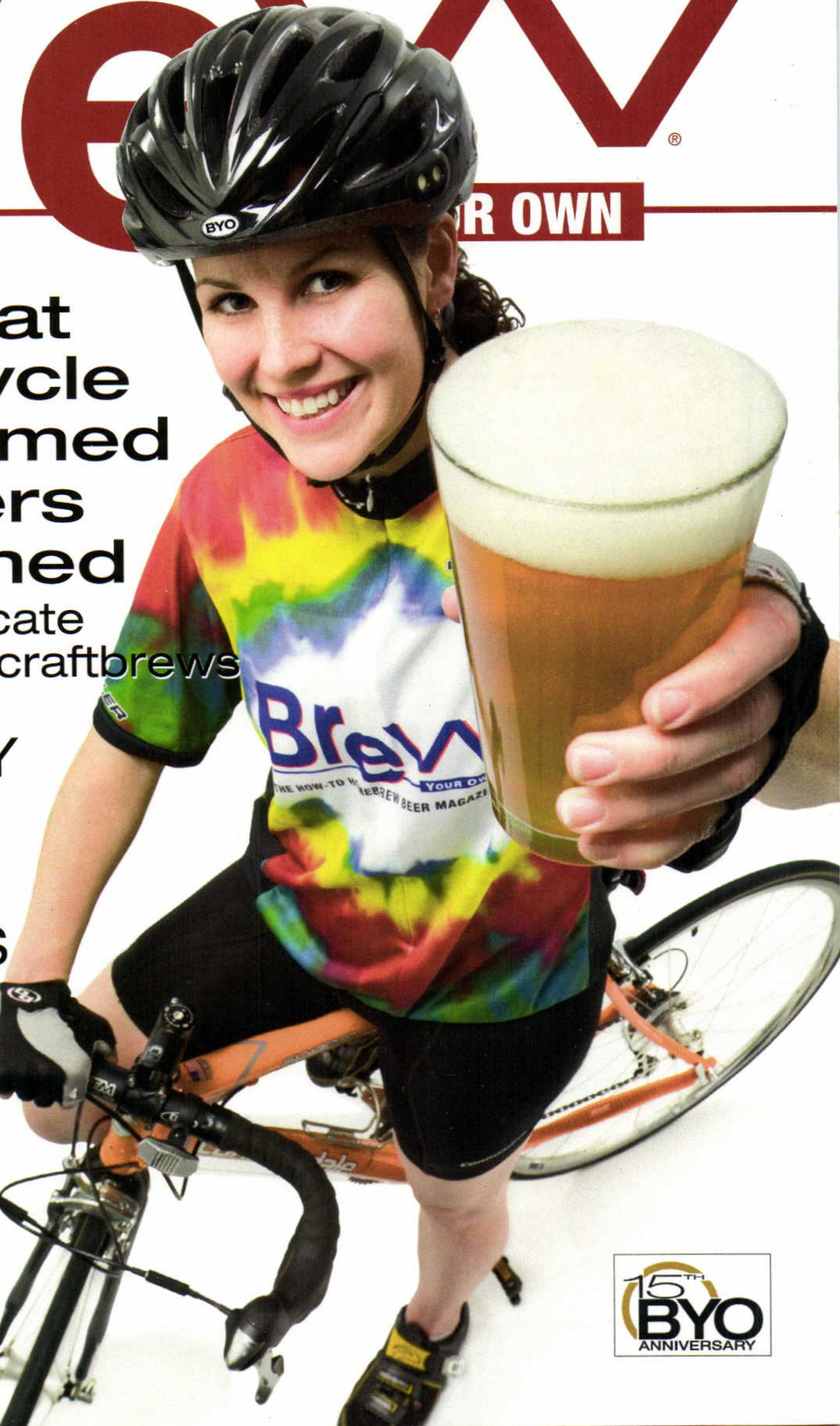
THE HOW-TO HOMEBREW BEER MAGAZINE

MARCH-APRIL 2010, VOL.16, NO.2



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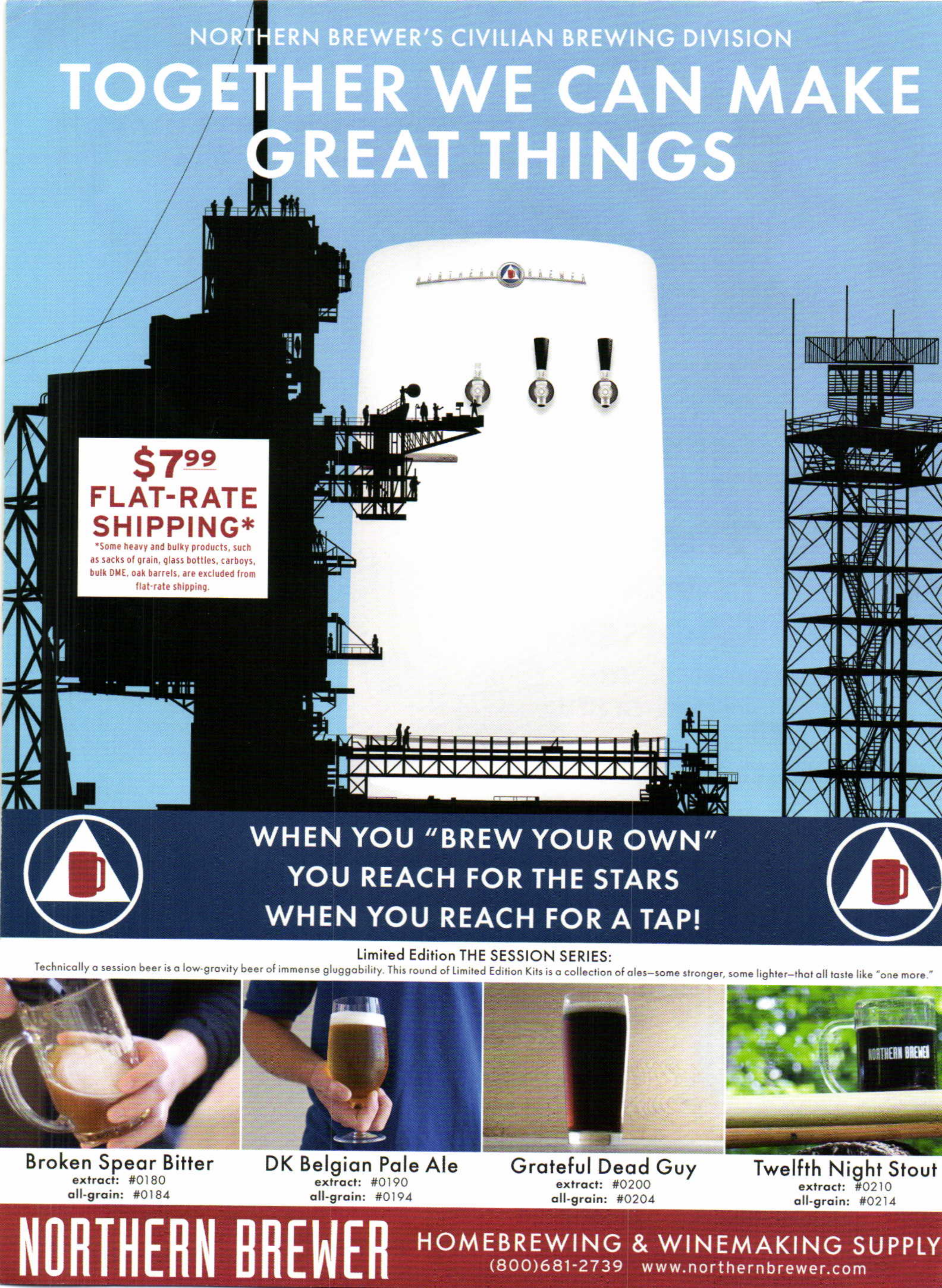
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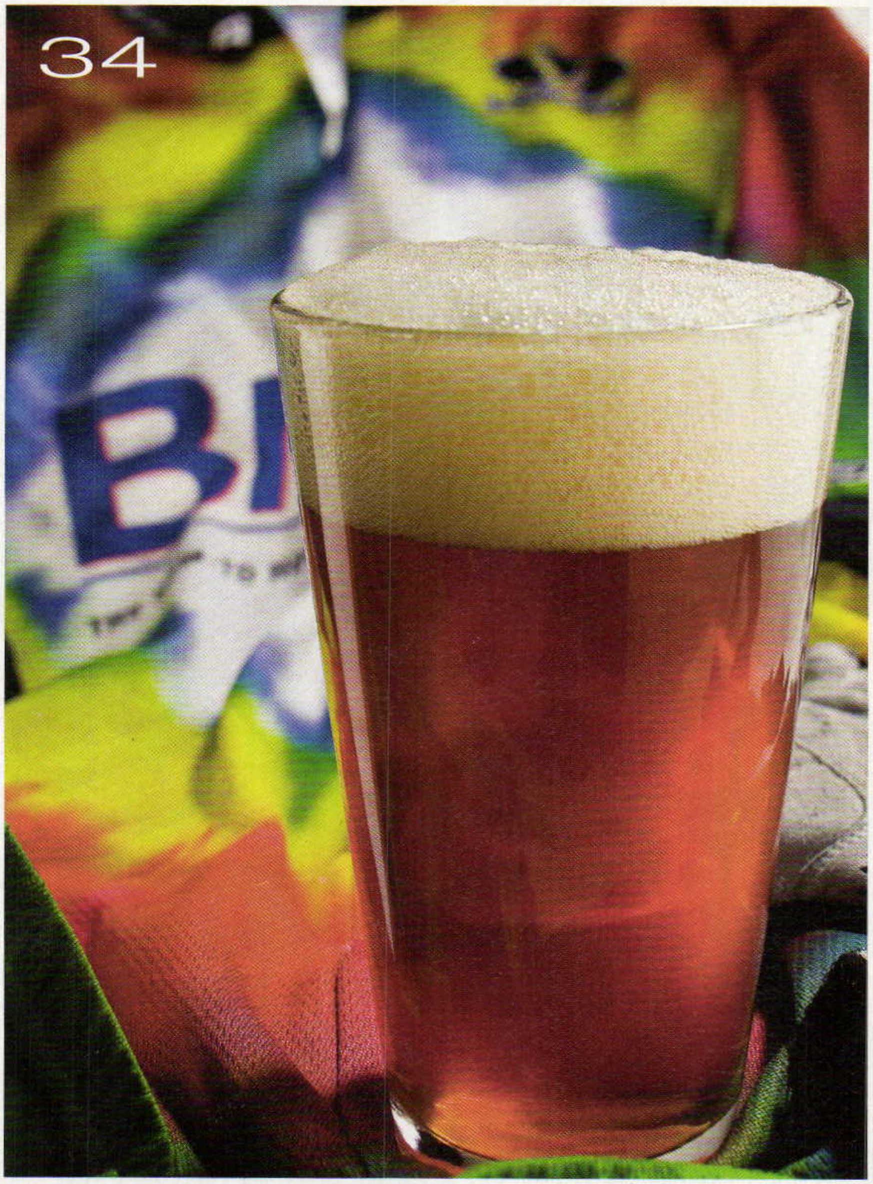
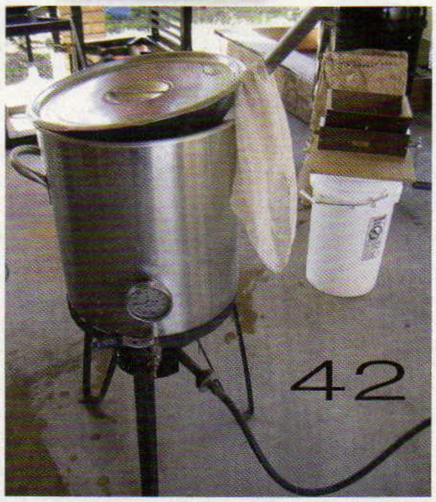
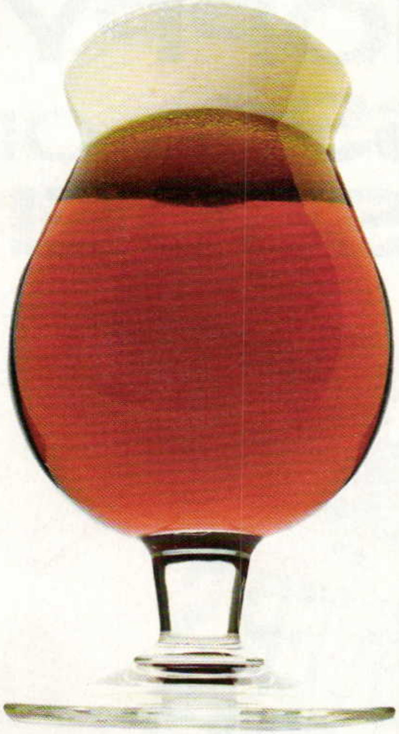




features



departments

where to find it

RECIPE INDEX

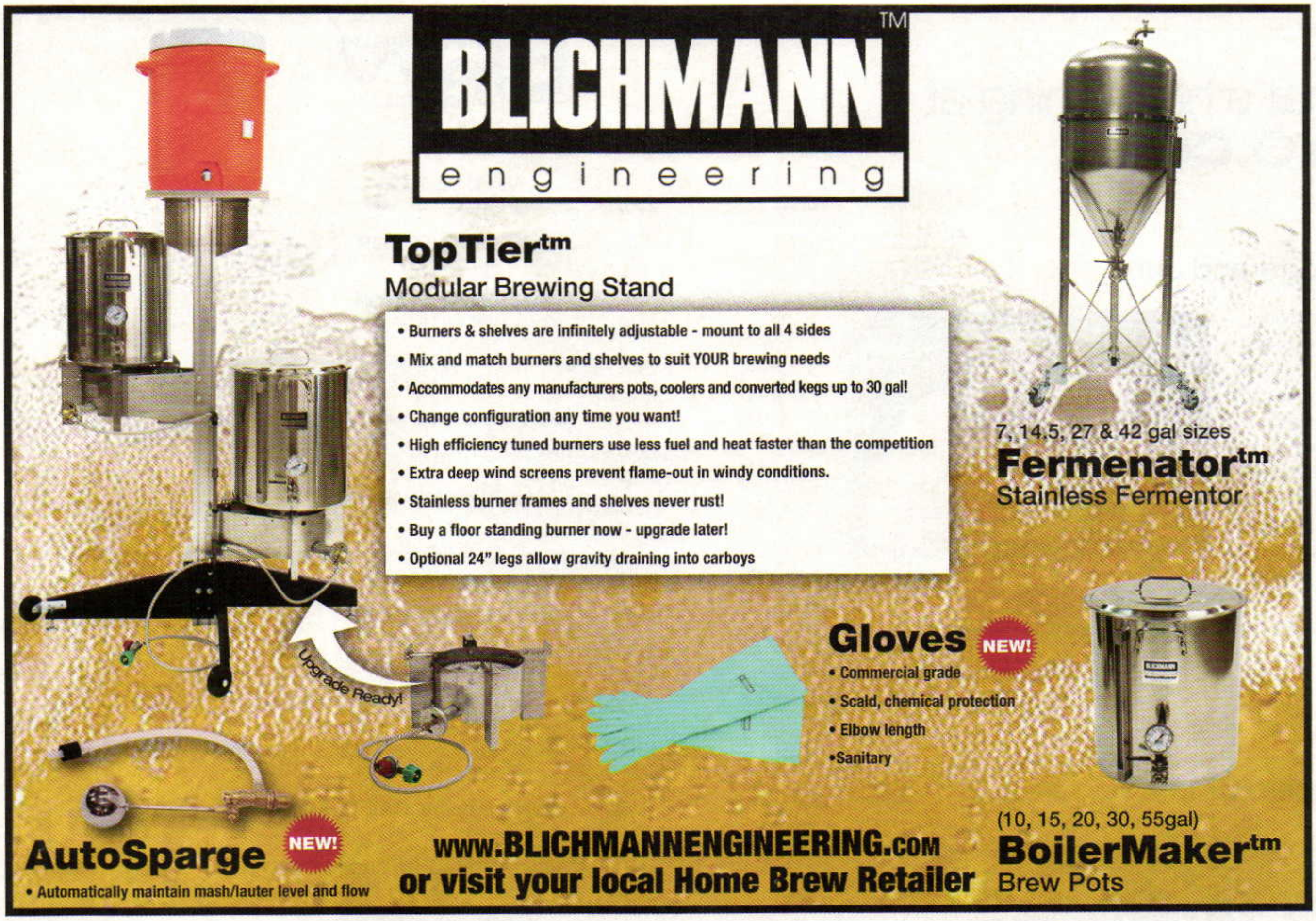
BYO
RECIPE STANDARDIZATION

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

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

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

Hops:
We calculate IBUs based on 25% hop utilization for a one hour boil of hop pellets at specific gravities less than 1.050.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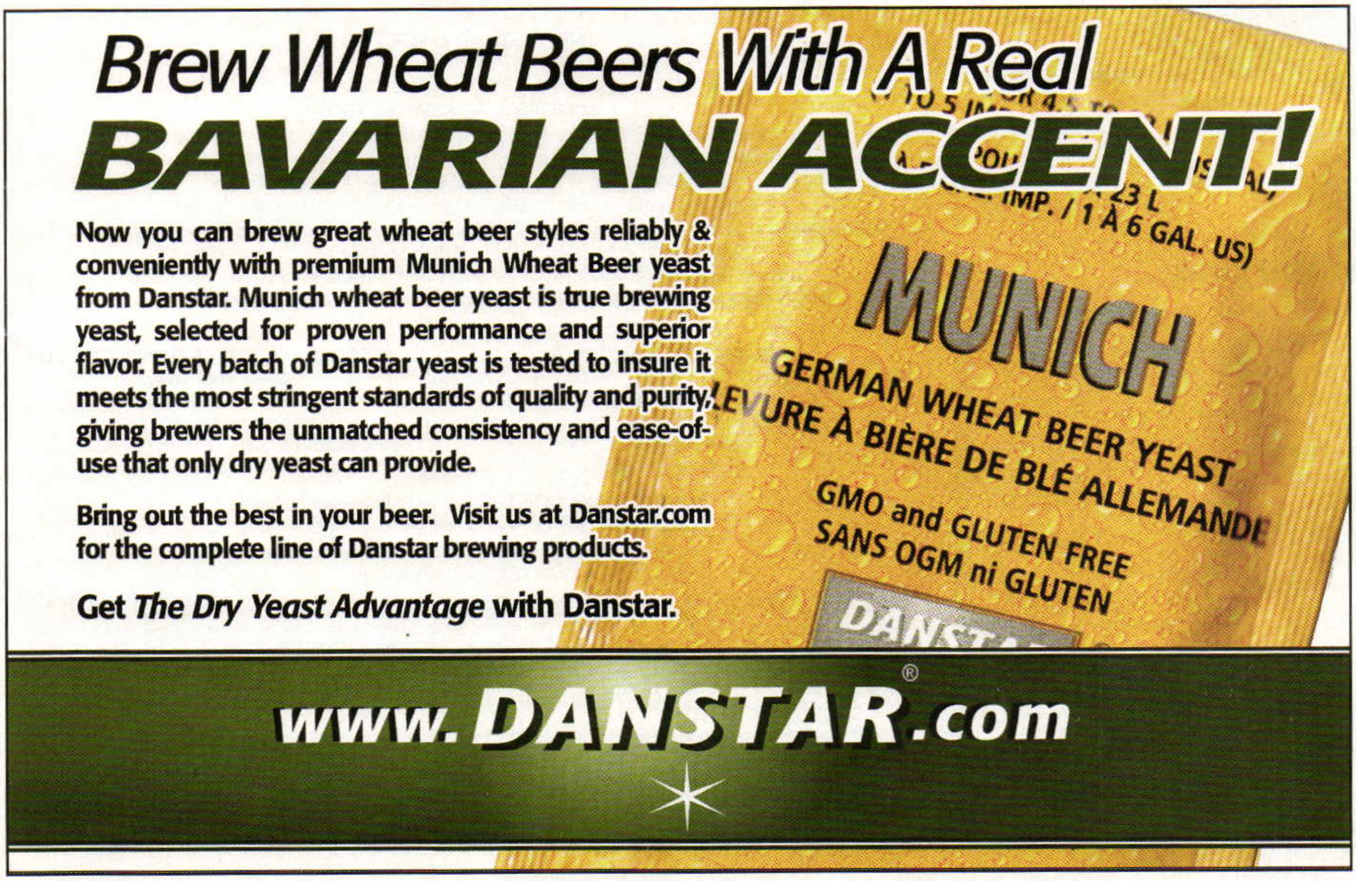
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what's happening at **BYO.COM**

Judge and Jury

If evaluating your own homebrew is old hat, maybe it is time to consider becoming a certified beer judge! Read about how BJCP judges evaluate beer in competition.

http://byo.com/component/resource/article/756

More on Malt

If you want to take your homebrew one step closer to 100 percent homemade, become a maltster. Read up on the process of malting your own grain.

www.byo.com/component/resource/article/1097

Find that Grain

Looking for just the right malt for your next batch of homebrew? Check out BYO's online grains and adjuncts chart. Search by grain origin, additions and sugars!

Key: L = Degrees Lovibond, G = Gravity

American Grains

Malt	L	G	Description
Black Barley	525°	1.023-1.027	Imparts dryness. Unmalted; us porters and dry stouts.
Black Patent Malt	500°	1.026	Provides color and sharp flavo and porters.
Chocolate Malt	350°	1.034	Use in all types to adjust color nutty, toasted flavor. Chocolate
Crystal Malt	40°	1.033-1.035	Sweet, mild caramel flavor and color. Use in light lagers and li
Crystal Malt	90°	1.033-1.035	Pronounced caramel flavor and color. For stouts, porters and b beers.
Crystal Malt	60°	1.033-1.035	Sweet caramel flavor, deep go red color. For dark amber and ales.
Crystal Malt	30°	1.033-1.035	Sweet, mild caramel flavor and color. Use in light lagers and li
Crystal Malt	20°	1.033-1.035	Sweet, mild caramel flavor and color. Use in light lagers and li
Crystal Malt	120°	1.033-1.035	Pronounced caramel flavor and color. For stouts, porters and b beers.
Crystal Malt	10°	1.033-1.035	Sweet, mild caramel flavor and color. Use in light lagers and li
Crystal Malt	80°	1.033-1.035	Sweet, smooth caramel flavor to deep red color. For porters,
Dextrin Malt (carapils)	1.5°	1.033	Balances body and flavor witho color, aids in head retention. Fo beer.
Munich Malt	10°	1.034	Sweet, toasted flavor and aro Oktoberfests and malty styles.
Pale Malt	1.8°	1.037-1.038	Smooth, less grainy, moderate

www.byo.com/resources/grains

Cover Photo: **Charles A. Parker**

Brew Your Own — THE HOW-TO HOMEBREW BEER MAGAZINE

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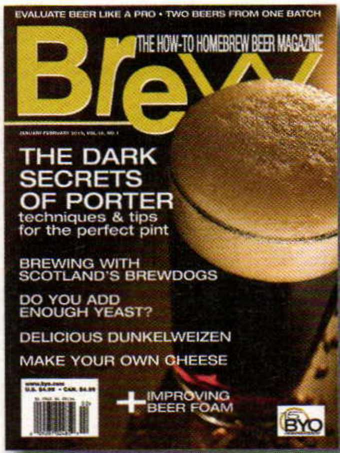


Baker's yeast at bottling?

In the January-February 2010 edition of *Brew Your Own*, you talked about techniques for ensuring more reliable carbonation when bottle conditioning. (Mr. Wizard, p. 16) I was particularly interested in the part where you said, "Adding fresh yeast at bottling time makes sense... This yeast is used to produce carbon dioxide and does not affect flavor... If you want to use a different strain for bottle conditioning, for reasons of convenience, for example, you will be fine." How far does that go? For example, can I carbonate my beer using my jar of Fleischmann's Active Dry that I keep in my fridge for baking?

Can you also elaborate on the technique for adding yeast at bottling time? How much yeast should be added? Is it best to add to the carboy and then bottle, or should you add a little bit to each bottle? If adding to the carboy, is there a reliable way to distribute it evenly without aerating the beer? If adding to the bottle, is there a good way to portion it out for each bottle?

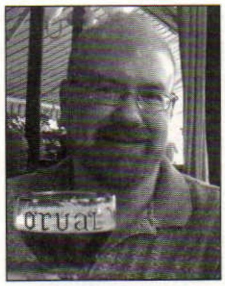
Eric Husky
Mountain View, California

Adding bottling yeast is a good idea whenever you are planning to bottle condition a beer that you suspect may have a low yeast count or stressed yeast. If you have made a high-gravity brew or conditioned a beer for an extended period at low temperatures, adding bottling yeast is a good insurance policy. Even without bottling yeast, most lagers and strong ales will eventually carbonate, but the process may be slow and proceed unevenly among your bottles. Adding bottling yeast is not necessary for regular-strength ales.

We haven't tried using bakers yeast, but would caution against it on general principles. Use a good quality beer yeast. Unless you brew a very lightly-flavored beer and pick one of the more exotic Belgian strains for your bottling yeast, you are unlikely to be able to detect any yeast-derived character from your bottling yeast. This is because the amount of sugar the bottling yeast processes is tiny compared to the total amount of carbohydrates fermented by the main beer yeast.

The best way to add bottling yeast is to take a sanitized measuring spoon measure out a quarter tsp. of yeast slurry from a recent low to moderate gravity fermentation. (This is easy to do if you have a conical fermenter, or if you rack a low-gravity beer the

contributors



Gordon Strong is President of the Beer Judge Certification Program (BJCP). He led the development of the 2004 and 2008 BJCP Style guidelines — the latter being the most current version of the judging guidelines used by most homebrew competitions. He is the only Grand Master V beer judge. Strong has won a variety of homebrewing awards, including the Ninkasi Award — the award for the most points scored in the second round of the AHA National Homebrew Competition — in 2008 and 2009.

In the May-June 2009 issue of *Brew Your Own*, Strong discussed hybrid beer styles. In this issue, he explains how to critically taste your beer with an eye towards improving it. Can carefully tasting your beer really make you a better brewer? Turn to page 26 and judge for yourself.

Bev Blackwood has been brewing for over a decade as an award winning homebrewer. He currently writes on beer for several publications, including *Southwest Brewing News* and travels widely in his pursuit of new and interesting brews. He resides in Houston, Texas and is an active member of the Foam Rangers homebrew club.

Blackwood has long been involved with the Saint Arnold Brewery in Houston, from being a tour guide for their Saturday tour to eventually being a Brewer and later the Brewery Production Manager. He also became Saint Arnold, in the persona of the Saint Arnold bobblehead doll. In this issue — on page 44 — he explains what Saint Arnold taught him about professional brewing and what lessons you can apply to your homebrewing.

Coleen Heingartner is celebrating her tenth year as the Art Director for *Brew Your Own* with a full redesign of *BYO*'s regular departments. She is also the creative force behind *BYO*'s sister magazine, *WineMaker*.

Coleen grew up in Old Bennington, Vermont and studied studio art at the University of Vermont. Following her graduation, she was an original member of the design staff at the Burton Snowboard Company when their corporate headquarters was located in Manchester Center, Vermont. She joined the *BYO* staff in 2000.

An avid snowboarder and fan of rock climbing and hiking, Coleen lives in Pawlet, Vermont with her son, Jordan, and a collection of friendly housecats. Her favorite beer style is Belgian wit.

same day you bottle.) You can also measure out the same amount of dried yeast. This amount is easily enough for dosing 5–10 gallons (19–38 L) of beer immediately prior to bottling. Add the yeast to your sanitized bottling bucket first, then siphon the beer onto it and the yeast should mix evenly throughout the beer.

Boiling big or add LME late?

In your January-February 2010 issue, Jamil Zainasheff has an extract recipe for dunkelweizen. In the recipe instructions, he calls for a full 5.9 gallon boil. Now, as a beginner I do not have a brew kettle that big (yet!), so I was wondering if I can still add the full amount of LME (liquid malt extract) that is called for, which amounts to 6.6 pounds, to 3.5 gallons of liquor and just add water to the fermenter to make up the difference?

The reason I ask is that a member of my local homebrew club when asked the same question suggested that I should boil the wort (made from specialty grains) and hops in ~3 gallons and then add the 6.6 lbs of LME in the last 15 minutes of the boil. They said that with a higher gravity wort the hop utilization will suffer so this was one way around it. Also, doing a boil with the LME for the full 60 minutes might cause caramelization. Needless to say I am a little confused.

Love the magazine, keep up the excellent work. The first beer I brewed was just opened on the weekend and it turned out pretty good. It was from a recipe of British clones from an earlier *BYO* issue. A little too hoppy for a bitter, but with a little aging that should reduce some what.

Pat Wheatley
Montreal, Quebec

As an extract brewer, your best bet for all beers is to boil the full amount of wort — for a 5-gallon (19-L) batch, start with more than 5 gallons (19 L) and boil it down to 5 gallons (19 L) at the end of the boil. How much more than 5 gallons (19 L) you should start with depends on your boil vigor. It's common for homebrewers to evaporate about a gallon (3.8 L) per hour, but this varies depending on the power of their heat source and kettle shape.

Your second option is to boil as much of your wort as you can manage and add a portion of the malt extract late in the boil. Many BYO *recipes call for boiling roughly half the volume of wort and adding approximately half of the extract near the end of the boil. The wort is then brought to full volume by adding cool water to the fermenter. Adding the malt extract late in the boil is indeed suspected to enhance hop utilization — and this very question is being tested right now in the* BYO/*BBR Collaborative Experiment Series. Previous experiments, published in the October 2005 issue of* BYO, *have shown that adding the extract late does decrease the amount of wort darkening that occurs in the boil.*

You are right that the bitterness in your British clone will likely fade with time. Welcome to homebrewing and good luck with your beers!

Carbonation query

I have just been reading through the last issue of *BYO* about "Better Bottling," from the question from Joe Sorg. (Mr. Wizard, p. 16) I myself am sitting here drinking my last homebrew, a porter, and have determined that it seems to be a little too flat. I like that you boldly detest the ¾ cup of priming sugar per batch rule. Unfortunately, like Joe, I have followed that rule but now have something new to try on my next batch due to your answer. In your answer you gave an example to try to achieve 2.8 volumes of carbon dioxide. Upon further reading in the same issue on "The Dark Secrets of Porter" the pro brewers were asked about what levels of carbonation they shoot for. Their answers ranged from 2.2 to 2.7 volumes. How is carbonation measured in the final product and is there a specific tool for doing so?

Jeff Fennel
Cary, North Carolina

The vast majority of homebrewers do not have the equipment to measure the level of carbonation in their beer. As such, the carbon dioxide (CO_2) level in homebrew is estimated in one of a couple ways.

Homebrewers who keg their beers can use a carbonation chart to predict their carbonation level. A carbonation chart allows brewers to see the predicted carbonation level of their beer at a given temperature and CO_2 pressure. More gas dissolves into colder beer and, likewise, more gas is dissolved into liquids at higher gas pressures. Getting an accurate estimate of CO_2 levels depends on accurately measuring the temperature of the beer and the CO_2 pressure above it. In addition, the chart gives the equilibrium volume of CO_2 dissolved into the beer; it may take several days for the beer to reach that level once the proper temperature and pressure have been established. For homebrewers who bottle condition their beers, there is one procedure that allows them to manipulate their carbonation levels fairly accurately.

At the end of fermentation, the level of carbonation depends on the temperature of the beer and the pressure it is under, just as in kegged beer. Brewers can look up the level of residual CO_2 in their beer and add an appropriate amount of priming sugar to generate the remaining amount of CO_2 required to hit their target level of carbonation. You can find these charts at www.byo/resources/carbonation. The chart assumes the reader is near sea level, but the correction for high altitudes is small. BYO

homebrew nation

BREWER PROFILE

Brewer: Christian Lavender

Hometown/State: Austin, Texas

Years Brewing: 3

Type of brewer:
All-grain brewer and extreme hop head experimenting with balancing vegetable, nut and fruit flavors.

Homebrew Setup (volume, style, efficiency):
10-gallon (38-L) capacity. Hot liquor tank: 15-gallon (57-L) Blichmann BoilerMaker. Mash tun: converted 15.5-gallon (59-L) keg. Brew Kettle: 15-gallon (57-L) MoreBeer! stainless kettle with thermometer

Currently fermenting:
Imperial Black IPA

What's on tap/in the kegerator:
Big Bear Black Rye Porter

My websites/blog:
Niche Stores, Inc: www.HomeBrewing.com, www.Kegerators.com
Tap Boards, Inc.: www.TapBoards.com

How I started brewing:
Before ever brewing my first batch, I built my first kegerator in the late 90s. Soon after, I started a website called Kegerators.com to help teach people how to convert old refrigerators into kegerators. The site now has evolved into an online guide/community for kegerator enthusiasts from all over the country. After buying many different types of keg beer for my personal kegerator, I became curious how beer was made and purchased *The Complete Joy of Homebrewing*. I ran to the local homebrew shop and bought a kettle, a couple of carboys, copper wort chiller and was hooked on my first and only partial-mash/extract batch. Enjoy my porter recipe to the right.

PROFILE RECIPE

Fortified Fennel Porter
(5 gallons/ 19 L, extract with grains)
OG = 1.074 FG = 1.019
IBU = 11 SRM = 30+ ABV = 8.2%

A fortified ale is a unique way to produce a unique taste in beer. Fortified ales are ales that have increased alcohol content through the addition of hard liquor. The ale is then force-carbonated in the keg. This is necessary for the carbonation process because the increased alcohol level kills off all but the hardiest of yeasts. Fortified ales are one way to add distinct herbal flavors to your beer, and here is an example of one way to do so.

Ingredients
4.5 gallons (17 L) purified or spring water
7.5 lb. (3.4 kg) dark dried malt extract
0.5 lb. (0.23 kg) caramel malt (120 °L)
0.5 lb. (0.23 kg) Briess Organics chocolate malt
0.5 lb. (0.23) American pale 2-row malt
0.5 oz. (14 g) Cascade hops (bittering)
0.5 oz. (14 g) Fuggle hops (finishing)
1 pack Nottingham Dry Ale yeast
0.5 liter of vodka or rum (40% alcohol or 80 proof)
1 oz. (28 g) dried fennel seed
0.5 oz (14 g) dried anise

Step by Step
The first thing to do with this beer is to make the porter base. Add your malts to 4.5 gallons (17 L) purified or spring water and bring to 170 °F (77 °C). Remove grains, add bittering hops and bring to a boil. Now add your malt extract and continue boiling for 55 minutes. Add your finishing hops at 55 minutes. Boil for five more minutes, cool the wort and add to your primary fermenter along with yeast. While the ale ferments in the primary fermenter for the next two weeks, your fennel will extract in the alcohol.

To make the extract, place the fennel and anise seed into a jar with the 0.5 liter of alcohol. Shake vigorously for about five minutes then let it sit. When your beer is ready to pour into the secondary fermenter, strain the fennel tincture out from the seeds.

When the beer is ready to keg from the secondary fermenter, which should take seven to fourteen days, add the extract into the keg and force carbonate the beverage with CO_2. Leave this concoction for about another week and a half and you will have a delicious fortified fennel porter.

byo.com brew polls

have you ever considered becoming a beer judge?

Yes, I would like to 46%
Maybe 26%
No, I'm not interested 19%
Yes, I'm working towards it 9%

new products

Sabco has introduced a new heat controlling component system — the RIMS-WIZARD™. This new component utilizes some of the key elements of their Brew-Magic pilot system. Designed to assist small-batch all-grain brewers, the RIMS-WIZARD™ regulates mash temperatures within a fraction of a degree without the consequences of mash stirring, aeration, caramelization or kettle heat layering. Visit Sabco at www.kegs.com or call 419-531-5347 for more information.

Monster Brewing Hardware has a new base and hopper for their grain mills. The new accessories work with any of Monster Brewing's grain mills for homebrewers and eliminate the need to fabricate your own base or hopper. The new base is made from medium density fiberboard and drilled for top mounting. Models are available for mills with either 1.5" or 2" rollers. The new hoppers are made from CNC bent, laser cut, 20-gauge galvanized steel, and are modular, making them easy to assemble with the included machine screws. The hopper holds approximately 11 lbs. of base grain. For more information, visit ww.monsterbrewinghardware.com, email info@monsterbrewinghardware or call 678-350-1731.

MALTSTER'S
RESERVE SERIES

Briess Malt & Ingredients Company has released Caracrystal® Wheat Malt, the first product in their new Maltster's Reserve Series line of seasonal malts. Caracrystal® Wheat Malt is a roasted caramel wheat malt processed from Wisconsin-grown wheat, recommended for all beer styles using caramel malts such as IPAs, Pale Ales, low alcohol beers, wheat beers, Bock beers, and session beers. Caracrystal® Wheat Malt is available now through March 2010. For more information about the Maltster's Reserve Series and Caracrystal®, visit www.brewingwithbriess.com

calendar

March 5
Buffalo, New York
Amber Waves of Grain
The annual homebrew competition organized by the Niagara Association of Home Brewers and part of the New York State Homebrewer of the Year Competition. Entry deadline is February 20. Entry fee is $6. More information is available at www.niagarabrewers.org or by emailing Keith Curtachio at keith@niagarabrewers.org

March 13
Aurora, Illinois
Drunk Monk Challenge
The entry deadline for this year's Drunk Monk Challenge is March 13. Entry fee is $6. Email drunkmonkchallenge@gmail.com for more information or visit www.knaves.org/DMC/index.htm

March 27
Rochester, New York
Empire State Open Homebrew Competition
The Upstate New York Homebrewers Association annual competition, which is also a part of the New York State Homebrewer of the Year competition. Deadline is March 13. More information is available at www.unyha.com or by emailing Kira Barnes at kiracalico@gmail.com

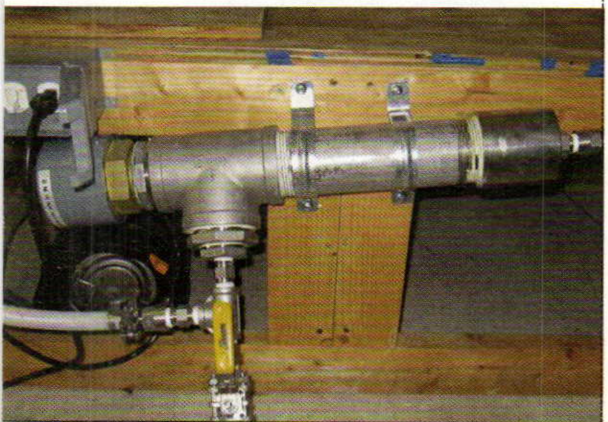
April 16-18
Manchester Center, Vermont
WineMaker International Amateur Wine Competition
The deadline to enter your meads and homemade wines in *WineMaker* magazine's annual competition is March 15. Entry fee is $25 for each mead or wine entered. Rules and entry forms are available online at www.winemakermag.com/competition.

homebrew drool systems

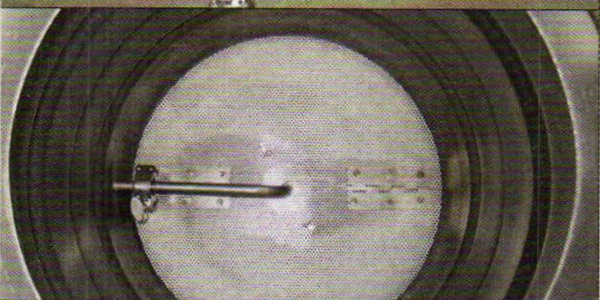
Cumberland County RIMS

andy goulding • fayetteville, north carolina

My homebrewery is an all tri-clamp RIMS system. I had Sabco do all the welding to my specifications for the kegs. They also supplied the false bottoms, siphon drains and sight tubes. I built everything else from scratch.

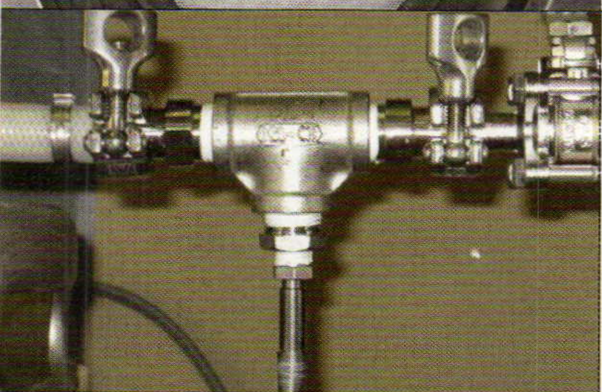


I'm utilizing a custom element manufactured by TrueHeat. It produces just over 4000 watts at 45 watts/square inch (220V). It's capable of heating a full mash (25-35 lbs./11-16 kg of grain) from 60 °F (15.5 °C) to 155 °F (68 °C) in an hour or so (depending on the size of the mash).



This is the interior of the boil kettle (the mash tun is basically the same with one additional fitting for the inlet).

> "I had Sabco do all the welding to my specifications for the kegs."



Here is a picture of the temperature probe at the outlet of the mash tun.

And finally here is where I serve my beer. I purchased this BevAir on Craigslist for $600 (if you can believe that!)

hop profile

COLUMBUS

A well-loved bittering hop that matures mid to late season with medium to large, tight, rounded cones. Columbus has a pungent aroma and is widely grown in the US. Ranging from 11–16% alpha acids, it can be substituted with Chinook, Northern Brewer, Nugget and UK Target.

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beginner's block

HIGH GRAVITY BREWING

by betsy parks

big, bigger and biggest — high gravity beers seem to be a trend lately, and you may have noticed many more beers with beefy ABVs at your local bottle shop and in homebrew competitions. High gravity brewing is more complicated than a simple feat of fermentation, but anyone can brew big at home with a little attention to the details and some patience.

What's big

What beers are worthy of the "high gravity" label? There is not necessarily a set number to define what's big, however, on their website, Wyeast considers anything with an original gravity above 1.065 to be high gravity, for example, while *Radical Brewing* author Randy Mosher considers beers in the range of about 8% ABV and up to be high gravity. Regardless of the numbers, high gravity beers are more often recognized by style: barleywine, Scotch ales, strong Belgian styles and imperial styles like double IPA and imperial stouts.

Malt

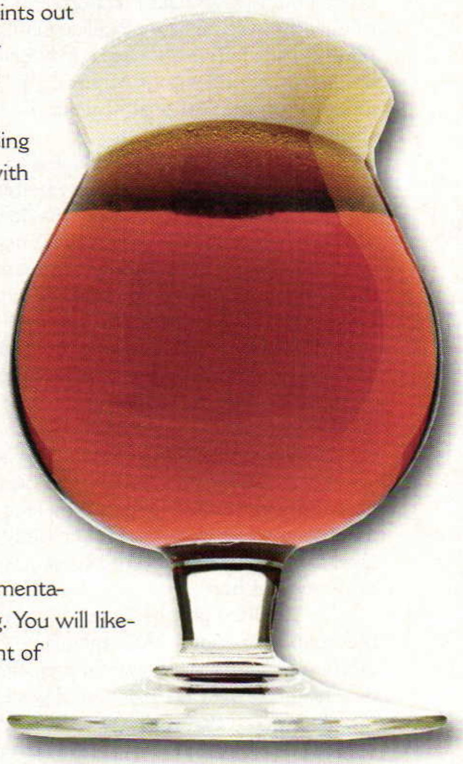
To make a big beer, you're going to need a big wort. For extract brewers, this can be achieved by simply using more extract. All-grain brewers can also use malt extract added to the wort to raise the gravity. Rather than try and make a high gravity beer by simply doubling the malt or grain in a regular-sized recipe, however, choose a high gravity style and start out with a reliable recipe that you know will work.

Yeast

Regardless of what style or recipe you choose, high gravity beers can cause stress on the yeast, which can result in a stuck fermentation. These beers must have a large, robust population of yeast that can tolerate a more hostile environment in order to make it to the end of fermentation. Most yeast companies have strains that can tolerate high gravity/high alcohol environments, but making a yeast starter ahead of time can make these strains even stronger and healthier. It is also very important to aerate your wort when you pitch the yeast, and fermentation can take longer than a lower-gravity beer, so patience is a must.

Balance it out

Because high-gravity beers are based on lots of malt, they also need lots of hops to balance out all that malty flavor. Mosher also points out in *Radical Brewing* that high-gravity worts assimilate hop bitterness poorly during the boil. Therefore, plan on loading your high-gravity brew up with lots of hops. For instance, normal beers often fall in the 20-40 IBU range, while high-gravity styles like imperial stout will often fall in the 50-90 range. And of course imperial IPAs can go even higher.



Conditioning

High gravity beers require patience not only during fermentation, but also in conditioning. You will likely need to reduce the amount of additional sugar added at bottling as there will still be some fermentable sugars present that will provide a percentage of the carbonation. These sugars take time to ferment, however — sometimes as much as six months.

High-gravity beers also tend to improve with some aging, especially styles like barleywine and some Scotch ales. When you choose what style to brew, research how other brewers condition and age them to get a good idea of what to expect when the fermentation finishes.

by marc martin

DEAR REPLICATOR,

On a recent visit to Hartford, Connecticut to see my son I discovered the Olde Burnside Brewing Company. My son and I were treated to an enthusiastic tour of the cramped spaces (the building was actually an old icehouse). I was a little disappointed to hear that their flagship beer was described as a Scottish Ale. I have never really developed a taste for Scottish ales even though I have sampled many and brewed a few. This sample was surprisingly different. I'm not sure I would call it Scottish ale, but whatever it is, it was addictive. Rich caramel colored, malty but well balanced, nice thick light colored head but unfortunately only 64 ounces. Can you help me with this beer? It's over four hours away so I need to try and make my own.

DAN MOORE
PLATTSBURGH, NEW YORK

One of my favorite countries to visit is Scotland and it is there that I came to appreciate fine Scotch ales. This past spring I decided to combine a trip to the *BYO* office with a few extra days of touring Vermont. At the Bluebird Tavern in Burlington, Vermont I found Ten Penny Ale on tap. I agree, it seems to be a mellower version of a true Scotch ale, and a very excellent beer indeed.

You would be hard pressed to find a brewery with a more interesting history than Olde Burnside Brewing. The company was founded in 1911 by Albert McClellan as solely an icehouse. Ice was harvested from an adjoining pond and delivered to homes in town with a horse and wagon. In the 1950s the company diversified and began selling rock salt, home heating oil and coal, plus providing winter snow removal services. It is presently the second oldest family-owned business in East Hartford and one of only three remaining block ice plants in New England. The business and building are currently under consideration for inclusion on the National Register of Historic Places.

In 1994 they noticed that demand was increasing for their uniquely pure water, sourced from a 400-foot- (122-m)- deep well on their property. When customers were asked about their use of so much water they responded "for brewing beer." Laboratory analysis revealed that the water was fairly high in mineral content and closely resembled the famous English Burton-on-Trent water profile.

The homebrewing tradition also runs deep in this family. When Jason McClellan was 21 his father, Bob, bought him his first homebrewing kit and he began making batches in the mid 1990s. He too discovered that this was excellent brewing water and the idea of starting a small commercial brewery was born.

In 2000 the plan became reality after locating a 15-barrel system from a defunct brewpub in Sheriden, Wyoming. The first keg of beer was delivered on November 22, 2000, which was their now famous Ten Penny Ale. The original formulation was developed by their first brewer, Ray Ballard, from a homebrew recipe.

Today, Ten Penny Ale and their other beers are brewed by Head Brewer Joe Lushing. He began his vocation as a homebrewer and has been at Olde Burnside for six years. Jason describes Ten Penny ale as a medium weight version of Scotch ales. He feels that it more closely resembles an 80-shilling export example. The milder alcohol level gives this beer "session" beer qualities. A very clear, deep amber beer that is topped by a creamy, light tan head. This is a malt forward beer with just enough bitterness to offset the residual sweetness. I found the malt profile to be heavily accentuated by caramel notes, the result of a longer boil. A medium dry finish exhibits a hint of smoke. A beer and brewery steeped in Scottish tradition.

Dan, you won't have to make a long drive to Connecticut because now you can "Brew Your Own". For further information about the brewery and their other fine beers visit the website www.oldeburnsidebrewing.com or call them at 860-528-2200. BYO

Olde Burnside Brewing Company Ten Penny Ale

(5 gallons/19 L, extract with grains)

OG = 1.056 FG = 1.014
IBUs = 29 SRM = 13 ABV = 5.5 %

Ingredients

3.3 lbs. (1.5 kg) Muntons light, unhopped, liquid malt extract
2 lb. (0.9 kg) light dried extract
2 lb. (0.9 kg) 2-row pale malt
11 oz. (0.31 kg) carastan malt (65 °L)
3 oz. (85 g) Weyermann German wood smoked malt
1.5 oz. (43 g) crystal malt (150 °L)
1 oz. (0.28 g) roast barley (450 °L)
8.1 AAU Centennial hop pellets (0.85 oz./ 24 g of 9.5% alpha acids) (45 min.)
½ tsp. yeast nutrient (last 15 minutes)
½ tsp. Irish moss (last 30 minutes)
White Labs WLP013 (London Ale) or Wyeast 1968 (London ESB) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 2 gallons (7.6 L) of water at 154 °F (68 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the liquid malt extract and boil for 90 minutes. While boiling, add the hops, Irish moss and yeast nutrient as per the schedule. Now add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 66 °F (19 °C). Hold at that temperature until fermentation is complete. Transfer to a carboy, avoiding any splashing to prevent aerating the beer. Allow the beer to condition for one week and then bottle or keg. Allow the beer to carbonate and age for two weeks.

All-grain option:

This is a single step infusion mash using 11 lbs. (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 154 °F (68 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil for 90 minutes. Reduce the single hop addition to 0.75 oz. (21g) Centennial hop pellets (7.1 AAU) to allow for the higher utilization factor of a full wort boil. The remainder of this recipe and procedures are the same as the extract with grain recipe.

* Brewers note: if you use soft or bottled water add 1 tsp. of "brewing salts" the last 10 minutes of the boil. A cooler fermentation may reduce esters.

Degrees of Crystal

Experimenting on the Lovibond scale

by Betsy Parks

CONFUSED BY THE DIZZYING SPECTRUM OF CRYSTAL MALTS? JUST LIKE A PALATTE OF ARTIST'S COLORS, CRYSTAL MALTS ARE AVAILABLE IN MANY DIFFERENT DEGREES OF LOVIBOND. IN THIS ISSUE, TWO BREWERS AND A MALT EXPERT DISCUSS HOW THEY USE CRYSTALS AND HOW TO CHOOSE THE RIGHT MALT.

At Dark Horse, we have pretty much settled on the selection of crystal malts we use most frequently. We are a production brewery, so we brew a lot of the same beers all the time, therefore we often use the same crystal. But we do still have fun and sometimes make one-off beers. When we do those kinds of experiments I sometimes get to use some different levels of malts.

I use different kinds of crystal malts in our beers because I think they are great for adding some color to a beer as well as a malty sweetness.

We use crystal malt in about every beer we make at the brewery. For the majority of our beers we use 77 and 45 °L and occasionally some others. For maltsters, we use Rahr Malting for our base malt and for most of our specialty malts we use Crisp or Simpson.

If you're homebrewing and want to know more about the different kinds of crystal, study the different malts so when you use them you understand what you are using them for, whether it be the color, body and malty sweetness, or even just a particular taste in a beer.

I think the best way to gain a better understanding of what each crystal malt can do is simply trial and error, but you can also read up about the different levels of crystal in books and on the Web.

Always ask pro brewers and your fellow homebrewers questions about their beers, the kinds of crystal they use and why. Also, taste the raw product. It will futher your understanding of the malts.

Aaron Morse, Owner and Head Brewer of Dark Horse Brewing Company, Marshall, Michigan. Aaron parlayed his interest in homebrewing into the opening of Dark Horse as a brewpub in 1997. In 2000 they expanded the brewery from a brewpub to a production brewery.

We use a wide variety of caramel/crystal malts, including 20, 40, 80, and 120 °L varieties. For the paler and hoppier beers (420 and IPA), typical usage amounts are 5-10%, moving up to about 20% for our ESB.

We use Bairds malt for caramel 20, 80, and 120 °L. Canada Malting Company supplies our caramel 40 °L. We also use Briess, Cargill and Weyermann for some of our other specialty malts. It really depends on personal preference by variety and experience using different malts from various suppliers.

I typically like to use caramel 20–80 °L for beers that require a more subtle caramel sweetness. For very malty beers, I prefer to use a higher percentage of low Lovibond caramel so that the resulting beer doesn't have a lot of burnt sugar character. I usually reserve caramel 120 °L for stouts and porters, or when some burnt caramel flavor is desired.

Homebrewers have the advantage of brewing many different beers. I recommend trying several varieties then deciding which is best for each type of beer based on personal preference. When deciding how much to use, remember to consider what characteristics you are looking for in the finished beer, such as burnt character, malty, hoppy, or a balance of several.

Also, taste the malts. This will give you a good idea of what to expect in the finished beer. The best way is to experiment by brewing the same type of beer with varying amounts. You will get a feel for how much to add based on experience with prior brews.

Mark Medlin, Brewmaster, Sweetwater Brewing Company, Atlanta, Georgia. Mark started homebrewing in college at Virginia Tech and attended the UC-Davis Master Brewer's Program in 2004. He worked at Goose Island Beer Co. as Brewery Manager and came to Sweetwater in 2008.

Bob Hansen, Manager of Technical Services, Briess Malt and Ingredient Company, Chilton, Wisconsin. Bob used to brew at Milwaukee's Water Street Brewery. He joined Briess Malting in 2001 and is a member of *Brew Your Own*'s editorial review board.

There are many different types of crystal malts in varying degrees out there because brewers love variety.

Lighter styles of crystal malt (up to 50 °L) are used in lighter colored beers where subtle caramel flavors and increased body and mouthfeel are desired. This would include many of the more popular styles such as märzen/ Oktoberfest, pale ale and amber ales.

Darker malts are used for a variety of effects. The medium dark range (50–80 °L) are used where light reddish hues or color contribution are desired but with less flavor and unfermentables, such as adjusting color in light beers or bock. These or darker (80–120 °L) crystal malts are used anytime intense reddish or mahogany hues are required, such as in Belgian abbey or barleywine. The darker crystal malts have distinct, complex flavors described as raisiny or pruney. Percentages of crystal malts in a grist can vary quite a bit depending on the effect desired.

A fun experiment is to brew a batch of beer and then split the fermentation and add worts from steeped and boiled crystal malts to the same color equivalent to the different fermenters. For example you can add 4 ounces (113 g) of caramel 120 °L or 8 ounces (227 g) of caramel 60 °L or 1 pound (0.45 kg) of caramel 30 °L to a five-gallon (19-L) batch to add six degrees Lovibond of color.

Crystal malts work great to adjust color and flavor when simply steeped, removing the grain and adding to worts from all-grain or extract batches. Brewers should make sure they are brewing with true crystal (or caramel) malt produced in a roaster when using this practice. That's because only roasters allow for the uniform application of significantly high temperatures to green malt. This is a must for the true consistent caramelization of sugars in each kernel. European and some American caramel, or crystal, malts are produced in a roaster and are uniformly caramelized and glassy in their kernels (true caramel malts). However, some American malt marketed as caramel, or crystal, malts are actually produced on a kiln and are only partially converted. These can be identified by cracking the kernels. If mealy starch is discovered in many of the kernels, the product was produced on a kiln or blended and will require conversion in a mash. BYO

Making spud suds

Powdery yeast, recipe math

by Ashton Lewis

Q A lady in our small town of Etna, California told me that she heard of using potatoes to brew beer — so I tried it! My spud ale came out quite good, but I need to do some refinement. Any advice?

JACK TILLMAN
ETNA, CALIFORNIA

A When I was a graduate student at UC-Davis I attended a Master Brewers meeting at the local Sudwerk Privatbrauerei Hübsch brewery where I worked part-time as a brewer. The speaker at this particular meeting was a retired brewmaster from the Lucky Lager Brewing Company in San Francisco, which closed in 1978. The retired Lucky brewmaster talked about what he did during WWII to keep beer flowing from the brewery when corn and rice adjuncts were rationed and unavailable to brewers. He told of using potatoes as a replacement for rationed raw materials commonly used by brewers as adjunct grains. If my memory serves me right (this talk was given in 1993 or 1994) he used dried potato spuds. Before diving into this question I bought some dried potato spuds and verified that they are easy to handle and could have been received, stored and conveyed like other dry raw materials used by brewers. They also are extremely easy to hydrate.

So there is a precedent for potato beer. When you add potatoes to beer, be they boiled and mashed or dehydrated spuds, you must recognize that you are adding starch. This starch must be converted by amylase enzymes into fermentable sugars, just like any starchy brewing ingredient. The gelatinization temperature of potatoes is around 140 °F (60 °C) The other thing about potatoes is that they have a distinctive sulfur aroma and I would remove these compounds before fermentation. That's another plus of using dehydrated potato spuds, since a lot of the sulfur aromatics in wet potatoes are driven off with moisture during the dehydration process.

The nice thing about potato starch is that it is not so different from barley starch. It normally contains a bit more amylose than barley starch (different varieties of potatoes and barley have different amylose and amylopectin profiles), but usually is about 50% amylose and 50% amylopectin. It also has a gelatinization temperature similar to barley starch (of course the dehydrated spuds are already gelatinized). What this means is that potato starch will behave quite normally in the mash and even if you decided to use "raw" potatoes instead of dehydrated spuds you would not have to boil the potatoes before mashing. If you shredded your tubers using a cheese grater as if preparing hash browns the potatoes will hydrolyze like the endosperm of malt when added to the mash.

I think the use of potatoes makes a lot of sense and you do have history on your side. But you also know now that their use by US brewers seems to have stopped after the rationing of food crops during WWII . . . so one has to wonder why it was discontinued. 'Taters are certainly cheap, so my guess is that off aromas may be an issue in some cases.

If I were you I would brew some more batches, but would use step mashing to convert the potato starch into fermentable sugars.

While we're on the subject, I have to admit that I have considered using potatoes for an Irish dry stout for a really geeky reason; Ashton, Idaho is known as the potato seed capital of the world, my name is Ashton and there was something in Ireland's history related to potatoes. Like I said, pretty geeky!

> "The nice thing about potato starch is that it is not so different from barley starch."

Q For years I assumed that if the sediment in your bottled beer doesn't set firm, and is easily disturbed when the bottle is moved, that the beer is contaminated even if there isn't the tell-tale ring in the neck or ropiness in the bottle. Is this true? Is the beer contaminated if this happens? What may cause this?

JOHN "JJ" VALLEJO
WAUKESHA, WISCONSIN

A I think that it is interesting that so many homebrewers and small scale commercial brewers are familiar with the term ropiness when in fact this particular problem is not common. This defect is caused by certain bacteria that secrete polysaccharide slime, and is named as such because this mucilaginous compound looks like long, clear tendrils. I have never actually seen a sample of ropy beer and I can guarantee that if I ever do it will not touch my lips as the affliction sounds absolutely revolting.

With today's understanding of brewing sanitation and our ability as brewers at practicing good brewery sanitation, these sorts of problems are much less common today than they were in the past. The good news is that if you use good brewing tools as well as good sanitary methods you can dramatically reduce the chance of brewing a batch of contaminated beer. It is true that when beer becomes badly contaminated with bacteria it often takes on an intensely murky appearance. I rely on smell and taste to diagnose contamination issues and suggest that you sample your beer before you convince yourself a batch of ale is bad based solely on appearance.

The issue you are describing in the question sounds like powdery yeast. This is a trait of some brewing yeasts; when powdery yeast is used for bottle conditioning it is easily moved from the bottom when the bottle is moved and when the bottle is poured. There is nothing wrong with powdery yeast and the appearance you describe causes no alarm bells to sound in my head.

Other yeast strains have better flocculation properties. If you do not want to have this appearance in the bottom of your bottles, the easy solution is to select yeast strains with moderate to high flocculation characteristics. Many brewers prefer these types of yeasts for bottle conditioning. One downside with highly flocculent strains is that if there is a lot of yeast sediment in the bottle, and when the sediment becomes dislodged during serving, it tends to come out of the bottle in clumps. This appearance is not very appealing. When using flocculent strains in bottled conditioned beers it is advisable to limit the amount of yeast in the bottle.

There are times when brewers want to use powdery yeast for bottle conditioning. German hefe-weizen is a style where a uniform haze is a desirable attribute. One way that weizen brewers achieve this appearance is by conditioning with powdery yeast strains. As it turns out, lager strains are usually less flocculent than ale strains and it is common to add a lager strain to weizen at the time of bottling. These strains make it easier to swirl the yeast around from the bottom of the bottle during pouring.

My advice is to taste before assuming that just because you have powdery yeast that you have a microbiological problem with this batch. There is no relation between the two traits.

Q I started with 5-gallon (19-L) kits, but after about 30 batches I decided to double my capacity and brew all-grain 10-gallon (38-L) batches. My basic need is to convert a 5-gallon (19-L) recipe to 10-gallons (38 L). In the past I simply doubled the amount of each ingredient. Is this correct?

GLEN ALDEN
ORMOND BEACH, FLORIDA

A In general terms, I agree that when recipes are scaled up in volume that the ingredients are simply not proportioned to the change in volume. The reason that this method normally does not work is that there are usually differences between the efficiencies of small and large brewhouses.

This scaling is often done when a commercial brewer is taking a batch of brew from their pilot brewery to a commercial size. Even in a small brewery this may mean scaling a 5-gallon (19-L) batch to a 15-barrel batch, or a 100-fold increase in volume. This jump in volume is significant because small differences in material efficiency become very apparent during this sort of scale change.

It is easy to demonstrate with standard brewhouse calculations that differences in brewhouse efficiency do affect wort original gravity. Also, the shape of your brew kettle and the type and size of heater used for the kettle can affect wort color, hop utilization and evaporative rate. These factors all are important if you want to make the same batch of beer twice on different scales.

All recipes published in *BYO* are based on assumed raw material yields. Since the actual efficiency of a particular brewhouse setup is fairly consistent and easy to calculate, those who brew frequently typically know their brewhouse efficiency and can modify recipes to account for the difference between an assumed efficiency and actual efficiency. Not all brewers calculate efficiency the same way, but the numbers are handy no matter the method. I prefer comparing how much extract I produce during wort production to the weight of malt used.

For example, let's assume that I produce 20 liters of 12 °Plato wort and used 3.4 kg of malt in the process. My extract yield is equal to (liters wort)*(decimal equivalent of °Plato)*(equivalent specific gravity to Plato). You can convert Plato to specific gravity using the following formula:

Specific gravity = {Plato/(258.6-([Plato/258.2]*227.1)}+1

Once you determine that 12 °Plato is equivalent to 1.048, the rest of the calculation is easy. I have included units below to show how the units cancel, resulting in kg of extract:

(20 ~~liter~~)*(0.12 kg extract/~~kg wort~~)*(1.048 ~~kg wort/liter~~) = 2.52 kg extract

The 2.52 kg of extract represents what was extracted from the 3.4 kg of malt during wort production. When 2.52 kg is compared to 3.4 kg the result shows that 74% of the malt added to the mash ended up as extract in the wort.

Most homebrew set ups do not have a yield this high and a more typical number is 68%. So if I gave you one of my recipes and told you that my brewhouse yield was 74% you could easily adjust the malt bill accordingly by simply multiplying my malt bill by 1.09 (74 ÷ 68), assuming your brewhouse has a 68% efficiency.

Scaling up hops is much more difficult as there is no easy method homebrewers can use to determine how much iso-alpha-acids end up in their finished beers. When scaling recipes up and down without actually knowing hop utilization, brewers rely on rules of thumb, tables containing scaling factors and good old sensory evaluation.

However, if I were scaling a 5-gallon (19-L) batch up to a 10-gallon (38-L) batch I would be very tempted to just double the whole bloody recipe and forget the math. After all, we're not blending something hazardous here, we're brewing beer. If the result is off, then you can always tweak it next time. BYO

British Balance

Northern English brown ale

by Jamil Zainasheff 

My daughters enjoy dining at a certain Mexican food chain restaurant. Visiting there recently, I noticed the restaurant now has Newcastle Brown Ale on draft in place of a classic Mexican beer. At first Mexican food and British beer seemed like an odd pairing to me, but I was willing to give it a try. Some people talk down about Newcastle, saying that due to worldwide brewery consolidation this Northern English brown ale is not the classic British beer that it once was. Regardless, I still find it quite enjoyable, especially served on draft alongside tacos and enchiladas.

Northern English brown ale is a flavorful, malt-focused beer with hints of nuttiness, biscuit, and caramel. It ranges in color from dark amber to a reddish-brown color, with a moderate, off-white to light tan head. It features gentle malt sweetness in an overall balanced beer. Even though the malt sweetness and hop bitterness are evident, both are restrained and neither overwhelms the other. The malt character is full of biscuity and nutty flavors and aromas, and hop character is usually low to none. Brewers are often confused as to the difference between Northern and Southern English brown ales. Northern is drier and more hop bittered than its Southern cousin. Southern has more caramel character, is usually darker in color, and can have some darker malt character. Where Southern can have some subtle coffee and chocolate notes, Northern generally does not. Northern is a moderate alcohol beer, while Southern is always lower in alcohol.

Hops only play a supporting role in this style, with just a balancing bitterness, subtle hop flavor, and little to no hop aroma at all. The finish can be slightly sweet or slightly dry, the body will be around medium, and the overall impression is balanced. Fermentation character often includes low fruitiness, similar in nature to other British beers. Another classic British example is Samuel Smith's Nut Brown Ale. Other UK and US brewers offer good examples, including Wychwood Hobgoblin, Tröegs Rugged Trail Ale and Samuel Adams Brown Ale. (See the sidebar on page 23 for more examples).

In any beer, the base malt character plays a big role. In most British beers, it is critical. British pale ale malt is a good choice for Northern English brown as it provides a background biscuit-like malt character that people associate with fine British beers. British pale ale malt is kilned a bit darker (2.5 to 3.5 °L) than the average American two-row or pale malt (1.5 to 2.5 °L) and this higher level of kilning brings out the malt's biscuity flavors. A few malt companies (Crisp Malting is one) still produce British pale ale malt from cultivars such as Maris Otter using a traditional floor malting method. Warminster also makes a hand-raked British floor malt from Maris Otter that would also work well (although this is harder to come by in the US). The result is malt with a slightly darker color (3.5 to 4.0 °L) and more flavor than other pale ale malts. It is the malt of choice for many English beer fanatics. If you can find mild malt, you can use it as the base for your English brown ales with excellent results. However, you'll need to adjust your specialty grains to compensate for the darker color of the malt (~5 °L) and the increased toasted, nutty flavor.

These highly modified malts are perfectly suited to single infusion mashes, which is typical for all British beers. Target a mash temperature in the range of 150 to 154 °F (66 to 68 °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 temperature range to avoid too full of a body, which can limit drinkability.

If you brew with extract, your best choice is an extract made from British pale ale malt. There are some British-style malt extracts currently on the market made from 100% Maris Otter malt and they are an excellent choice for English beers. If you end up using domestic two-row malt or extract made from it, you'll need to compensate with some additional specialty malts such as Biscuit or Victory, but use

Continued on page 24

northern english brown ale
by the numbers

OG:	1.040–1.052 (10–12.9 °P)
FG:	1.008–1.013 (2.1–3.3 °P)
SRM:	12–22
IBU:	20–30
ABV:	4.2–5.4%

Northern English Brown Ale
(5 gallons/19 L, all-grain)
OG = 1.051 FG = 1.013
IBU = 26 SRM = 14 ABV = 5.1%

Ingredients

8.82 lb. (4 kg) Crisp British pale ale malt 3 °L (or similar)
10.6 oz. (300 g) Briess special roast 50 °L (or similar)
5 oz. (141 g) Great Western crystal malt 40 °L (or similar)
5 oz. (141 g) Briess Victory malt 28 °L (or similar)
4 oz. (113 g) Crisp pale chocolate 200 °L (or similar)
3.5 AAU East Kent Goldings hops (0.7 oz./20 g at 5% alpha acids) (60 min.)
3.5 AAU East Kent Goldings hops (0.7 oz./20 g at 5% alpha acids) (5 min.)
White Labs WLP013 (London Ale), Wyeast 1028 (London Ale) or Fermentis Safale S-04 yeast

Step by Step

I use Crisp Malting's British Pale Ale malt (made from Maris Otter) as my base grain, but other malts of a similar nature should work well (see some suggestions on page 21). Remember, the bulk of the flavor comes from the base grain, so try to get British pale ale malt.

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 5.9 gallons (22.3 L) and the gravity is 1.044 (10.9 °P).

Once the wort is boiling, add the bittering hops. The total wort boil time is 60 minutes after adding the bittering hops. With 15 minutes left add the Irish moss or other kettle finings and at five minutes left add the last hop addition. Chill the wort to 68 °F (20 °C) and aerate thoroughly. The proper pitch rate is 9 grams of properly rehydrated dry yeast or two packages of liquid yeast.

Ferment around 68 °F (20 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in a week or less. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished.

Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 1 to 2 volumes depending on your packaging. Serve the finished beer at 50 to 55 °F (10 to 13 °C).

Northern English Brown Ale
(5 gallons/19 L, extract with grains)
OG = 1.050 FG = 1.012
IBU = 26 SRM = 14 ABV = 5%

Ingredients

5.73 lb. (2.6 kg) Edme Maris Otter, Muntons or similar pale English liquid malt extract (4 °L)
10.6 oz. (300 g) Briess special roast 50 °L (or similar)
5 oz. (141 g) Great Western crystal malt 40 °L (or similar)
5 oz. (141 g) Briess Victory malt 28 °L (or similar)
4 oz. (100 g) Crisp pale chocolate 200 °L (or similar)
3.5 AAU East Kent Goldings hops (0.7 oz./20 g at 5% alpha acids) (60 min.)
3.5 AAU East Kent Goldings hops (0.7 oz./20 g at 5% alpha acids) (5 min.)
White Labs WLP013 (London Ale), Wyeast 1028 (London Ale) or Fermentis Safale S-04 yeast

Step by Step

I use an English-type liquid malt extract custom made for my homebrew shop from a 100% Maris Otter malt. Always choose the freshest extract that fits the beer style. If you can't get fresh liquid malt extract, it is better to use 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 1 gallon (~4 L) of water at roughly 170 °F (77 °C) for about 30 minutes.

Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags. Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 5.9 gallons (22.3 L) and a gravity of 1.043 (10.6 °P). Stir the wort thoroughly to help dissolve the extract and bring to a boil.

Once the wort is boiling, add the bittering hops. The total wort boil time is 60 minutes after adding the bittering hops. With 15 minutes left add the Irish moss or other kettle finings and at five minutes left add the last hop addition. Chill the wort to 68 °F (20 °C) and aerate thoroughly. The proper pitch rate is 9 grams of properly rehydrated dry yeast or two packages of liquid yeast.

Ferment around 68 °F (20 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in a week or less. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished.

Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 1 to 2 volumes depending on your packaging. Serve the finished beer at 50 to 55 °F (10 to 13 °C).

For more Northern English Brown Ale recipes (and other brown ales), check out byo.com/component/resource/article/340-brown-ale-style-of-the-month or visit BYO's online directory of recipes at byo.com/stories/recipes/recipeindex.

commercial examples

Newcastle Brown Ale
Scottish & Newcastle p.l.c.
Edinburgh, UK
www.newcastlebrown.com

Samuel Smith's Nut Brown Ale
Samuel Smith Old Brewery
Tadcaster, North Yorkshire, UK

Riggwelter Yorkshire Ale
Black Sheep Brewery PLC
North Yorkshire, UK
www.blacksheepbrewery.com

Wychwood Hobgoblin
Wychwood Brewery
Witney, Oxfordshire, UK
www.wychwood.co.uk

Tröegs Rugged Trail Ale
Tröegs Brewing Co.
Harrisburg, Pennsylvania
www.troegs.com

Avery Ellie's Brown Ale
Avery Brewing Co.
Boulder, Colorado
www.averybrewing.com

Goose Island Nut Brown Ale
Goose Island Brewing Co.
Chicago, Illinois
www.gooseisland.com

Samuel Adams Brown Ale
Boston Beer Company
Boston, Massachusetts
www.bostonbeer.com

Smuttynose Old Brown Dog Ale
Smuttynose Brewing Co.
Portsmouth, New Hampshire
www.smuttynose.com

Bells's Best Brown
Bell's Brewery
Galesburg, Michigan
www.bellsbeer.com

Bolita Brown Double Nut Brown Ale
Cigar City Brewing
Tampa, Florida
www.cigarcitybeer.com

restraint. For a 5-gallon (19-L) batch, add no more than ¾ pound (0.34 kg) total.

When brewing Northern English brown your specialty grains can be as simple as a moderate amount of crystal malt, no more than 10% of the grist. Crystal malt adds caramel and other flavor notes to a beer and helps build body. The type of crystal malt also makes a difference. Darker color crystal malts add richer colors, as well as some dark caramel, toasty, roasted and raisin flavors. Lighter color crystal malts add sweeter caramel notes. You can experiment with different colors and amounts in the range of 30 to 150 °L. Keep in mind that in this beer style it is important to show restraint on the crystal malts. You want the beer to have more of a nutty character than a caramel character. That is why the base malt is so important. If you want to build an even nuttier, toasty character, then specialty grains such as Victory (28 °L) and pale chocolate (200 °L) malt will help. Use caution when adding any sort of dark malt to your grist. If you are using malts darker than pale chocolate (200 °L) it can quickly add a strong roasty flavor that is inappropriate for the style, turning your Northern brown into a stout or porter. Overall, keep the goal of drinkability in mind. Too much specialty malt results in a cloying, heavy beer. Depending on the types of specialty malts, the upper limit for this style is about 20%.

While corn, cane sugar and other adjuncts are traditional in brewing many English beers, I usually omit them, unless I'm crafting a big beer and I want to increase wort fermentability, thin the body or reduce the intensity of the base malt flavors. None of those apply in the case of brewing Northern English brown. The fact is simple sugars ferment fully, thin the beer and provide very little in the way of flavor contributions. I've seen recipes that use brown sugar, but don't count on it to add much in the way of flavor. In fact, many style purists believe that adding any kind of sugar to a Northern English brown is inappropriate. Corn and other non-barley adjuncts also reduce the overall malt flavors when used in place of the base malted barley. For me, I want as much base malt flavor as possible, so I do not use any adjuncts in my Northern brown.

Northern English brown is best brewed with English hops, such as East Kent Goldings, Fuggles, Target, Northdown or Challenger, though US hops such as Willamette, can be used for bittering in a pinch. The bittering level is in the range of 20 to 30 IBU. Target enough hop bitterness to provide a near-even balance without overwhelming the malt sweetness. Keep in mind that there are many factors at play in the final impression of bitterness for the drinker. Darker-kilned malts add dryness while crystal malts add sweetness and both affect the perception of bitterness. For Northern brown, a bitterness-to-starting gravity ratio (IBU divided by OG) between 0.4 and 0.6 gives good results. The bulk of the hopping should be as a bittering addition at 60 minutes. If you want a touch of hop flavor, a small addition, around ¼ to ½ ounce (7 to 14 g) for a 5-gallon (19-L) batch, near the end of the boil is acceptable. Keep in mind this style shouldn't have more than a low amount of hop flavor and no hop aroma, so don't use larger additions.

Fermentation creates much of the flavor and aroma in most British beers. "English" yeast strains provide a variety of interesting esters and tend to be low to moderately attenuating, leaving some residual sweetness to balance the bitterness and help fill out the beer. They are also extremely flocculent, which makes them ideal for cask conditioning. These yeasts produce a fairly low level of esters at cool fermentation temperatures (<65 °F/18 °C) and abundant fruity esters and alcohol notes at high temperatures (>70 °F/21 °C). In general, it is better to start in the middle of this range, letting the temperature rise a few degrees, slowly over a couple days. This creates the expected level of esters and keeps the amount of diacetyl in the finished beer at a minimum.

There are quite a few excellent yeast strains available, each providing characteristic yeast flavors and aromas appropriate to English brown ales. In general, try to select English yeast that attenuates in the 70–75% range. White Labs WLP013 London Ale, WLP005 British Ale, WLP023 Burton Ale or Wyeast 1028 London Ale, 1098 British Ale, 1275 Thames Valley Ale and 1335 British Ale II are all good choices. If you prefer using dry yeast, Fermentis Safale S-04 produces good results. Ferment around 68 °F (20 °C) with any of these yeasts.

Restrained carbonation is common in most British beers. Gentle carbonation can enhance the drinkability, filling the drinker with beer, not gas. Target a carbonation level of 2 volumes for bottled, 1.5 volumes for kegged, and just over 1 volume of CO_2 for cask conditioned beer.

> "Fermentation creates much of the flavor and aroma in most British beers."

Serving your English brown ales at cellar temperature, around 50 to 55 °F (10 °C to 13 °C), allows the character of the beer to blossom. Colder temperatures prevent the drinker from picking up the interesting fermentation and malt flavors and aromas of this style, so don't go below 50 °F (10 °C). BYO

Jamil Zainasheff is host of Can You Brew It, *a show about cloning your favorite commercial beers and* Brew Strong, *a show that answers technical questions about brewing. Both can be found on the Brewing Network (www.thebrewingnetwork.com). He writes "Style Profile" in every issue of* Brew Your Own.

by **GORDON STRONG**

BE YOUR OWN BEST CRITIC

HOW JUDGING YOUR OWN BEER CAN IMPROVE YOUR BREWING

WHEN PEOPLE ASK ME FOR ONE THING THEY CAN DO TO BECOME A BETTER BREWER, I USUALLY TELL THEM TO LEARN HOW TO JUDGE BEER. YEAH, I GET A LOT OF SURPRISED LOOKS IN RETURN — MAYBE THEY WERE EXPECTING SOMETHING ON MASH TECHNIQUES, YEAST MANAGEMENT OR SANITATION. BUT ANY ENGINEER CAN TELL YOU THAT YOU CAN'T REALLY CONTROL A PROCESS WITHOUT INCORPORATING A FEEDBACK LOOP. BREWING ISN'T ANY DIFFERENT. IF YOU THINK ABOUT THE PROCESS OF PRODUCING TASTY BEER, CRITICAL STRUCTURED TASTING (AKA "JUDGING") PROVIDES JUST THE RIGHT INFORMATION TO MAKE SUBSEQUENT CORRECTIONS (AKA "BREWING BETTER BEER").

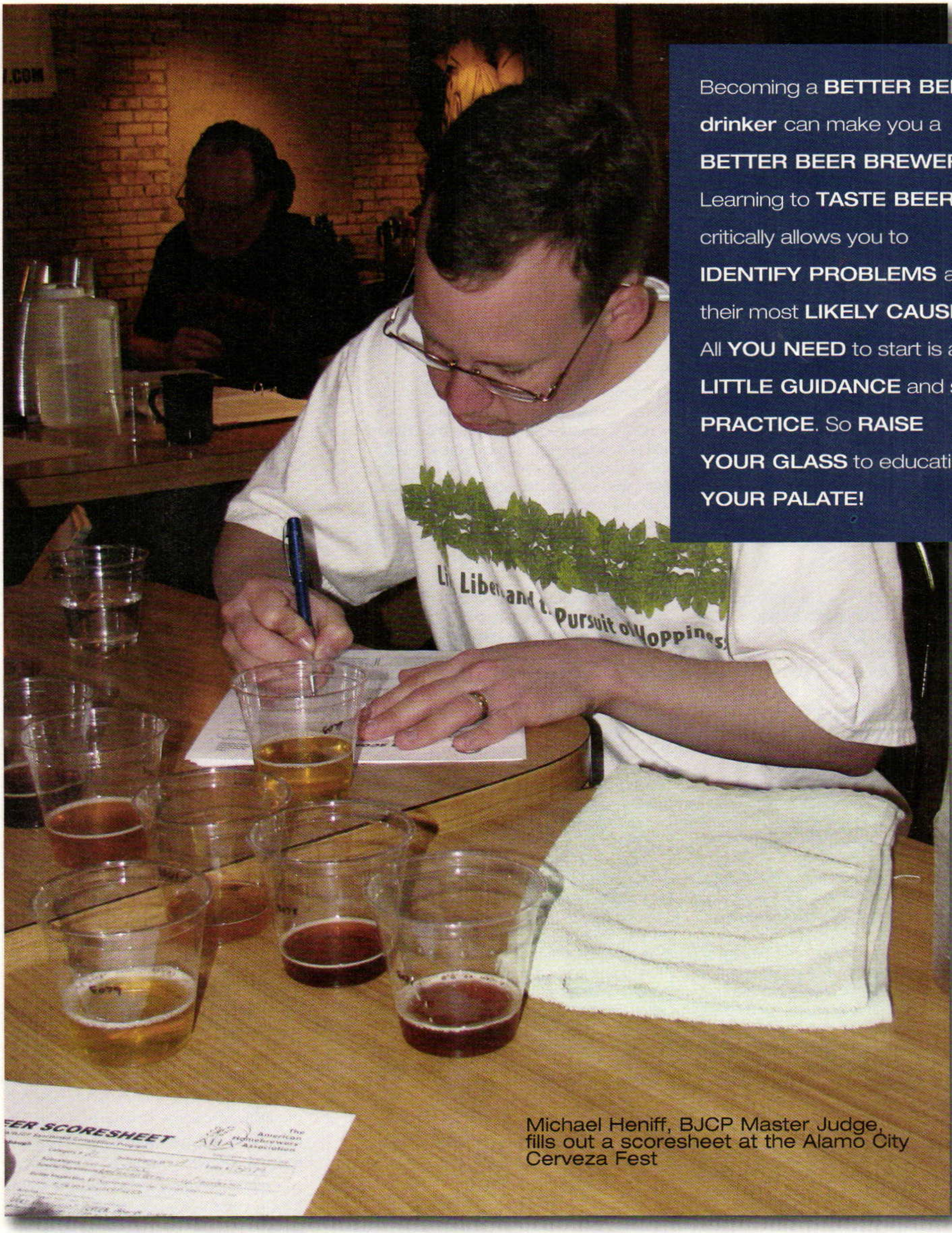
PERCEPTION IS REALITY

You don't have to be a Beer Judge Certification Program (BJCP) judge to properly assess a beer. The training, study, and practice all help, but I know many excellent judges who have never taken the exam. However, these judges know how to perform structured tastings of beer. That is, they can completely, thoroughly, and accurately describe the major perceptual characteristics (aroma, flavor, appearance, mouthfeel) of a beer. This is the most important aspect of judging, and one that many novices gloss over in their quest to identify faults, discuss beer styles and hypothesize about potential corrections.

First things first — to judge a beer, you have to understand and be able to articulate what you are tasting! Brewers entering a competition want this information first. If they are advanced brewers (or professionals), chances are this is the only feedback they want. Yet this is scary for many new judges, since they don't always have the trained palate or the vocabulary to describe what they are sensing. I recommend that judges in training start with the checklist version of the BJCP scoresheet (found at www.bjcp.org/docs/Beer_checklist.pdf), since it lists much more detail about all of the possible sensory characteristics.


Photo by Bev Blackwood

Becoming a **BETTER BEER drinker** can make you a **BETTER BEER BREWER**. Learning to **TASTE BEER** critically allows you to **IDENTIFY PROBLEMS** and their most **LIKELY CAUSE**. All **YOU NEED** to start is a **LITTLE GUIDANCE** and some **PRACTICE**. So **RAISE YOUR GLASS** to educating **YOUR PALATE!**



Michael Heniff, BJCP Master Judge, fills out a scoresheet at the Alamo City Cerveza Fest

Photo by Bev Blackwood

Common Beer Faults

Here are some of the faults most frequently seen in beers submitted to homebrew contests, and their most likely causes:

Acetaldehyde — Acetaldehyde is a precursor to ethanol in beer yeast's fermentation pathway. It lends a green-apple-like aroma to beer. Running a healthy fermentation and letting beer condition sufficiently will eliminate any excess acetaldehyde.

Astringency — Astringency is a dry, puckering mouthfeel of the same type as found in many teas, some red wines and when eating tannic fruits (such as chokecherry). In very astringent beers, it can also have a rough or sandpaper-like feel on the tongue. It is often confused with bitterness. Astringency is caused by tannins, a large group of polyphenols found in plants. Problematic levels of tannins can be extracted from malted grains by excessive sparging, or sparging at temperatures over 170 °F (77 °C), especially near the end of lautering. Very dark malts and highly-roasted grains yield more tannins than lighter malts. Any other plant material added during the boil, including hops or other spices, can contribute astringency.

Contamination — Contaminating microorganisms can cause a variety of off flavors, aromas and mouthfeels. Common contamination-related faults include flavors and aromas that are tart/sour, plastic/Band-Aid-like, butterscotch/buttery (see diacetyl below), medicinal, vegetal and vinegar-like. Some of these faults can be caused by other things as well. Although there are a number of different bacteria and yeast that can contaminate wort or beer, the corrective measure is the same in all cases — clean your brewing equipment and environment thoroughly and sanitize any piece of brewing equipment that will come in contact with chilled wort or beer. Likewise, do not repitch yeast following a contaminated batch.

Diacetyl — At moderate levels, diacetyl tastes and smells like butterscotch. It also contributes a slick, coating mouthfeel. At high levels, it strongly resembles butter. (Diacetyl is the main ingredient in the butter flavoring used on popcorn.) At low levels, it can be confused with caramel flavors. Most beer drinkers describe beers without diacetyl as being "cleaner" than those containing diacetyl and it is considered a fault in most beers. Diacetyl is produced by yeast — and, if present, some contaminating microorganisms — during fermentation. In late fermentation, it is taken up by the yeast. Contamination or prematurely separating the beer from the yeast in the primary fermenter are two common causes of excess diacetyl. In some lagers, the fermentation temperature is raised to ale-like temperatures near the end of fermentation. It is held there until sampling indicates that the diacetyl level has fallen below the level of perception. This is called a diacetyl rest. Aerating your wort during primary fermentation will increase diacetyl production.

DMS — Dimethyl sulfide (DMS) lends a cooked corn flavor to beer. It is primarily caused by a weak boil or slow wort cooling, especially when a large amount of very pale malts are used.

Higher alcohols — Higher alcohols (also called fusel alcohols or fusel oils) are alcohol molecules with more carbon atoms than ethanol, a 2-carbon alcohol. Higher alcohols lend a "hot" alcoholic, solvent-like character to beer, which can be reminiscent of nail polish remover. The primary cause of excessive higher alcohols in a beer are high fermentation temperatures or yeast that struggles to complete a fermentation. Strong beers are more prone to developing this fault, especially when not adequately pitched with healthy yeast. Some yeast strains produce more higher alcohols under stress than others.

Oxidation — Oxidation causes stale flavors and aromas in beer that resemble paper or cardboard. It can also cause Sherry-like flavors, especially in strong beers. Any exposure to oxygen after the beer has been fermented sets the stage for oxidative flavors and aromas to develop. Splashing of beer when racking to bottles or kegs is a common cause. Eventually, all beers will show signs of oxidation. Storing beers cold will prolong the amount of time they remain fresh.

When evaluating a beer, follow the same general order as the sections on BJCP scoresheets: Aroma, Appearance, Flavor and Mouthfeel. These categories guide you through the entire sensory experience of evaluating a beer. Within each category, look at the sensory aspects listed under each section. Ask yourself whether the beer contains that attribute or not, and if so, in what intensity. I like to think about the sensory characteristics in the order I perceive them, rather than how they are listed on the scoresheet. If you were describing the beer to someone, you would want to list the most intense characteristics first, since those are the dominant flavors and aromas. Use the checklist scoresheet to check your thoroughness — get used to looking for all those flavors and aromas, even if they aren't present.

Once you can identify if a perceptual component (say, malt or hops) is present and in what intensity, then you can get down to the business of describing it in more detail. This is where the additional adjectives come into play on the scoresheet. For example, is the malt grainy, bready, toasty, caramelly, roasty or just richly malty? Are the hops citrusy, piney, earthy, floral, spicy or grassy? Remember that beer can be made of many ingredients, and each lends its own character to the beer. You can describe a beer with multiple adjectives, if they all apply. An imperial stout will have more than just a roasty malt character — it will be quite a bit more complex. Describe all that you perceive.

Those are the essentials of structured tasting. Repeat the process for each section of the scoresheet, describing what you perceive in the beer. Once you get enough practice using this process, you don't have to use the checklist scoresheet — you can simply take structured tasting notes. I often use a small pocket notebook for this purpose, but any medium that captures your thoughts will work.

As with any new skill, the amount of practice you put in will have a measurable effect on how well you perform. Get into the habit of doing a structured evaluation every time you taste a beer. You don't have to write it down; you can do it mentally, if you remember the process and the steps. This is what I often do if I'm at a bar, or drinking in a social setting. Take a few sips and run through the process. I can do a quick evaluation in less than 30 seconds and then get back to the fun of drinking. A more thorough check will take a few minutes. It's the mental exercise that counts, not how you write it down. If you do this exercise with other beer geeks, you can turn all that talking about beer into practice.

FINDING FAULT

So far, we've focused mostly on the positive sensory aspects of beers — those attributes that can be considered desirable or features of some styles. There is another class of perceptions that don't belong in beer — these are faults, or potential errors to correct. Faults can be broken into two major groups: technical faults and style faults. Technical faults are generally derived from brewing, fermentation or storage mistakes, while style faults are often balance-related.

Before we delve into specific faults, know that some faults are temporary while others are permanent. Temporary faults will sometimes go away on their own, or can be coerced to go away, while permanent faults often lead to dumping your beer. Be careful about writing off a batch of beer, unless you know a fault is unrecoverable. If a beer is too bitter, too roasty, too estery or too alcoholic, those features tend to fade with time, so simple aging under proper storage conditions will likely mellow those faults. Sour, medicinal, or oxidized flavors are usually there to stay — toss those.

Dealing with faults in a beer is similar to how a doctor treats an illness. You start with the symptoms, form a diagnosis of the problem and then you prescribe treatment for the underlying problem. Anybody can "tell you where it hurts," but a doctor goes to medical school to understand how to identify the important symptoms, understand what condition this represents and then decide what to do about it.

Fortunately, fixing a beer is much less complicated than healing a person, but knowledge and experience still are required. As the brewer, you have some inside information that will help; you know the ingredients and process used. If you can combine that with your sensory skills and knowledge of common faults, you are well on the way to solving your brewing problems.

The BJCP publishes a list of common beer faults, along with potential solutions, at www.bjcp.org/docs/Beer_faults.pdf. The faults are described using their perceptual characteristics; simply use structured evaluation to isolate the faults and then reference the fault list to help determine cause-and-effect. A complicating factor is that some faults can come from several different sources. Consider the most likely causes of faults rather than those that are rare, and look for multiple clues towards the underlying problems.

One problem with identifying faults and problems with beer is that some faults are confused with seemingly positive features. For example, if you detect caramel and fruitiness, you could be drinking an English beer, or you could be sensing early forms of oxidation. Heavy caramel (especially kettle caramelization) is sometimes confused with diacetyl. Be careful about jumping prematurely to conclusions.

Some balance-related faults are temperature-dependent. If you serve a bitter beer too cold, it will seem even more bitter since the balancing malt is suppressed. Warming it up might bring it into balance. Warm temperatures can exaggerate the impression of esters, alcohols and other volatile aromatics. Try to assess the beer at proper serving temperature for the beer style in question.

You can simplify the diagnosis by leveraging your knowledge as the brewer. For example, if you know the fermentation was sluggish or that the target gravity wasn't met, use that to prune the possible choices for the faults you detected. If you think the problem is ingredient-related, do you have any other beers made with the same ingredients? Do they have problems too? Think likewise regarding process. What are the common elements between different batches? Think of this as the "medical history" part of the investigation. If you made recent changes or have a recurring problem, see if that can lead you to the source.

MATTERS OF ASSESSMENT

Sensory training is mostly a function of practice. The more you do it, the better you get. However, there is another dimension to judging that requires more study and knowledge — understanding beer styles and how well a beer matches them. Admittedly, this is more important to some brewers than others. Those who enter competitions will likely be fairly fanatical about beer styles, while many professional brewers act as if they could care less about them.

Beer styles are a convenient shorthand for describing beers. They set a common frame of reference between brewers and drinkers, and allow for similar beers to be compared. Unless you like being completely surprised, it's common to ask what you're drinking before you taste it. That lets you get into the proper mindset to enjoy a particular beer. For judges and critical tasters, it's even more important. You develop a mental picture of what you are tasting so you can immediately begin looking for the key characteristics of the style.

Once the perceptual components of a beer have been described and any technical flaws identified, a judge must then compare the sample beer against some common standard. The BJCP publishes style guidelines for use in homebrew competitions, and these are what most beer evaluators will use as their primary reference. They don't cover all the world's beer styles, but they do describe the most popular ones. Other sources can be used, but a judge does need some kind of standard against which to compare the beer. If the brewer is attempting to clone a specific commercial beer, the reference beer itself is the standard. If the brewer is creating a new type of beer, it still should be described in sufficient detail to understand if the standard was met.

Regardless of the reference used, you need to understand the essentials of the style you are brewing or tasting. Style guidelines can contain a wealth of information, but it's easy to get lost in all the detail and miss the big picture. You should be able to describe any beer style in a paragraph, touching on the main required points that define the style and separate it from others. Often this is simply the overall balance of the beer and the major flavor impression. Don't worry about specific style parameters as much; you are trying to hit the key style characteristics.

Think about what best defines the beer style in question, and evaluate your beer against those aspects. You can get many small points correct, but if you miss any of the major defining characteristics, then the beer won't seem right. Again, it's more important to get the impression correct than the measured parameters. An IPA should be a bitter beer, not simply one measuring more than 50 IBUs. The impression of bitterness is affected by the intensity of the malt and other flavors, the amount of body, and the overall attenuation of the beer. When all those factors are considered, the impression needs to be one of bitterness, because that's how the beer will be judged.

I think that the balance is probably the most important point to get right. But balance is a misunderstood word, since it implies an absolute balance. In beer judging, balance is always relative to the target style. A balanced IPA is very different than a balanced Scotch ale. A malty beer needs enough bitterness so that it doesn't seem cloyingly sweet, while a hoppy beer needs enough malt so that it doesn't seem harsh. Understanding what constitutes a balanced beer in the specific style is the key to brewing a good example. The rest is mostly choosing the right malt, hop and yeast varieties to get the right flavor profile.

NO BEER LEFT BEHIND

Your goal in critical tasting of your own beer is to identify gaps between what you have and what you want. These differences are what you need to focus on when adjusting your beer. The first changes you should make are the ones that hit key stylistic elements of the beer — those important attributes that define the style. Worry about the lesser changes later.

I like to record tasting notes along with the recipe so that I can see what changes to make next time I brew it. If a flavor element is off, I think about the cause-and-effect of ingredient selection. Should I use a different variety of malt, hops or yeast? Should I vary the percentage of some element? Knowing what flavors are produced by the different source ingredients is very helpful when making these adjustments. Some of this is learned by trial-and-error, which is another reason for keeping detailed tasting notes of all your beers. Quiz other brewers when you note a flavor you like, asking them what ingredients produced that outcome.

One technique I use when figuring out what changes to make with a future batch of beer is blending. If I think a beer needs more bitterness, I'll add a little bit of an IPA or other strongly-hopped beer. If that works, I'll note it in the recipe log and try adding more hops in the next batch. This works with just about any flavor component. You can blend on a small scale (in a glass not a keg), so you can keep trying different proportions. If you find something you like, scale it up. This is a fast way to try out ideas without having to rebrew. It's an experiment, and not all experiments work out. That's OK — you're still learning something.

FINAL THOUGHTS

When judging your own beer with an eye towards improving your brewing, it's most important that you be objective and honest with yourself. It's often difficult to judge your own work, but you have to set aside those feelings and put yourself in the shoes of a dispassionate judge in a competition or a consumer at a bar. Judge your beer as you judge other beers. Practice is an important part of building and maintaining any skill. While self-study is helpful, you also need to periodically check your skills against others so you know that you have learned them well. In matters of perception, you need to know that you haven't got a perceptual blind spot (for example, not detecting diacetyl) or other bias that may affect your judging. For your tasting notes to be useful to you, you have to be able to trust them.

When performing structured tastings of your beer, take good notes. You will want to record a full evaluation at least once, and then make notes on how the beer changes over time or how it tastes under different serving conditions. You are developing a profile of your beer that you will use as a reference. If you make changes, you will want to compare your current version against previous incarnations.

Use the feedback wisely, whether your own or from others. Be careful about making too many adjustments at once. You need to be able to gauge the impact of your changes. If you are fine-tuning a beer, you probably should only make one change at a time. If you are quite far away from your target or have multiple problems, feel free to make more changes.

Finally, know why you are brewing. Are you trying to brew better beer for yourself, are you trying to win competitions or do you simply want to have something you're proud to share with others? Keep in mind that judging and tasting are subjective, and that you won't always please everyone. As long as you are happy with yourself, you are getting the right enjoyment out of brewing. BYO

Gordon Strong is President of the Beer Judge Certification Program (BJCP).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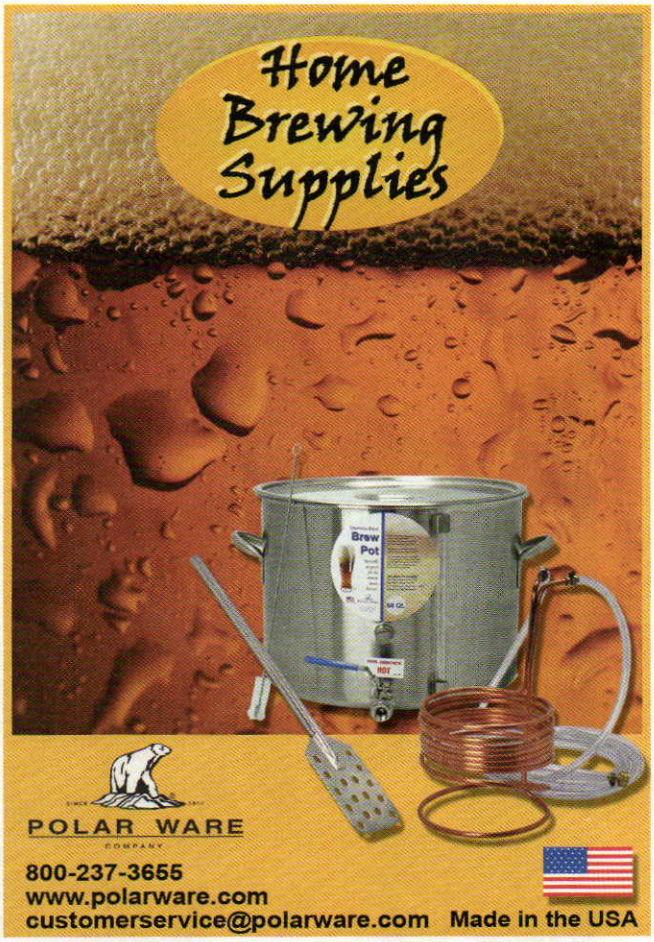
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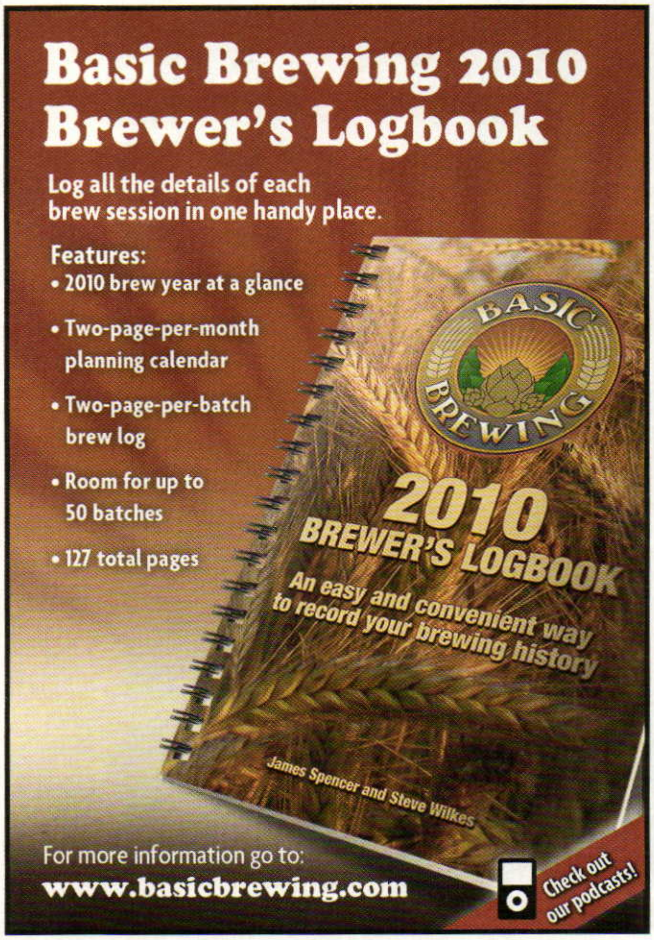
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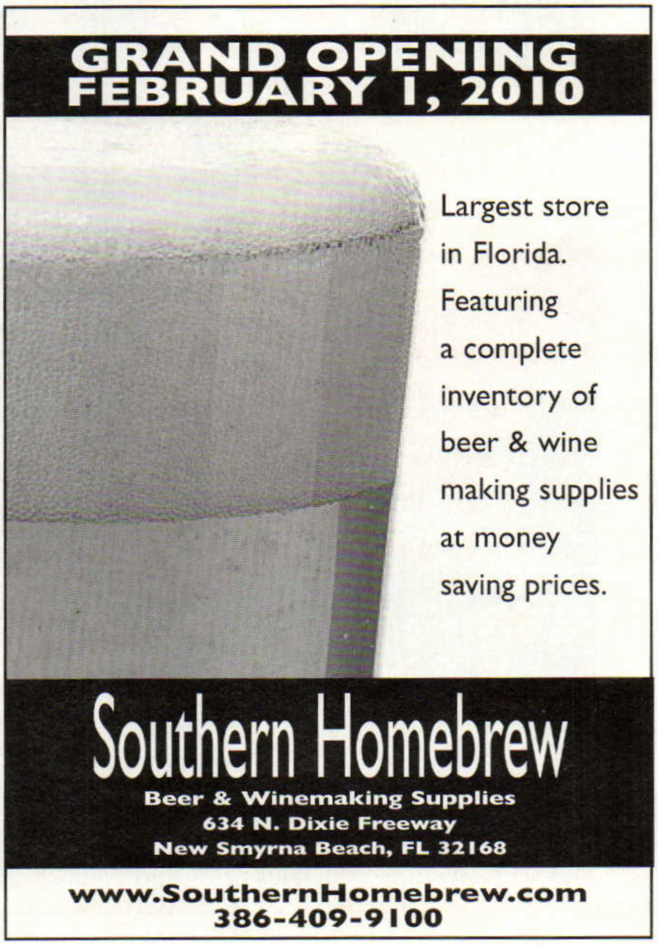
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by **GLENN BURNSILVER**

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BICYCLE BEER CLONES

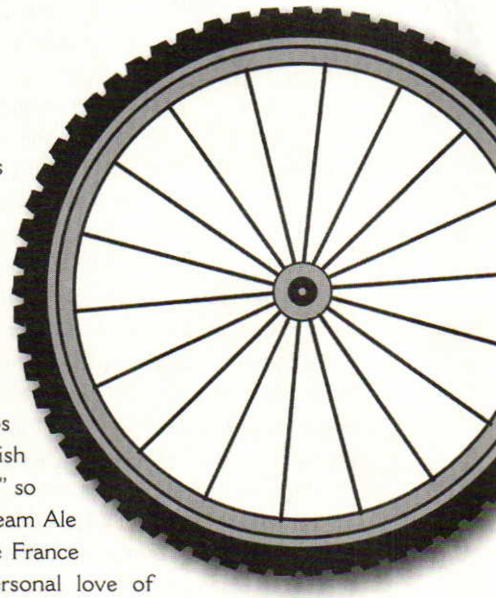
SIX RECIPES TO MAKE YOUR BREWING PEDAL-POWERED

SCAN THE SHELVES at your favorite craft beer retailer and the odds are good that scattered among the various images of monks, animals, snowflakes and palm trees, a bike or two will pop out. Bikes have been appearing on beer labels since the early 1900s, mainly in Europe where cycling draws high passion.

In the United States, the pairing of bikes and beer on labels and at pubs is a relatively newer phenomenon, especially considering the craft brew industry (as currently defined) only reaches back a few decades. Bikes may have appeared on labels earlier — entirely possible since there were literally thousands of small breweries in the States up until Prohibition — but little evidence of these labels was found in an extensive Internet search.

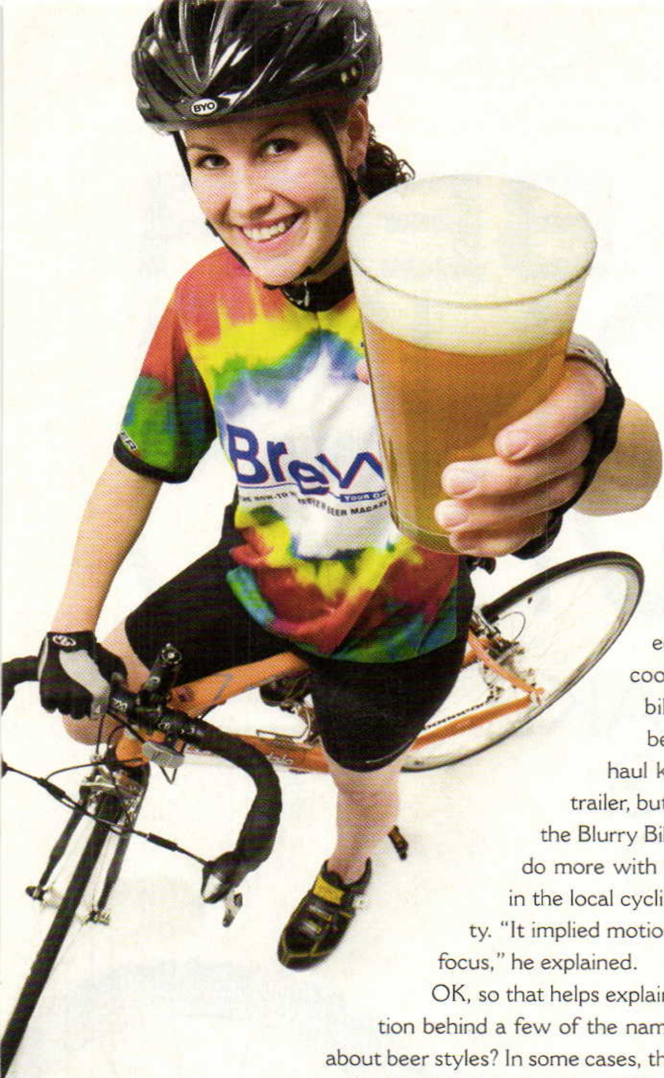
When the first bike labels appeared in Europe, it was to target a specific group of beer drinkers — cyclists. Radler (which also means cyclist in German) was the popular brew, a wheat beer mixed with lemon-lime soda. Today, brewmasters and pub owners are attracted to bicycles not because of sales potential (though certainly that doesn't hurt), but because cycling is such a big part of their culture or the local community culture where they are based.

In mountainous Boulder, Colorado, for example, Singletrack Copper Ale with its mountain biker on the label fits perfectly in a community jammed with mountain bikers and outdoor recreationalists who can relate to the image. Just up the road in Fort Collins, Fat Tire Amber Ale, adorned with a vintage cruiser bike, reflects the flat, wide streets of the town, but also founder Jeff Lebesch's love of cycling, and the facts that he 1) conceived of his brewery idea while on a Belgian bike tour, and 2) he delivered his earliest creations to stores on his beloved bike.



Others, such as Matt Phillips, owner of Phillips Brewery in Victoria, British Columbia, "grew up a roadie," so the label of his Slipstream Cream Ale — modeled after old Tour de France posters — reflects that personal love of cycling. Similarly, Charles Finkel, founder of Pike Brewing in Seattle, is a regular cyclist. With his wife on the back, the pair ride their tandem to the brewery most clear days. His beer: Tandem Double Ale.

Other brewers fall somewhere in between. Squatters Full Suspension Pale Ale is the creation of brewmaster and former bike racer Jennifer Talley. She purchased a Titus mountain bike frame and it was delivered to the brewery in Salt Lake City. All week while developing a new pale ale recipe, that full-suspension frame was on her mind. In cyclist-friendly Columbus, Ohio, Barley's Brewing Company's Ale House #1 Head Brewer Angelo Signorino



grew up cycling with his dad (who bungie-corded a beer-filled cooler to his bike) and has been known to haul kegs in a kid's trailer, but his vision for the Blurry Bike IPA had to do more with what he saw in the local cycling community. "It implied motion, not lack of focus," he explained.

OK, so that helps explain the motivation behind a few of the names, but what about beer styles? In some cases, the connection is clear. Well, in the case of Blurry Bike IPA, less so. "We don't filter our IPA, so that could certainly be perceived as 'blurry,'" Signorino adds.

Talley explained that the aggressive mountain bike motif also represents the edginess of Full Suspension.

"When I designed Full Suspension, we had a pretty mild pale ale at the time. Not a lot of hops or hop character. So I wanted to make a very hop forward pale with ample hop bitterness, flavor and aroma. I guess you could say (it is) hop aggressive, and mountain biking is a pretty aggressive sport at times, especially if you are flying down a rocky trail at rocket speed," Talley says.

Boulder Beer Company President Jeff Brown's sentiments are similar: "Back in the mid-90s, when we developed the recipe, it pushed the envelope of style guidelines a bit, much the same way screaming down a singletrack pushes your bike handling."

Pike's Tandem is a double in two ways. Besides being a two-seater, it is also a Belgian dubbel, or double. Finkel's tandem, the one he rides, was even painted orange to match the beer.

Phillips says his cream ale is "as smooth as a pedal stroke," while New Belgium Brewery "Spokes Model" Bryan Simpson says Fat Tire is a fine balance of hop to malt, bitter to sweet. "Much like having to balance on a bicycle, this is a tricky thing to accomplish, but once you're there the payoff is remarkable." But at these breweries, bike culture is also an important part of the setting. All make beers with a bicycle motif or theme, but most support bike teams, Bike to Work events, sponsor cycling races, place extra bike racks out front, print bike jerseys, socks and hats, give out patch kits and much more. And all encourage employees to use pedal power over carbon emitting vehicles.

Brown says he rides about 10,000 miles per year, while his brewmaster David Zukerman commutes by bicycle "100 percent" to the brewery.

"If I were hiring an employee in the brewery, and had more than one equally qualified candidate, but one rode a bike to work and the others didn't . . . I don't think that would be discrimination," Signorino says.

"They're not an alternative form of transportation — they're an outstanding form of transportation," Simpson says of bicycles (Simpson in fact gave up cars altogether four years ago). Each year, New Belgium promotes the self-created Tour de Fat, a cycling festival of epic proportions. The event features, among other things, a bike parade around Fort Collins, and several years ago made the Guinness Book of World Records for the largest of its kind. (I was there, pedaling a green and cream 1955 Schwinn Starlet and pulling a trailer.)

"Riding bikes, like drinking craft beer, also makes a statement about individuality and lifestyle — a 'putting money where your mouth is' protest against a consumer culture that wastes huge quantities of fossil fuel driving to global grocers to purchases large quantities of innocuous, bland beers and sugary soft drinks. It is also a statement about quality over quantity," Finkel adds.

Now, maybe this article has been overlooking the obvious, bike riding leads to thirstiness, which needs quenching, and what better beverage to do that than beer?

"For me, beer is the ultimate electrolyte replenishment system. It is the perfect thing to charge the battery after a great ride," Phillips says.

"After I am done with a beautiful mountain bike ride through the cottonwoods, nothing really sounds better than a craft beer," Talley adds. "I guess it is my reward for a hard ride."

Signorino says, "While any number of beverages could relieve a parched throat, beer is an excellent choice."

OK, no need to be labor that assessment, but Phillips, perhaps, sums up the exquisite pairing of bikes and beers best:

"I see a lot of bikes parked in front of the brewery. I think that perhaps bikes may be for independent thinkers, just like craft beer. That this is one thing that is cool about bikes — they mean different things to different riders," he says. "I guess this isn't too different from beer."

Glenn BurnSilver is the Features Editor at the Fairbanks Daily News-Miner *in Fairbanks, Alaska and a regular feature contributor to* Brew Your Own. *He particularly enjoys homebrewing when it's -45 °F (-43 °C).*

BICYCLE clones

Singletrack Copper Ale clone
(5 gallons/19 L, all-grain)
OG = 1.052 FG = 1.012
IBU = 32 SRM = 13 ABV = 5.2%

"It is a medium-bodied ale, similar to an English-Style Pale Ale. A small amount of toasted rye is added to the malt in the mash tun, adding a dry, somewhat nutty flavor to the beer."—Jeff Brown

Ingredients
8.75 lb. (4.0 kg) 2-row domestic pale malt
1.0 lb. (0.45 kg) British crystal malt (50–60 °L)
0.50 lb. (0.23 kg) Briess Carapils® malt
0.75 lb. (0.34 kg) flaked rye
0.50 tsp. Irish moss (15 mins)
3.1 AAU Nugget hops (90 mins) (0.25 oz./7.1 g of 12.5% alpha acids)
4.5 AAU Tettnang hops (30 mins) (1.0 oz./28 g of 4.5% alpha acids)
5.6 AAU Tettnang hops (5 mins) (1.25 oz./35 g of 4.5% alpha acids)
American ale yeast (such as Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Fermentis Safale US-05 yeast
1 cup corn sugar (for priming)

Step by Step
Mill the pale, crystal and dextrin (Carapils) malt together, keep the rye separate. Mix the milled grains with 3.4 gallons (13 L) of 168 °F (76 °C) water treated with 1 teaspoon of gypsum. Mix the rye flakes into the top quarter of the mash to hydrate. Let mash rest, at 156 °F (69 °C), half an hour, or until starch conversion is complete. Recirculate until wort is clear then sparge to kettle with 4.5 gallons (17 L) of 170 °F (77 °C) sparge water. Collect 6.0 gallons (23 L) of wort, boil for 90 minutes and hop at times indicated in ingredient list. Chill and aerate wort in the fermenter and pitch a healthy slurry of American Ale yeast. (Note: If you can get 10 to 12 oz. of fresh yeast slurry from your local brewery or brewpub, fermentation will be quicker.) Ferment in primary at 70–73 °F (21–23 °C) and condition in secondary for 2 weeks at 32 to 38 °F (0.0–3.3 °C).

Singletrack Copper Ale clone
(5 gallons/19 L, extract with grains)
OG = 1.052 FG = 1.012
IBU = 32 SRM = 13 ABV = 5.2%

Ingredients
0.75 lb. (0.34 kg) 2-row pale malt
1.0 lb. (0.45 kg) British crystal malt (50–60 °L)
0.50 lb. (0.23 kg) Briess Carapils® malt
0.75 lb. (0.34 kg) flaked rye
1 lb. 14 oz. (0.85 kg) Briess Light dried malt extract
3.3 lb. (1.5 kg) Briess Light liquid malt extract (late addition)
0.50 tsp. Irish moss (15 mins)
3.1 AAU Nugget hops (90 mins) (0.25 oz./7.1 g of 12.5% alpha acids)
4.5 AAU Tettnang hops (30 mins) (1.0 oz./28 g of 4.5% alpha acids)
5.6 AAU Tettnang hops (5 mins) (1.25 oz./35 g of 4.5% alpha acids)
American ale yeast (such as Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Fermentis Safale US-05 yeast
1 cup corn sugar (for priming)

Step by Step
Steep crushed malts and rye flakes in 1.0 gallon (3.8 L) of water, Steep for 30 minutes at 156 °F (69 °C). Add water and dried malt extract to make 3.0 gallons (11 L) and bring to a boil. Boil for 60 minutes, adding hops and Irish moss at times indicated. Stir in liquid malt extract during final 15 minutes of the boil. Cool wort and transfer to fermenter. Add water to make 5.0 gallons (19 L), aerate wort and pitch yeast. Ferment in primary at 70 to 73 °F (21–23 °C) and condition in secondary for 2 weeks at 32 to 38 °F (0.0–3.3 °C).

Squatters Full Suspension clone
(5 gallons/19 L, all-grain)
OG = 1.044 FG = 1.013
IBU = 42 SRM = 11 ABV = 4.1%

"My only real direction was I wanted big hop presence. At 4% ABV, the bitterness is not over the top which makes it super drinkable. I guess you could call it a session pale ale."—Jennifer Talley

Ingredients

3.5 lb. (1.6 kg) Maris Otter pale ale malt
3.5 lb. (1.6 kg) 2-row pale malt
1.0 lb. (0.45 kg) Munich malt (10 °L)
1.0 lb. (0.45 kg) Carapils malt
6.0 oz. (0.17 kg) Simpsons crystal malt (50–60 °L)
2.4 AAU CTZ (Columbus, Tomahawk or Zeus) hops (50 mins) (0.15 oz./4.3 g of 16% alpha acids)
5.1 AAU CTZ hops (30 mins) (0.32 oz./9.1 g of 16% alpha acids)
6.6 AAU CTZ hops (15 mins) (0.41 oz./11 g of 16% alpha acids)
8.5 AAU CTZ hops (5 mins) (0.53 oz./15 g of 16% alpha acids)
0.44 oz (12.5 g) CTZ hops (dry hop)
ale yeast (your choice)
1 cup corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C). Boil for 60 minutes. Ferment at 68 °F (20 °C).

Squatters Full Suspension clone
(5 gallons/19 L, extract with grains)
OG = 1.044 FG = 1.013
IBU = 42 SRM = 10 ABV = 4.0%

Ingredients

1.0 lb. (0.45 kg) Munich malt (10 °L)
1.0 lb. (0.45 kg) Carapils malt
6.0 oz. (0.17 kg) Simpsons crystal malt (50–60 °L)
1 lb. 5 oz. (0.60 kg) Muntons Light dried malt extract
3.3 lb. (1.5 kg) Muntons Light liquid malt extract (late addition)
2.4 AAU CTZ (Columbus, Tomahawk or Zeus) hops (50 mins) (0.15 oz./4.3 g of 16% alpha acids)
5.1 AAU CTZ hops (30 mins) (0.32 oz./9.1 g of 16% alpha acids)
6.6 AAU CTZ hops (15 mins) (0.41 oz./11 g of 16% alpha acids)
8.5 AAU CTZ hops (5 mins) (0.53 oz./15 g of 16% alpha acids)
0.44 oz (12.5 g) CTZ hops (dry hop)
ale yeast (your choice)
1 cup corn sugar (for priming)

Step by Step

Steep crushed grains at 152 °F (67 °C) in 3.0 qt. (2.8 L) of water for 45 minutes. Add water to make 3.0 gallons (11 L), add dried malt extract and bring to a boil. Boil wort for 60 minutes, adding hops at times indicated. Stir in liquid malt extract during final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water, aerate and pitch yeast. Ferment at 68 °F (20 °C).

Fat Tire Amber Ale clone
(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.013
IBU = 20 SRM = 14 ABV = 4.8%

"People get biscuity, bread-like flavors off the malts and there's just enough hops to linger on the palate and set you up nicely for that next sip."—Bryan Simpson

Ingredients

8 lb. 10 oz. (3.9 kg) 2-row pale malt
0.50 lb. (0.23 kg) Munich malt
0.50 lb. (0.23 kg) Carapils malt
0.50 lb. (0.23 kg) crystal malt (20° L)
6.0 oz. (170 g) biscuit malt
1.0 oz. (28 g) chocolate malt
4 AAU Willamette hops (90 mins) (0.80 oz./22 g at 5% alpha acid)
2 AAU Fuggle hops (20 mins) (0.40 oz./11 g at 5% alpha acid)
2 AAU Fuggle pellet hops (0 mins) (0.40 oz./11 g at 5% alpha acid)
1 tsp. Irish moss (15 mins)
Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast (1.25 qts./~1.25 L yeast starter)
0.75 cup corn sugar (for priming)

Step by Step

Mash at 154 °F (68 °C) for 45 minutes. Sparge with hot water of 170 °F (77 °C) or higher to collect 6.0 gallons (23 L) of wort. Add 0.5 gallons (1.9 L) of water and boil for 90 minutes, adding hops at times indicated in ingredient list. Ferment at 68 °F (20 °C) until complete (usually 7–10 days).

Fat Tire Amber Ale clone
(5 gallons/19 L, extract with grains)
OG = 1.050 FG = 1.013
IBU = 20 SRM = 14 ABV = 4.8%

Ingredients

2 lb. 3 oz. (1.0 kg) Coopers Light dried malt extract
3.3 lbs. (1.5 kg) Coopers Light liquid malt extract (late addition)
0.50 lb. (0.23 kg) Munich malt
0.50 lb. (0.23 kg) Carapils malt
0.50 lb. (0.23 kg) crystal malt (20° L)
6.0 oz. (170 g) biscuit malt
1.0 oz. (28 g) chocolate malt
4.3 AAU Willamette hops (60 mins) (0.80 oz./22 g at 5% alpha acids)
2 AAU Fuggle hops (20 mins) (0.40 oz./11 g at 5% alpha acids)
2 AAU Fuggle hops (0 mins) (0.40 oz./11 g at 5% alpha acids)
1 tsp. Irish moss (15 mins)
Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast (1.25 qts./~1.25 L yeast starter)
0.75 cup corn sugar (for priming)

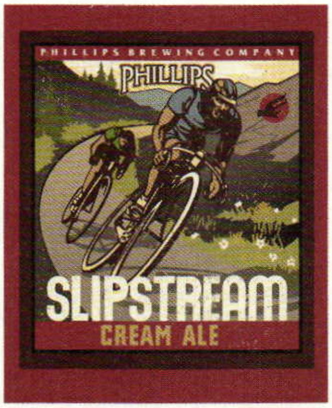
Step by Step

Place crushed malts in a nylon steeping bag and steep in 3.0 qts. (2.8 L) of water at 154 °F (68 °C) for 30 minutes. Rinse grains with 1.5 qts. (~1.5 L) of water at 170 °F (77 °C). Add water to make 3.0 gallons (11 L), stir in dried malt extract and bring to a boil. Boil for 60 minutes, adding hops at times indicated in ingredient list. Add the liquid malt extract and Irish moss with 15 minutes left in the boil. Cool brewpot in sink, with the lid on, until the side of the brewpot no longer feels warm. Transfer wort to fermenter and top up to 5.0 gallons (19 L) with cool water. Aerate wort and pitch yeast. Ferment at 68 °F (20 °C) until complete, then transfer to secondary, or rack into bottles or keg with corn sugar. (The low amount of priming sugar is meant to mimic the low carbonation level of Fat Tire.) Lay the beer down for at least a few weeks to mellow and mature for best results.

Slipstream Cream Ale clone

(5 gallons/19 L, all-grain)

OG = 1.044 FG = 1.011
IBU = 16 SRM = 14 ABV = 4.3%



"A cream ale in British Columbia is a different animal. If we are going to be honest about it, it is a cross between a mild and brown ale. Really big nutty and caramel flavors, in a medium-bodied beer."—Matt Phillips

Ingredients

8.75 lb. (4.0 kg) 2-row pale malt
0.33 lb. (0.15 kg) crystal malt (60 °L)
2.0 oz. (57 g) chocolate malt
3.8 AAU Magnum hops (60 mins)
  (0.27 oz./7.6 g
  of 14% alpha acids)
1.4 AAU Cascade hops (10 mins)
  (0.27 oz./7.6 g
  of 5% alpha acids)
London ale yeast (such as Wyeast 1968 (London ESB), White Labs WLP002 (British Ale) or Fermentis Safale S-04 yeast)
1 cup corn sugar (for priming)

Step by Step

Mash at 154 °F (68 °C) for an hour, run off and boil for 60 minutes, adding hops at times indicated in the ingredient list. Ferrment at 68 °F (20 °C) with a London ale type yeast.

Slipstream Cream Ale clone

(5 gallons/19 L, extract with grains)
OG = 1.044 FG = 1.011
IBU = 16 SRM = 15 ABV = 4.3%

Ingredients

1.5 lb. (0.68 kg) 2-row pale malt
0.33 lb. (0.15 kg) crystal malt (60 °L)
2.0 oz. (57 g) chocolate malt
1.5 lb. (0.68 kg) Muntons Light dried malt extract
3.3 lb. (1.5 kg) Muntons Light liquid malt extract (late addition)
3.8 AAU Magnum hops (60 mins) (0.27 oz./7.6 g of 14% alpha acids)
1.4 AAU Cascade hops (10 mins) (0.27 oz./7.6 g of 5% alpha acids)
London ale yeast (such as Wyeast 1968 (London ESB), White Labs WLP002 (British Ale) or Fermentis Safale S-04 yeast)
1 cup corn sugar (for priming)

Step by Step

Steep crushed grains at 154 °F (68 °C) in 3.0 qt. (2.8 L) of water for 45 minutes. Add water to make 3.0 gallons (11 L), add dried malt extract and bring to a boil. Boil wort for 60 minutes, adding hops at times indicated. Stir in liquid malt extract during final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water, aerate and pitch yeast. Ferment at 68 °F (20 °C).

Blurry Bike IPA clone

(5 gallons/19 L, all-grain)
OG = 1.058 FG = 1.015
IBU = 80+ SRM = 7 ABV = 5.6%

"Ride your bike to the local homebrew shop — it won't turn out the same otherwise!"—Angelo Signorino

Ingredients

11 lb. 10 oz. (5.3 kg) Muntons 2-row malt
0.50 lb. (0.23 kg) Briess crystal malt (20 °L)
0.50 oz. (14 g) Columbus hops (FWH)
21 AAU Columbus hops (45 mins) (1.5 oz./43 g of 14% alpha acids)
28 AAU Columbus hops (20 mins) (2.0 oz./57 g of 14% alpha acids)
2.0 oz. (57 g) Columbus hops (0 mins)
2.0 oz. (57 g) Columbus hops (dry hop)
British ale yeast (such as White Labs WLP005 (British Ale) yeast
1 cup corn sugar (for priming)

Step by Step

Infusion mash at 150 °F (66 °C) for 1 hour. Add first wort hops (FWH) during wort collection. Boil wort for 1 hour, adding remaining hops at times indicated. Ferment cooler than usual (lower 60s °F, 15–17 °C), but pitch with a healthy starter of British ale yeast (preferably procured from your local brewery, via bicycle). Dry hop (in the secondary fermenter) with a good couple ounces more of Columbus hops. Obviously, drink it up, make more, repeat . . .

Blurry Bike IPA clone

(5 gallons/19 L, extract with grains)
OG = 1.058 FG = 1.015
IBU = 80+ SRM = 8 ABV = 5.6%

Ingredients

1.5 lb. (0.68 kg) Muntons 2-row malt
0.50 lb. (0.23 kg) Briess crystal malt (20 °L)
3.0 lb. (1.4 kg) Briess Light dried malt extract
3.3 lb. (1.5 kg) Briess Light liquid malt extract (late addition)
0.50 oz. (14 g) Columbus hops (FWH)
21 AAU Columbus hops (45 mins) (1.5 oz./43 g of 14% alpha acids)
28 AAU Columbus hops (20 mins) (2.0 oz./57 g of 14% alpha acids)
2.0 oz. (57 g) Columbus hops (0 mins)
2.0 oz. (57 g) Columbus hops (dry hop)
British ale yeast (such as White Labs WLP005 (British Ale) yeast
1 cup corn sugar (for priming)

Step by Step

Steep crushed grains at 150 °F (66 °C) in 3.0 qt. (2.8 L) of water for 45 minutes. Add water to make 3.0 gallons (11 L), add dried malt extract and first wort hops and bring to a boil. Boil wort for 60 minutes, adding remaining hops at times indicated. Stir in liquid malt extract during final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water, aerate and pitch yeast. Ferment at 68 °F (20 °C).

Pike Tandem Ale clone

(5 gallons/19 L, all-grain)
OG = 1.066 FG = 1.010
IBU = 25 SRM = 28 ABV = 7.2%

"I'd recommend about 6 or 7 coriander seeds be crushed and added for the last minute of boil. Although this may seem like a miniscule amount, a touch of coriander is all that is desired." —Drew Cluley, head brewer

Ingredients

6.5 lb. (3.0 kg) American 2-row malt
3.0 lb. (1.4 kg) British pale malt
1.0 lb. (0.45 kg) wheat malt
1.0 lb. (0.45 kg) American Munich malt
1.2 lb. (0.54 kg) crystal malt (70–80 °L)
4.0 oz. (113 g) roasted barley
8.0 oz. (227 g) cane sugar (20 mins)
4.5 AAU Northern Brewer hops (75 mins) (0.5 oz./14 g of 9% alpha acids)
2.3 AAU Mt Hood hops (30 mins) (0.5 oz./14 g of 4.5% alpha acids)
2.3 AAU Mt Hood hops (15 mins) (0.5 oz./14 g of 4.5% alpha acids)
White Labs WLP530 (Trappist Ale) yeast
1 cup corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C) for 1 hour. Boil for 90 minutes, adding hops at times indicated. Pitch with a Belgian Trappist Yeast. At Pike we use White Labs WLP530. We control the fermentation pitching at 72 °F (22 °C) and not allowing the beer to get above 74 °F (23 °C). High temperature fermentation will produce a more phenolic Belgian style beer.

Pike Tandem Ale clone

(5 gallons/19 L, partial mash)

OG = 1.066 FG = 1.010
IBU = 25 SRM = 31
ABV = 7.2%

Ingredients

- 1.0 lb. (0.45 kg) American Munich malt
- 1.2 lb. (0.54 kg) crystal malt (70–80 °L)
- 4.0 oz. (113 g) roasted barley
- 2.75 lb. (1.3 kg) Muntons Light dried malt extract
- 4.0 lb. (1.8 kg) Muntons Light liquid malt extract (late addition)
- 8.0 oz. (227 g) cane sugar (20 mins)
- 4.5 AAU Northern Brewer hops (75 mins) (0.5 oz./14 g of 9% alpha acids)
- 2.3 AAU Mt Hood hops (30 mins) (0.5 oz./14 g of 4.5% alpha acids)
- 2.3 AAU Mt Hood hops (15 mins) (0.5 oz./14 g of 4.5% alpha acids)
- White Labs WLP530 (Trappist Ale) yeast
- 1 cup corn sugar (for priming)

Step by Step

Steep crushed grains at 152 °F (67 °C) in 3.0 qt. (2.8 L) of water for 45 minutes. Add water to make 3.0 gallons (11 L), add dried malt extract and bring to a boil. Boil wort for 60 minutes, adding hops and sugar at times indicated. Stir in liquid malt extract during final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L), aerate and pitch yeast. Ferment at 72 °F (22 °C). BYO

Story and photos by **CHRIS COLBY**

CONDITIONED MILLING

The basic process of brewing beer is the same whether beer is brewed commercially or at home. However, differences in scale and equipment have lead to numerous small differences between commercial and home brewing. In homebrewing, malt is almost always crushed dry, using a two-roller mill. In larger commercial breweries, four, five or six-roller mills may be employed and sometimes the malt is wetted before it is milled.

In an older form of wet milling, little practiced in the US, the malt was sprayed with 86–122 °F (30–50 °C) water for 15–30 minutes prior to milling. During this process, the water content of the malt increased to about 30%. The wet grain was then put through a two-roller mill with a narrow gap (compared to that used for dry milling). The wet husks were split and the pasty interior of the grain squeezed out.

Wet milling reduced the possibility of a grain dust explosion in the brewery. In addition, the larger husk pieces made for a more porous grain bed, which allowed brewers to increase their lautering speed and have fewer husk pieces in the run off wort. If the lautering speed was not increased too much, wet milling resulted in higher extraction effi-

Steaming your uncrushed malt can be done easily in a heatable lauter tun with a false bottom. This treatment makes the husks more pliable.

Conditioned (steamed) malt on the left vs. dried malt on the right, after crushing. Note the larger, nearly intact husks in the conditioned malt. These husks, however, are empty.

ciency. Likewise, because the husks were left mostly intact, tannin extraction was decreased.

This form of wet milling can't be done at home — not easily, at least — but there are variations on wet milling that can. In these methods, the malt is exposed to steam or hot water for a short period of time, just long enough for the husks to absorb some moisture.

In conditioned dry milling, malt is exposed to steam or sprayed with 86–95 °F (30–35 °C) water for 1–2 minutes prior to milling. Due to this treatment, the moisture content of the husks rises by a couple percentage points, but the moisture level of the interior of the grain remains basically unchanged. In steep conditioning, the malt is sprayed with water at 140–158 °F (60–70 °C) for 50–60 seconds prior to milling. The hotter water results in faster water uptake by the husks, which reach up to 22% water by the end of the steep.

If you are an advanced all-grain brewer who has had problems with small husk particles, astringency or slow runoff when using finely-crushed malt, you may want to experiment with conditioning your malt. There are a couple ways you can approach this.

Conditioning with Steam

To wet your malt with steam, you'll need a large steeping bag and a heatable lauter tun with a false bottom. Add water to your lauter tun until it is just below the level of the false bottom and bring it to a strong boil. Place your (uncrushed) malt in the steeping bag and lower the bag into the lauter tun. Over the next minute or two, steam from the boiling water will be forced up through the grains. If you like, you can take your mash paddle and stir the malt a couple times while it is being steamed. This isn't necessary, however. Put a lid on the vessel when you are not stirring. After the steaming period, lift the bag out, stir the malt briefly and then begin milling.

Conditioning with Hot Water

To wet your malt with hot water, you will need essentially the same set-up as with steam conditioning, but your lauter tun does not need to be heatable. You will also need a way to spray or sprinkle the water over the grain. For example, heat your water to 158 °F (70 °C) and fill a watering can. Sprinkle water over the malt for 50–60 seconds. Let the excess water drain into the space below the false bottom. (Leave the valve on the vessel open.) If you have a brewing partner, he or she should stir the malt as you pour the water. When you're done, lift the bag out and stir the malt to even out the moisture. Let the malt sit for a minute or two, then crush it. The excess water can be added to your mash.

Practical Considerations

Applying too little water is greatly preferable to applying too much. In the worst case scenario with too little water, your grain will simply be dry, as it usually is. In contrast, if too much water is added, starch flour and excess water can form a sticky paste that is hard to clean and could potentially gum up your rollers.

The main idea is to wet the husks, but leave the center of the grain dry. So, be sure to mill your grain right after conditioning it, while the water is still confined to the outer layer of the kernel. If you steam or spray your malt, but delay crushing it, the water will diffuse more evenly throughout the grain. Letting the malt rest for a few minutes between conditioning and crushing is not going to lead to problems, but this isn't something that you should do the night before and then crush in the morning.

After conditioning, your grain should not seem dry, but it shouldn't be dripping wet, either. If some of the kernels stick together, stir the malt and let it sit for a minute or two. The grain should not be so wet that the rollers on your malt get gummed up with flour. If this does happen, small amounts of sticky flour can be removed by running some dried grain through the mill. The larger husk particle size will result in a more porous grain bed, and the same weight in malt will occupy more volume.

A malt mill is one of the larger expenditures for an all-grain brewer. As such, you may be leery of trying to condition your malt, for fear you will gum it up or rust your rollers. If you condition your malt properly, this shouldn't be an issue. If you have any expired malt lying around, try one of the above procedures and crush a small amount of it to see how it works.

The first few times you try this technique, mill some dried malt at the same gap setting for comparison. Compare the two samples of crushed malt and look for larger husk particles in the conditioned malt. Also, take good notes during your brewday and calculate your extract efficiency. Finally, compare beers made from dry milling and wet milling. Use this information to determine if you feel conditioned milling is worth the time and effort. BYO

Chris Colby is Editor of Brew Your Own.

Story and photos by **BEV BLACKWOOD**

WHAT I LEARNED FROM SAINT ARNOLD

PROFESSIONAL IDEAS FOR AMATEUR BREWERS

Saint Arnold (b. 580, d. 640) is the Patron Saint of Brewing. In his lifetime, he was known for encouraging local peasants to drink beer instead of water (as water sources were frequently contaminated in those days). These days, Saint Arnold lends his name to a microbrewery (b. 1994) in Houston, Texas. I have a long history with Saint Arnold brewery. I have known the owner since college and was the first volunteer for the weekly Saturday tour, eventually giving the tours myself. I have even become Saint Arnold, immortalized as the bobblehead (shown right) before I finally joined the staff, first as a Brewer and then as the Brewery Production Manager. Saint Arnold sponsors a wide range of activities that promote our hobby and has long offered their facilities (including the walk-in cooler) for judging The Dixie Cup, which is the Foam Rangers annual competition. In this article, I'll relate some of the things Saint Arnold taught me and how they can be employed at the homebrewing scale.

A Homebrewer Goes Commercial

Size matters, as they say. Yet the processes used in making beer really aren't that different between the homebrewer and the professionals. It's more about the size and complexity of the equipment you're using. Even so, bigger and better equipment doesn't guarantee good beer or even consistent beer. You have to have processes in place to compensate for the variables which affect your final product.

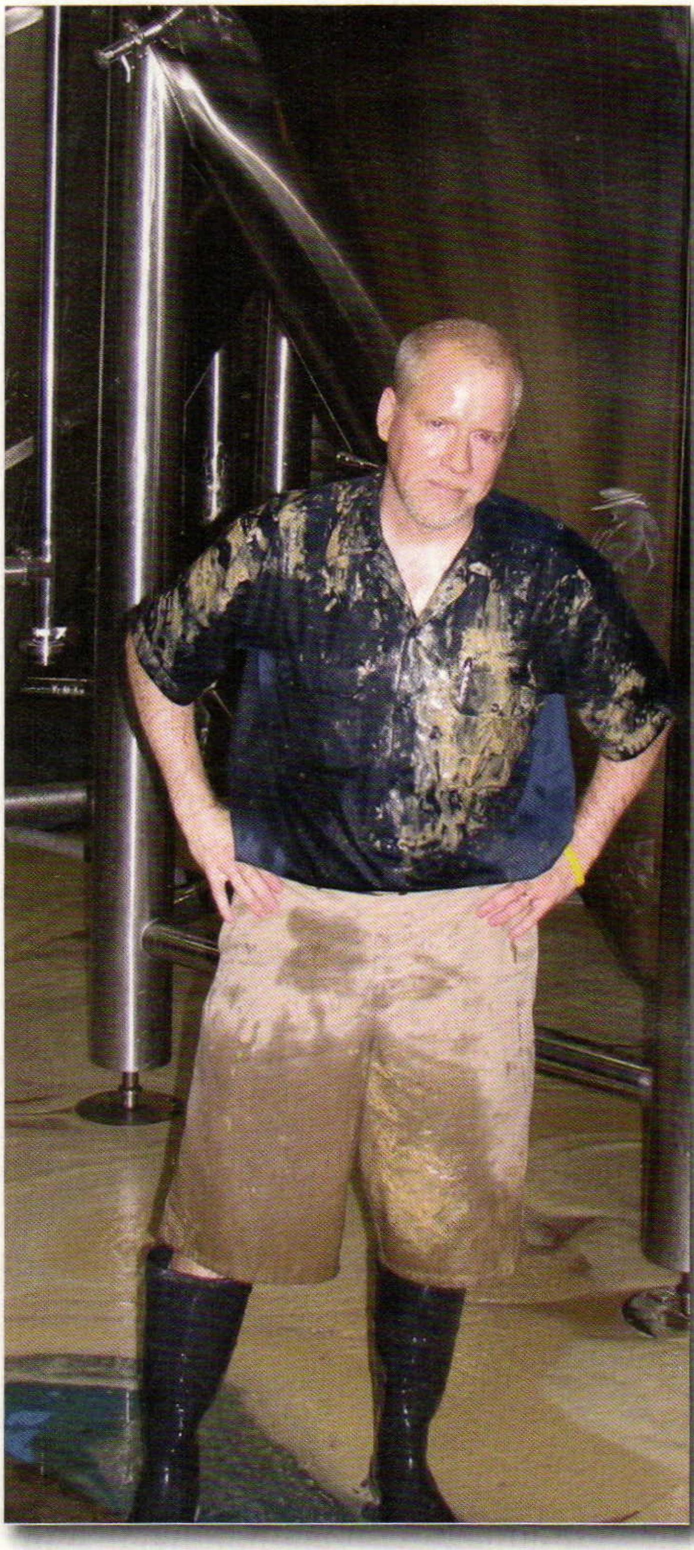
That was my greatest lesson learned in transitioning from a homebrewer to a professional. There's no magical wand that you use to ensure quality and consistency, it's all about the processes you use to create the exact same product every single time.

Coming from a homebrewing environment, where each batch had its own character, the notion of reproducing the same beers every day to the same exact specifications seemed almost impossible. Indeed, my own attempts at brewing the same beer twice were often thwarted by varying ingredients, gravities and alpha acid levels. What was a homebrewer to do?

My former boss, and owner of Saint Arnold, Brock Wagner, at times described the 30-barrel DME system at the heart of the brewery as a "glorified homebrewing rig." (Note: DME here refers to name of the company that fabricated the brewhouse vessels, not the commonly used homebrew acronym for dried malt extract.) Indeed, any homebrewer would instantly recognize the two vessel system as analogous to an all-grain homebrew system. Grain was ground and augured into the mash tun, allowed to steep, sparged and transferred to a kettle and then chilled as it was run off to the fermenter where yeast was waiting to do its work. What could be simpler?

The real key to producing consistent wort is to compensate for the variables you get in every mash. Grist quality will vary based on kernel sizes and composition. Efficiency will vary based on how loose or thick your mash is. Conversion will vary based on how accurately you hit your strike temperature. The alpha acid levels in your hops will vary year to year, even with the same varieties. One way the pros correct for these variables is to use a volumetric system of wort production. When you get down to it, all of the nuances of making wort boils down to getting the right concentrations of sugars and isomerized alpha acids every time. The beginning homebrewer follows that exact model when brewing with malt extract. A given volume of malt syrup and water should yield a wort at a given specific gravity.

For a commercial brewer (or all-grain homebrewer), however, the same amount of malt in the same amount of water doesn't yield a wort with the same gravity time after time. Even if you have calculated your average extract efficiency, every batch is a little bit different. In order to hit their expected original gravity dead on, the brewers at Saint Arnold do the following. They begin with a 30-barrel formulation of the recipe they are brewing. However, they know ahead of time that their average extract efficiency is higher than the formulation uses. In other words, they expect to collect enough extract to brew more than 30 barrels. After runoff, they measure the volume of wort collected and its specific gravity. Later, as the boil nears the end, they add boiling water to adjust their volume upwards and arrive at the exact starting gravity of the beer.



The author got down and dirty in pursuit of brewing wisdom working at Saint Arnold Brewing Company in Houston, Texas.

Applying that basic concept to the homebrew scale is simple. What we want to do is determine how successful our mash was by taking an initial gravity reading when the boil begins. It is essential that this gravity reading be taken quickly and accurately, so a glass cylinder is used for the hydrometer and it is quickly cooled to the appropriate temperature for the most accurate reading. If the reading is delayed, concentration of the wort will have already begun, giving a false starting point. Using that initial value, we then determine a final volume to achieve the desired gravity. After that you compensate for evaporation (remember it is based on the initial gravity, not the post-boil gravity) and arrive at a volume driven value that informs your hop level correction, if any.

The initial equation (equation 1) looks like this:

End of Boil Volume (V_2) = [Initial Gravity (G_1) x Initial Volume (V_1)]/ Target Gravity (G_2)

where the two terms for volume can be expressed in gallons or liters, as long as you are consistent, and the gravity terms are in gravity points (the three decimal points after the one in your specific gravity; for example, SG 1.045 equals 45 gravity points)

The volume correction equation (equation 2) looks like this:

Volume Correction (for hop additions) = [End of Boil Volume + Evaporation – Batch Constant]/Batch Constant

So what, pray tell is a batch constant? This is the batch size you planned for, albeit knowing that your actual yield will likely require you to make a volume adjustment. The evaporation term is the volume of wort evaporated during the boil.

At Saint Arnold, the company goal is to deliver over sixty barrels of beer for packaging every time they brew. To accomplish this, they brew two thirty-barrel batches to fill a sixty-barrel fermenter. Consider for a moment what that means. Starting with kettle loss (trub and hops) then yeast loss after fermentation and finally filtration loss, there may be several barrels in a sixty barrel batch that are lost in standard production.

The same is true for homebrewing, but on a smaller scale. Most homebrewers simply aim for five and a half gallons (21 L) of wort to get a five-gallon (19-L) batch. So the goal has to be something larger than what you intend to finish with. In the case of Saint Arnold, that's part of the difference between making money and losing it.

The key is to be intimately familiar with your kettle. You should know exactly how much liquid is in it at any given time. The brewery has a nice engraved scale (pictured at left) which hangs in

It is important to know the amount of wort in your kettle. One simple solution for measuing this is to calibrate a dip stick. Do this by pouring in measured amounts of water (a gallon or one or more liters) of water, marking the stick and repeating until the vessel is full.

the kettle that is easily read. My ten-gallon brew pot has a stainless steel spoon with engraved level marks on it that are calibrated to that specific pot. The finer the resolution of the marks, the easier it will be for you to accurately dilute (or concentrate) your wort to the desired strength.

So let's run through an example. Assume a batch constant (BC) size of 5.5 gallons. Saint Arnold's Amber has a target gravity (G_2) of 1.0545. Now let's say that our initial runoff volume (V_1) is 6.5 gallons at an initial (pre-boil) gravity (G_1) of 1.056. (In other words, we have more wort, at a higher gravity, than our target.) Thus, to calculate our end of boil volume (V_2):

$$V_2 = [G_1(V_1)]/G_2 = (6.5 \text{ gallons} \times 56)/54.5 = 6.68 \text{ gallons}$$

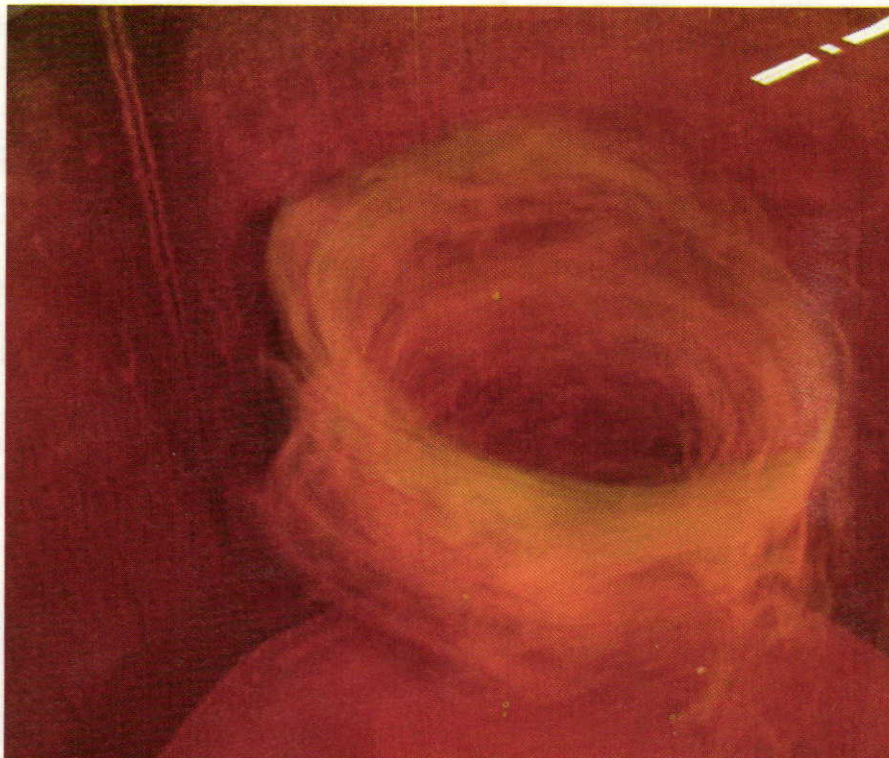
So, at the end of the boil, we will need to add enough boiling water to bring our volume up to 6.68 gallons. How much water we need to add depends on how much volume is lost during the boil. (You can see how a properly calibrated scale will come in handy, although I think it's possible to "eyeball" and come pretty darn close.) Kettle evaporation for a 90-minute boil at sea level is about 10% of the volume (according to Dave Miller's "Homebrewing Guide"), so 0.65 gallons will evaporate.

Knowing the volume that will evaporate will also allow us to adjust our hop amounts as per equation 2 :

$$VC_H = (6.68 \text{ gallons} + 0.65 \text{ gallons} - 5.5 \text{ gallons})/5.5 \text{ gallons} = 0.33$$

What that means is that your alpha acids need to be about ⅓ greater (remember your calculated final volume is larger than your batch constant) to achieve the same hopping level as the original. Multiplying the hop levels by 1.33 will give you the correct level. (Given that most homebrewers have brewing software, the hop calculation could also easily be done by simply changing the batch size in the software, and adjusting the hop amounts to reach the target IBU value. Multiplying the amount of each hop addition by the ratio of the new volume divided by the original volume will get you there.)

Of course, the amount of bitterness in a beer depends not only on the amount of hops added, but their alpha acid levels, and these differ between different seasons and



Above: The author cleaning the mash tun at Saint Arnold Brewing Co.

Below: Professional brewers use chemical sanitizers, such as the iodophor solution swirling in this tank, just as homebrewers do. However, many also use wet heat — from steam or hot solutions — for sanitizing hard to reach places.

crops. The Cascade hops in the Saint Arnold recipe were at 6.0% alpha acid in 2008, while the 2009 crop is at 7.5%. One way to correct for differences in alpha acid levels is:

Old Alpha / New Alpha = Alpha Correction
in this case $6 / 7.5 = .8$

So you can get the same alpha acid levels by using 80% as much of the new crop. That will be combined with the 1.33 correction required by the volume of wort. So overall, we have:

Original weight x Alpha Correction x Volume Correction

or $1 \times .8 \times 1.33 = 1.064$

It is important to note that you need only to adjust for alpha in hops that are providing bitterness. Flavor, aroma and dry hops still need to have the volume adjustment made. (And again, another option is to use brewing software, if you have it, to do this calculation.)

Having made all the required adjustments, only one remains to be executed, adjusting the final volume. Ideally this is done with near boiling water right at the end of the boil, so that you can boil a few moments, add your zero minute hops and proceed to chill. If you have been tracking your liquid level on your scale, then it's a simple matter to measure out the required volume and add it at the right time. With practice, a good brewer can hit within a point or less of target gravity every time.

Water and Yeast Nutrition

Of course, once you have your wort, you still have to ferment it. At Saint Arnold there is a reverse osmosis system that reduces water to its bare bones, but of course bones aren't exactly what you look for when it's time for a meal. Yeast need nutrients and reverse osmosis water has many of these nutrients removed. Interestingly enough, regular tap water has a lot of what yeast needs. What you don't need is the chlorine that comes with it. A simple charcoal filter will take care of the chlorine. The solution applied at the brewery was to set up a blend of mostly reverse osmosis water with charcoal filtered city water mixed straight in. Of course, every city's chemistry varies, so your mileage may vary. One thing is for certain though, reverse osmosis and distilled water lack the desired level of micronutrients that allow yeast to thrive. Beyond that, water salts can be adjusted to suit whatever you're brewing. Just don't use "bare bones" water.

Sanitation — Feel the Heat

Even with healthy and vital yeast, competitive strains of bacteria aren't what any brewer wants for his wort, which leads me to another "pro" level method of ensuring an organism-free environment, heat (in the form of hot liquid or steam). The most significant benefit of heat is that it penetrates surfaces, even scratches, fittings or gaskets that might harbor stray bacteria. Of course, using heat on a homebrewing scale can be dangerous. Glass carboys can break, plastic can melt and you can scald yourself if you are not careful. It is ideally used with stainless steel vessels, but can be used with extreme care on other materials.

Conclusion

Most of professional brewing remains the common sense methods good homebrewers use. The difference is process, everyone in the brewhouse doing the same things, the same way and achieving the same results. That process allows you to reproduce the same results, the same way every time. While it sounds rather boring, consider the implications. Once you know how to produce the same beer, the same way, every time, you have total creative control over your products. You can alter one variable at a time to bring about new creative visions. I recently had the privilege to interview Tomme Arthur of Port Brewing Company and his Lost Abbey series of beers exemplify that mentality. From a warehouse brewery like Saint Arnold's old facility they are starting to catalogue the intricacies of barrel maturation so that it can become a consistent part of the brewer's toolkit.

My own time in the brewhouse was both the most stressful job I ever have held, but also the most fun. Meeting the exacting standards requires skill. Meeting the rigors of lifting, climbing and cleaning requires physical endurance. Meeting the people who enjoy the beer is pure joy. BYO

Bev D. Blackwood II is a member of Houston's Foam Rangers.

Dry Hopping

The means and methods for success

by Terry Foster

If there is one characteristic that stands out in US craft and homebrewing it is the constant quest to introduce yet more hop flavor and aroma into beer. Common practices are additions of hops during the boil (continually in the case of Dogfish 60-minute and 90-minute for example), at the end of the boil, and passing the hot wort through a hop-back containing fresh hops. Dogfish Head's Sam Calagione even invented the Randall (see Tony Profera's similar project in *BYO* November 2008), so beer can be served by drawing through a packed column of fresh hops. And then there's dry hopping.

But there is nothing new about dry hopping, for it is a technique that has been employed in Europe since not long after hops were added to beer. We think of hops as being a source of various flavors and aromas, but their main appeal to brewers, for many centuries, was their preservative power when added during boiling. Once this became obvious to the brewer, the next step was to add a handful or two of fresh hops as the cask was bunged down for storage in the cellar. Eventually, someone realized that this added something to the flavor of the beer and they started to dry-hop for flavor rather than for preserving the beer. This became common practice in England even when the beer was no longer stored for any length of time, and the dry hops were added to the cask as it was shipped out to the pub. I've seen one or two publicans with hops in their hair when they carelessly broached an unusually lively beer! And have you ever wondered where the idea of "hop plugs" came from? They were made that way so that it was easy for the cellar man to stuff the dry hops into the cask as he was racking the beer.

A little science

But why should we consider dry hopping you ask? Isn't late hopping just as effective and less work for the homebrewer? Well, here we come down to chemistry, and what it is in hops that give us all those wonderful flavors and aromas. Bitterness, as we all know, comes from the alpha acids contained in the hop resins, but flavor and aroma come from the hop essential oils. The chemistry of the oils is quite complex, and the flavor effects of different constituents are not completely understood. Without getting too complicated, hop oils are made up of two fractions, hydrocarbons and oxygenated compounds. The former, of which the principal constituents are humulene, myrcene and caryophyllene, are all very volatile in steam, and consequently are not present in wort when the hops are added during the boil, and will likely be completely removed if added to hot wort as a "late addition."

The oxygenated fraction, which includes geraniol and linalool, substances both thought to give floral characters to the beer, are much less volatile than the hydrocarbons, and at least some proportion will survive a late boil addition. These compounds are thought to be the main source of hop aroma when added in this way, but can also undergo further reactions during fermentation. The broad result of this is that although it is possible to get significant aroma and flavor by late- or post-boil hopping (which is why many of us practice it), this flavor and aroma will come from only a part of the hop oil. In particular, the aroma will be different from that from the raw hop cone itself.

In the case of dry hopping, we are trying to remedy this by adding the hops at a point where very little of the original constituents of the oil are lost or changed. In other words, done effectively, dry hopping is going to give a flavor and aroma unlike that of late hopping, and an aroma closer to that of the hop prior to processing. In short, it is a process that is going to give us a quite different effect from that obtained by other hopping methods. It gives us a different colored thread to weave into the tapestry of the flavor/aroma spectrum of our beers.

Dry hopping is not a substitute for late kettle hopping, but a different method giving different results. However, it is not always easy for the homebrewer to get much hop flavor out of late hopping

> "Dry hopping is not a substitute for late kettle hopping . . ."

Dry hopping can add extra hop aromas and flavors to any beer that can not be achieved through regular or late-addition hopping techniques.

because of the volatility of the oils and the high surface-to-volume ratio in our small-scale equipment. On that basis, of course, the professional brewer has a distinct advantage for even a 7-barrel kettle (in most cases the smallest capacity kettle used in the industry) has something like thirty times less surface area per unit volume than the average kettle used by the homebrewer. Yet even the commercial system can result in significant loss of volatile oil components from late hop additions. That is because the hops sit in hot wort for some time before being cooled on the way to the fermenter. For example, at BruRm@BAR (in New Haven, Connecticut), we generally allow a 10-minute rest after knockout, followed by ten minutes whirlpooling, then a further 10-minute rest before running it through the wort chiller to the fermenter. Oil volatiles may be lost in this time, and also during the time it takes to complete the pump-over, which generally takes 40–45 minutes.

If you use an immersion coil to cool the wort, you might be tempted to think that you could get good results by making your aroma hops addition to the cooled wort. It might seem that this an effective way to dry hop the beer, without the possible inconvenience of doing so in the fermenter or the keg. Not so, first because most of the volatiles will be scrubbed out by the vigorous primary fermentation. Second, it takes a matter of days for the wort to take up a significant amount of oil, and you definitely do not want cooled wort sitting around that long before you add your yeast.

A little more science

The possibility of contaminating the beer by direct addition of hops may be a deterrent to some brewers. But hops appear to carry virtually nothing in the way of beer-spoilage organisms — remember they were first used in beer because of their antiseptic properties. Also, dry hopping in unpasteurized beers is very widely practiced without detrimental effects.

Another concern about dry hopping is adding more bitterness to the beer than you really want. Well, you are adding more alpha-acids, but in a beer at room temperature or less, no significant conversion of these will occur, so there will be no increase in IBU. But IBU is not all there is to perceived bitterness, so it is conceivable that a dry-hopped beer will taste a little more bitter than a similar beer that has not been treated in this way. In fact, Will Meyers of Cambridge Brewing Company offers a 4.5% ABV "Belgo-American Single"-style beer, which is not hopped in the boil, but is dry hopped with almost 1.5 lb. (0.68 kg) of hops per barrel. That works out to about 3 oz. (85 g) of hops per 5 gallons (19 L) of beer, much more than is normally used for this purpose, and the beer does indeed taste somewhat bitter, rather like a mildly-hopped pale ale. However, it is brewed with a Belgian yeast strain, which may very well have something to do with its unusual flavor.

When to dry hop

I think I have made it clear that dry hopping must be done after primary fermentation. This means that the hops must be added in the primary when fermentation has either ceased or is very gentle, with little CO_2 evolution occurring. Or, even better, during the secondary fermentation stage, especially if you are going to bottle the beer. If you are going to serve it on draught from a keg, then the hops can be added to the keg as the beer is racked into it. Professional brewers most commonly dry hop their beers either in the primary, or in the conditioning tanks prior to filtration. Dry hopping in kegs is more problematic because of the dispense system (read on for more information on this), but it can be accomplished in cask where dispense is via a beer engine, since the cask faucet incorporates a hop strainer, to prevent blockage in the lines.

At BruRm@BAR, we dry hop in the primary after about four to five days, when the specific gravity is about 4 degrees of SG (1 °P) above finishing gravity. We have to do this because we have no conditioning tanks. Beer goes straight from the primary to filtration and into the serving tanks in the pub. We try to allow seven to ten days after dry-hop addition before filtering, and five to ten days is a common time for this process. Todd Mott, of The Portsmouth Brewery in Portsmouth, New Hampshire (also a brewpub) likes to allow at least seven days, while Mitch Steele of Stone Brewing Company finds five to seven days most suitable (see *BYO*, December 2008). Steele also thinks that the less yeast in suspension the better, as yeast can adsorb much of the oil on its surface. All these brewers agree that dry hopping is best done in

> "Professional brewers most commonly dry hop their beers either in the primary, or in the conditioning tanks prior to filtration."

"warm" beer, that is, beer that is at around fermentation temperatures of 60–65 °F (15.6–18.3 °C).

For the homebrewer, I would recommend dry hopping in the secondary, or in the keg, as adding such hops in the primary in the late stages of fermentation is generally impractical. In either case, you do not want to use loose hops as racking canes or dispense taps are likely to become clogged; even if you filter your beer line blockage is likely to be a problem. The simple technique of using a sanitized muslin or nylon bag works well. For best results the bag should be weighted down with a sanitized weight attached to it or inside it. I use a Teflon coated bar, which works very well and worth looking for, but I am not sure if these are still available on the homebrewing market. I dry hop in the keg, since I generally do not use a secondary fermenter, but this means that the hops can be in contact with the beer for a very short or a very long time depending upon how long it takes to drink the beer. In the case of addition in the secondary, you have better control on the residence time in the beer, which is important if you want to compare the effects of different varieties of hop. You can use either cone hops or pellets for dry hopping; the latter I consider better, simply because they are more homogeneous which makes for better extraction of the oil than is the case with cone hops.

Of course, whether you dry-hop or not depends upon the style of beer you are brewing. Mostly it is a technique used for bitter, pale ale, and IPA, rather than for dark beers, or beers where malt is meant to dominate the palate, such as Scotch ales or Bock beers. That does not mean you cannot try it with a dry stout if you so wish, only that the flavor and aroma is best appreciated in a pale, dry beer. And what variety of hop you use is up to you also; I very much like Amarillo in an IPA, others like Nugget, or Cascades, and so on. A single variety may be used, but it is quite common to use two or more varieties. For example, you may want to finish an English pale ale with Fuggles and Goldings, or an American IPA with Centennial and Columbus, or Amarillo and Fuggles (as we used at BAR for Hitting 70 IPA). Really there is no limit to the variations you can try — if the fresh hop smells good to you it will probably work well in dry hopping. And that is the golden rule about dry hopping — use the very freshest hops you can find! (For more hop suggestions, check out *BYO*'s online hop guide, which is searchable by beer style, at http://www.byo.com/resources/hops.)

Similarly, you have a lot of options available when it comes to the quantity of dry hops you use. It is probably best to limit the amount to 1 oz. (28 g) in 5 gallons (19 L) for beers starting below OG 1.050, 2-3 oz. (56–85 g) if the OG is 1.050–1.070, 3–4 oz. (85–113 g) for beers above OG 1.070. That will also depend upon the variety; you'll probably want to use more of your milder hops such as Goldings than you would of something more pungent, such as Cascades or Columbus. Let your nose (and your taste) be your guide!

Finally, remember that dry hopping produces an effect that cannot be achieved in other ways, so experimentation is a must. After all, as I pointed out earlier, this is a traditional technique, yet one that modern craft brewers have taken to another level. Dry hopping is an excellent means for adding something extra to what you thought was already perfect! BYO

Terry Foster was born in London and holds a PhD in chemistry from the University of London. He lives part of the year in the UK and the other in Connecticut where he brews at the BruRm@BAR brewpub in New Haven. He is 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. *Terry writes "Techniques" in every issue of* BYO.

Foam Collapse

The three factors that flatten foam

by Chris Bible

Foams are fundamentally unstable systems. Even the most stable head of foam will have a relatively short life. Three events within foam systems eventually lead to the overall collapse of the foam matrix, foam coarsening (redistribution of bubble sizes), bubble film thinning and bubble film rupture.

Foam coarsening

Over time, the distribution of bubble sizes within a foam system changes. As time passes, the number of larger bubbles present within the foam structure increases as shown in Figure 1 (page 56).

Redistribution of bubble sizes is caused by the dependence of the gas pressure within an individual bubble upon the curvature of the bubble walls. Smaller bubbles have higher curvature and higher internal pressure. Larger bubbles have lower curvature and lower internal pressure. Gas preferentially diffuses through the bubble film from smaller bubbles into larger bubbles because the gas pressure within the smaller bubbles is higher than the gas pressure within larger bubbles. This situation is shown in Figure 2 (page 56). The radius of the wall of the larger bubble is given by
r_1, the radius of the smaller bubble is given by r_2 and the radius of the area common to both bubbles (the partition area) is given by r_0.

Laplace's equation describes vapor pressure above a curved surface. It states that the pressure inside a curved surface is always greater than the pressure on the outside of a curved surface. From Laplace's equation, the internal pressure within the larger bubble is given by:

$$P_1 = P_a + \frac{4\gamma}{r_1}$$

And the pressure within the smaller bubble is given by:

$$P_2 = P_a + \frac{4\gamma}{r_2}$$

where:
P_1 = internal pressure (larger bubble)
P_2 = internal pressure (smaller bubble)
P_a = atmospheric pressure
r_1 = radius of the larger bubble
r_2 = radius of the smaller bubble
γ = liquid surface tension

Since $r_2 < r_1$, and all other terms on the right side of the equations are equal, $P_2 > P_1$. In general, the internal pressure difference (P) between the two bubbles is given by:

$$\Delta P = \gamma(1/r_1 + 1/r_2)$$

It is this difference in pressure that drives the flow of gas from the smaller bubbles into the larger bubbles. The rate of gas flow between bubbles ($dV_{1,2}/dt$) is proportional to the pressure difference between the bubbles, and to the total interfacial surface area between the bubbles:

$$\frac{dV_{1,2}}{dt} \propto A\Delta P$$

It is also this flow of gas that causes the foam system to be unable to ever achieve a stable equilibrium. To achieve a stable equilibrium, the septum between the two bubbles must be concave toward the smaller bubble, and its radius given by:

$$\frac{4\gamma}{r_0} = \frac{4\gamma}{r_2} - \frac{4\gamma}{r_1}$$

or upon rearrangement:

$$r_0 = r_1 r_2/(r_1 - r_2)$$

where:
r_1 = radius of the larger bubble
r_2 = radius of the smaller bubble
r_0 = radius of the partition area (the area common to both bubbles)

If this equilibrium could be achieved, it would remain stable as long as no gas was able to penetrate through the septum and move from one bubble to another. But the bubble films are not impermeable to gas flow, and the gas does move through the

> "this difference in pressure drives the flow of gas"

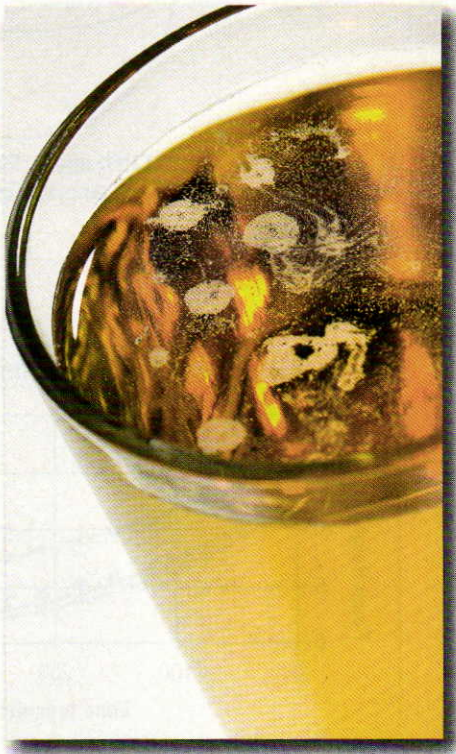


Photo by Charles A. Parker/Images Plus

All good things must come to an end. For foam, differential internal bubble pressures and gravity contribute to its collapse.

Figure 1

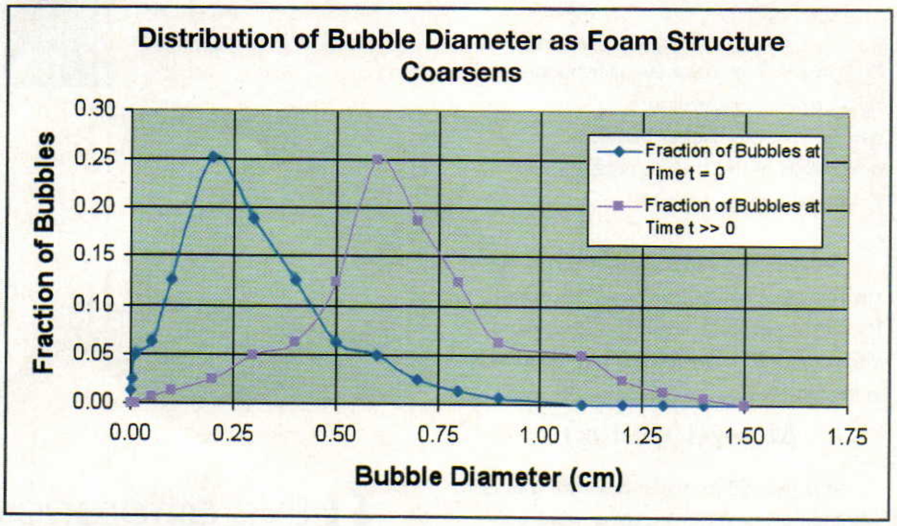
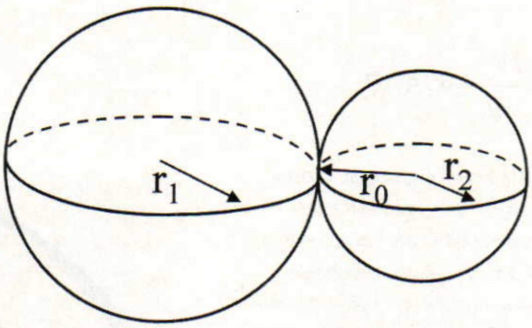
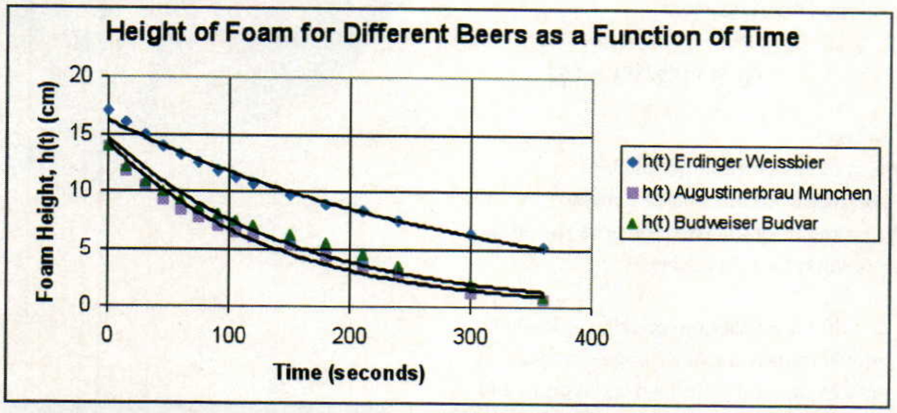


Figure 2



Gas Diffuses From Smaller Bubbles to Larger Bubbles In Foams

Figure 3



films from one bubble to another. Because of this, a stable equilibrium is never obtained for very long and the bubble systems within a foam structure evolve over time (see Figure 2).

Because bubble films are not impermeable, gas diffuses through the areas of bubble interface from the smaller bubble (the higher-pressure region) into the larger bubble (the lower-pressure region). Smaller bubbles shrink and larger bubbles grow. The foam system has an increasing fraction of larger bubbles as time passes. The foam structure "coarsens."

Film thinning and rupture

Foam coarsening leads to a thinning of the film between bubbles. This can be visualized by thinking of foam coarsening as a process that is similar to balloons being inflated. The bubbles within the foam structure are initially comprised of bubbles of gas that are surrounded by thin films of beer. As the bubbles become larger, the same initial beer film volume is forced to "stretch out" around the surface of an ever-increasing volume of gas. As the initial beer film volume is forced to cover an ever-increasing surface area, the thickness of the beer film decreases until it reaches a point where the film surface tension is no longer strong enough to contain the required volume of gas. The bubble ruptures or "pops" like an over-inflated balloon.

The rate at which this film-thinning due to coarsening occurs depends upon many factors. Coarsening rate is greatly affected by the combination of two or more gases of very different solubilities. The solubilitiy of carbon dioxide (CO_2) in water is approximately 50 times greater than the solubility of nitrogen (N_2) in water at a given temperature. There is also a similar difference in the permeability rates of thin films by these two gases. Beer films are much more permeable to CO_2 than to N_2. The total average permeability of a mixture of gases is equal to a fractional weighting of the permeability of both gases:

$$k_{avg}^{-1} = C_{CO2}k_{CO2}^{-1} + C_{N2}k_{N2}^{-1}$$

where:

k_{avg} = overall average permeability of the gas mixture

k_{CO2} = permeability of carbon dioxide (CO_2)
k_{N2} = permeability of nitrogen (N_2)
C_{CO2} = mole fraction of carbon dioxide present in the gas mixture
C_{N2} = mole fraction of nitrogen present in the gas mixture

This equation shows that the presence of a small amount of a relatively insoluble gas (in this case, nitrogen) in the mixture can significantly slow down the rate of foam coarsening by reducing the overall rate of gas transfer between bubbles.

Film thinning also happens as a result of gravitational force. The liquid in the beer film flows downward around the bubble surface due to the force of gravity. If we assume that the bubble system can be adequately approximated as a slit filled with liquid between two vertical walls, then the gravitational contribution to film thinning is described by:

$$\frac{dV}{dt} = \frac{g\rho_{\Delta}\omega\delta^3}{12\eta}$$

where:
dV/dt = the volumetric rate of liquid flowing down the bubble surface
g = acceleration due to gravity
ρ_{Δ} = the difference between the densities of the liquid and the gas in the foam system
η = the viscosity of the liquid
δ = bubble film thickness
ω = width of bubble film walls

Note that the viscosity term is in the denominator and is multiplied by a factor of twelve. Increasing beer viscosity decreases the rate at which the beer film drains from the bubble surface due to the influence of gravity.

When an individual bubble film thickness reaches a critical, minimum-required thickness, the bubble ruptures. The rate at which these individual ruptures occur within the foam structure varies depending upon many factors including the specific geometry of the bubble's interface with its neighbors, serving glass geometry, beer viscosity, beer temperature and all of the other factors described in last issue's installment of the column.

Head retention

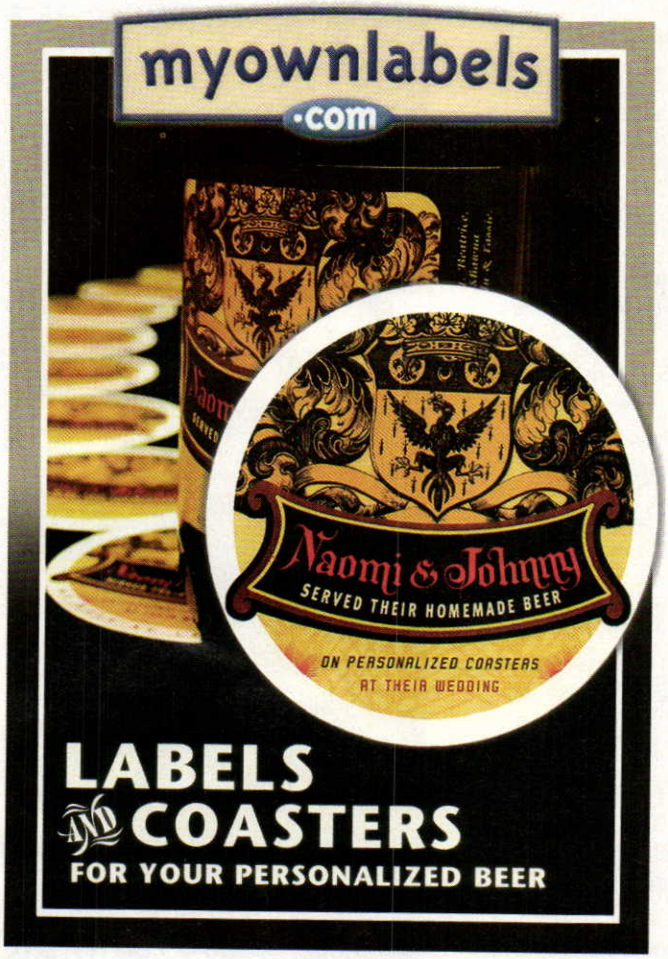
As brewers we are typically not as concerned with the rupture of an individual foam bubble as we are with the overall stability of the foam structure. Researchers have developed different models describing the decay and collapse of foam structures. It has been shown that, under ordinary conditions, the volume of beer foam present within a glass decays exponentially with time. Exponential decay theory predicts that foam height as a function of time is given by:

$$h(t) = h(0)e^{-(t/\tau)}$$

where:
h(t) = foam height at time = t
h(0) = initial foam height at time t = 0
t = time
τ = a constant that is specific to the foam system
e = a constant that is the base of natural logarithms (≈ 2.71828...)

During the time increment τ, a volume of foam equal to $1 - 1/e \approx 0.63$ = 63% of the original foam volume disappears. Figure 3 shows the rates of foam collapse for three commercially available beers. There are many physical and chemical variables that affect foam formation and head retention within beer, so it can be quite a challenge to make beer that has good head retention. A beer is often said to have "good head retention" if the foam generated by the initial pour of beer has a half-life of 60–90 seconds. BYO

Chris Bible is Brew Your Own*'s "Advanced Brewing" columnist.*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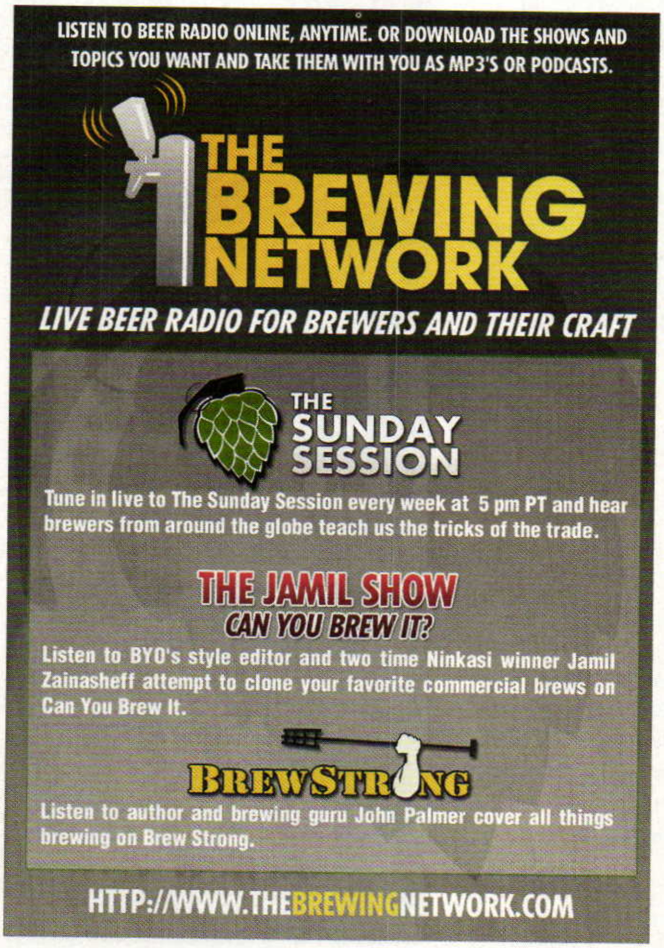
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Build A Tap Handle

Show off your homebrew labels

by Ken Lenard

Most of the homebrewers I know are very handy. They're tinkerers. They like to build, fix and improve things. I enjoy homebrewing very much, but I have to admit that I'm not very handy. So it is with great irony that I find myself writing an article about how to build something.

But even though I may not be handy, I also like the creativity that homebrewing allows. I like to formulate recipes, come up with catchy names for my beers (it helps me keep the various beers straight in my head) and create labels for my beers too. I don't really bottle much anymore, so I had a dilemma: where am I going to put a label? On a tap handle of course!

There are already many tap handles available for homebrewers to buy that will incorporate a label, but they seemed pricey to me, and often don't look terribly attractive. Therefore, I set out to find a way for an unhandy person to make some homemade tap handles.

Rather than draw out the plans and then amass the materials for the project, the design for these handles came to me just from browsing around my local hardware store. I knew that I wanted to make some handles, but I wasn't sure exactly what I would need until I got there. Because they ended up being so simple to make, I think it's possible that these handles can actually be made of anything that you have laying around the house or anything that you happen to find at your local hardware or building supply store. Be creative and make modifications to suit your own home bar.

I had this particular design in mind because I wanted to showcase my labels, which are rectangular. I found some oval-shaped pieces of wood that looked very cool, but the design would have made it tricky to fasten to a stem and it didn't look like I would be able to place a label on each side. If you have a different shaped label, choose your materials accordingly. I've seen homebrewers use all kinds of things for tap handles. One of my local homebrewers used an old Microsoft mouse. Last year my son's baseball team won a tournament. The kids and coaches both got trophies so there were two in our house. The trophy featured a nice, 7-inch (18 cm) wooden baseball bat. My son's trophy was proudly displayed on a shelf in our basement, but mine got taken apart and used as a tap handle. Nothing like a Home Run Red Ale, baby!

The result for these handles came out better than I originally envisioned. They are very sturdy due to a wooden dowel inside the handle (as well as some sturdy glue) and they do not flex at all when I pull on a tap to pour a beer. Now, whenever someone comes down to my basement bar, they'll know exactly what's on tap!

> "I set out to find a way for an unhandy person to make some homemade tap handles."

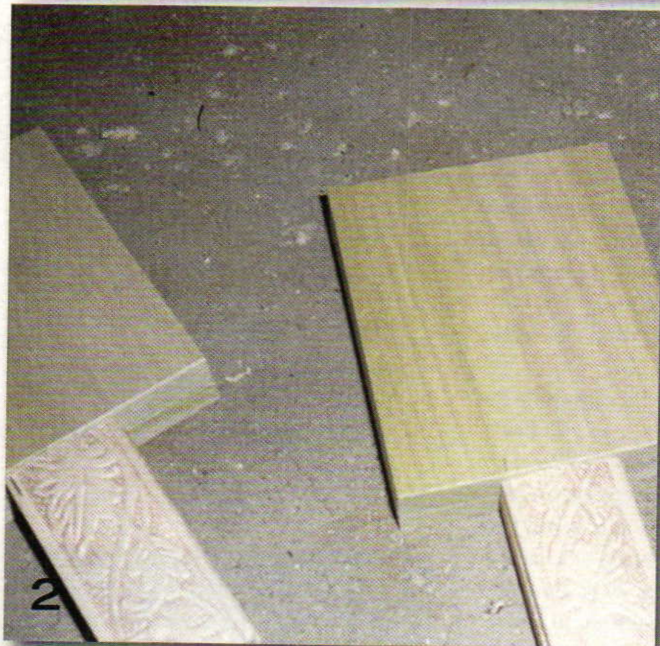
parts and equipment list

(TO MAKE EIGHT 7-INCH/18 CM-TALL TAP HANDLES)

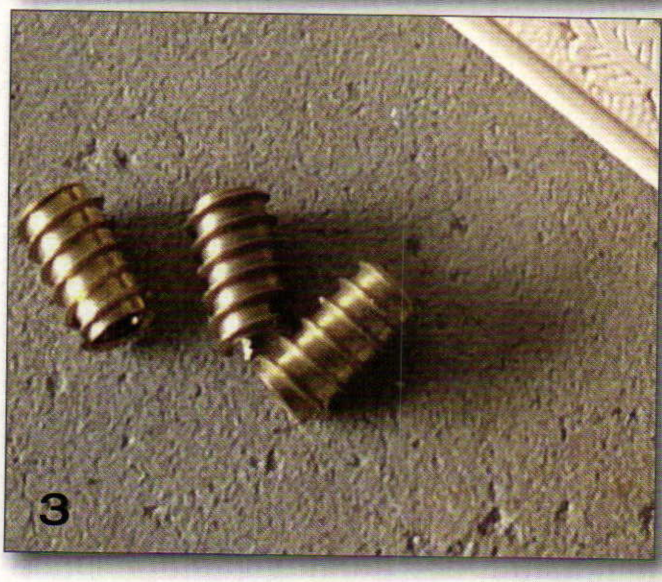
- 48 or more inches (122 cm) of 3.5-inch wide, 0.5-inch thick decorative wood trim
- 24 or more inches (61 cm) of 0.5-inch (1.25 cm) thick plain trim
- 64 inches (163 cm) of 3.5-inch (9 cm) wide, 0.5-inch thick plain wooden planks (for beer label mounting)
- 8 $\frac{3}{8}$-inch-16 faucet adapters
- 8 small drawer pulls (0.5-inch/ 1.25 cm across)
- Wooden dowels
- Wood glue
- Liquid Nails adhesive
- Mitre box
- Saw
- Drill with $\frac{15}{64}$-inch drill bit
- Vice
- Metal snips
- Measuring tape
- Pencil
- Spray mount glue
- Spray paint

These easy-to-make handles will give your labels the attention they deserve.

1. CHOOSE YOUR MATERIALS As I mentioned, before I started this project I took a trip to my local mega-hardware store for inspiration. As I stood in the "decorative trim piece" section, it occurred to me that I needed to make a "stem" piece that would accept the faucet adapter and then I would create a separate, larger piece (the "face") which would display the label. I thought it would be nice to fashion the whole thing out of a single piece of wood, but this requires skills and tools that I do not possess. I had heard of people using staircase spindles, which I considered. But they are pricey and when the handle was finished, it would look like a staircase spindle. I found some pieces of trim that had a leafy design on them. I immediately concluded that the manufacturer had a hop vine in mind when they made them. You can use any type of decorative design you would like, of course.

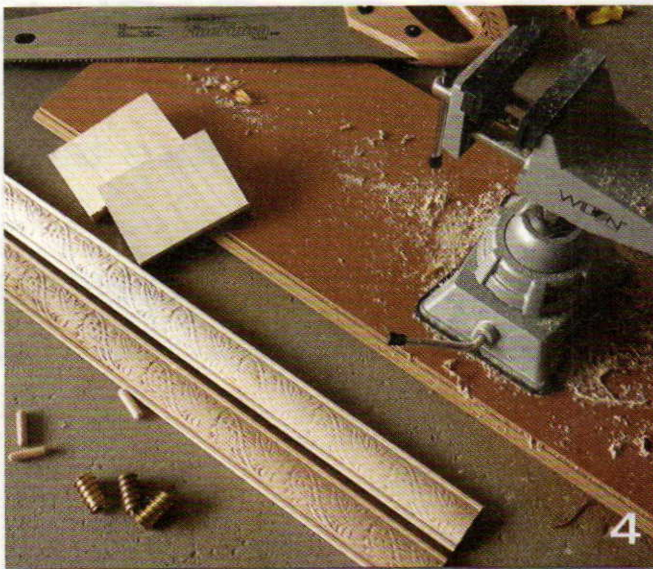


2. PLAN THE DESIGN The shape of the trim allowed me to place the pieces back to back to create a thick stem. The leafy pattern would show on both sides so that I could put a different label on each side of the handle so each handle I made could be used for two different beers. Just the two pieces of decorative trim together wasn't thick enough to accept the drilled hole for the faucet adapter, so I found another flat trim piece that I could sandwich between the leafy trim pieces to make the whole stem thicker. Next, I found some plain poplar planks that were 3 ½ inches (8.9 cm) wide, ½-inch (1.27 cm) thick and four feet (1.2 m) long. I cut these pieces in to 4-inch (10 cm) tall pieces to create the "face" of the handle. I envisioned the tap handle with the bottom of the stem drilled out to accept the faucet adapter, the top of the stem drilled out to accept a wooden dowel and the bottom of the face drilled out to accept the other end of the dowel.



3. FIND THE HARDWARE As I walked through the store, I found the kitchen hardware section and looked at the various drawer pulls. I was envisioning using them as a sort of finial that could be fastened to the top of the handle. The hardware came in a dizzying array of shapes and colors and I picked a few that looked good, so choose whatever you find appealing. I also found the faucet adapters in this department. The threads on the adapters are very coarse and there is usually a slot on one end so you can use a screwdriver to drive the adapter into the handle. The faucet adapters are readily available at many hardware stores and many homebrewers have screwed them into sawed-off table legs, antlers, lava rock and so on to serve as impromptu tap handles.

4. MAKE YOUR CUTS On the day I started on the handles, I got everything ready and set up a work area in the garage. I put some music on. I got a beer. It was a nice, sunny Saturday. I don't have a lot of room above my faucets (there is a TV there), so I knew I wanted the entire handle to be about 7 inches (18 cm) tall. Since the poplar planks I bought were 3 ½ inches (9 cm) wide, I printed out one my labels so it would be about 3 ¼ inches (9 cm) wide. If you want a larger label, be sure to get wider planks for the handle faces. Lay the label down on the plank and make a line with a pencil where the plank should be cut. The piece should be about 4 inches (10 cm) from top to bottom. Since the wood (I used poplar) is only ½-inch (1.27) thick and the stem was thicker, I cut two pieces of poplar and placed them back-to-back and glued them together. You can also use 1-inch-thick pieces. Next, cut the trim pieces into 3-inch (7.6) lengths. Place the pieces with the leaf pattern facing out and place a flat trim piece (which was the same width) between them and glue them together.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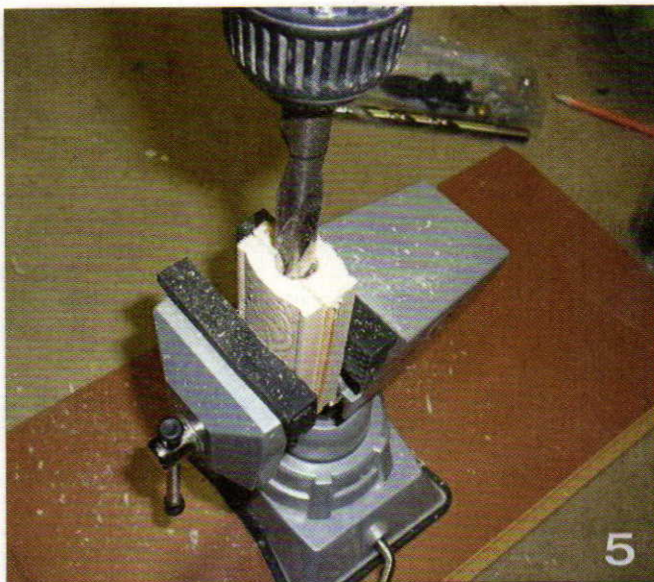
5. DRILL IT When the glue is dry, drill a hole in the bottom of one of the poplar pieces. The hole is drilled to accept the wooden dowel so it is important to make the hole as straight as possible. When I built my taps, this is the step where some skill would have been handy. I placed the poplar face into a vice and carefully drilled the hole and then another one in the top of one of the stems. I fitted the dowel in place and assembled the two pieces. To my surprise, the two pieces fit together very nicely. My cuts were square and the holes for the dowel were straight. Then I placed the stem into my vice so I could drill out the 15/64" hole for the faucet adapter. I did this with the trim piece in a vice and me standing over it with a corded drill. I drilled the hole and grabbed one of the adapters. I placed it into the hole and started to turn it. It went in crooked. I took it out and started again. It was a little better but now I saw that my three glued-together trim pieces were starting to break apart. I took a big slug of my beer. I drilled the hole out a little wider and tried again. Success! Have a slightly larger drill bit on hand in case this happens to you.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6. FINISHING TOUCHES I took the handle down to my faucets and tried it out. It wobbled a little so I readjusted the adapter until the handle spun like a top. Then I placed some glue into that hole to keep the adapter where I wanted it. This part takes some practice and the threads of the adapter make it tricky, but once you get one done, it becomes easier. Once you have it working as you would like, take the dowel out, place some glue into both holes and replace the dowel. Put the entire handle together, straighten it and lay it to the side to dry.

The final step is drilling a hole in the top of one of the handles for the "finial." Choose a drill bit that fits the size of the drawer-pulls you choose. Once the hole is drilled, cut the head off the screw with a pair of snips and then place the cut end of the screw into the centered hole. Then screw the finial onto the top.

Finally, I primed all of the handles and then painted them in various colors. When the paint was dry, I glued the finial screws into the holes and attached the hardware. BYO

6

Ken Lenard is a homebrewer from the Chicago area.

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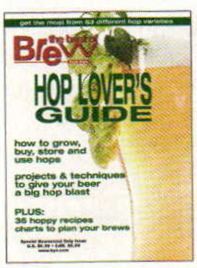

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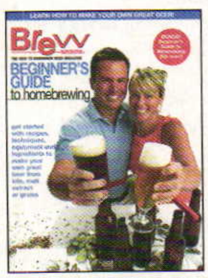

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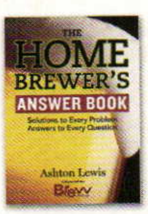

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Home 'Tooning

Making beer and drawing strips

Will Wilson • Jamestown, Rhode Island

When I was 18, I met with my collegiate guidance counselor and had a talk about my future.

"Well, son, what would you like to do?" he asked.

"Sir, I'd like to draw cartoons and drink beer for the rest of my life," I replied.

There's nothing like having your guidance counselor laugh at you.

While that guy saw college as a means to a good job, I saw it as a way to get better at what I was interested in. And in those four years — maybe five, who's counting? — I got better at drawing comics and pretty damn good at drinking beer. In fact, my passion for cartooning and brewing evolved together.

I got my first cartooning break writing a daily comic strip for my university's newspaper. I was pumped. I got exposure to something like 40,000 kids a day and the best part: IT PAID — not well, but it paid, and it was just enough for me to upgrade from Bud and Coors to Newcastle and Sam Adams. Once I had a taste of these "gateway beers," as I call them, I wanted more. This cartooning and beer sampling trend continued (and continues to this day), but unfortunately the paychecks haven't gotten much bigger. In the meantime, beer like Three Philosophers and Unearthly IPA are only getting more expensive. I persist, nonetheless.

During those early days my buddy Josh, a recent graduate of the American Brewer's Guild, and I started homebrewing. We bought the box-o-homebrew kit. Yes we screwed it up. And yes, we tried brewing again.

That was four years ago. Now we brew with an all-grain setup, wort chillers, kegs and so many of the devices that only brewers talk about for hours on end. It's a small price to pay for that liquid bliss and continual inspiration.

The number one question I'm asked concerning my comic strip is, "Where do you get your ideas from, Bill?" And frankly, I'm not entirely sure. Maybe it's the company I keep. I do, however, know what happens when I get a solid chunk of writer's block. I break out my newest homebrew and invite everyone over. Then I sit and listen, like a fly on the wall, to the comments made about the brew and about the stupid, knucklehead things we've done or are in the middle of doing. Depending on the amount of beer I've ingested, most of these nauseating tales of anti-chivalry and debauchery are remembered as a cartoon.

> "I'd like to draw cartoons and drink beer for the rest of my life."

THAT GUY

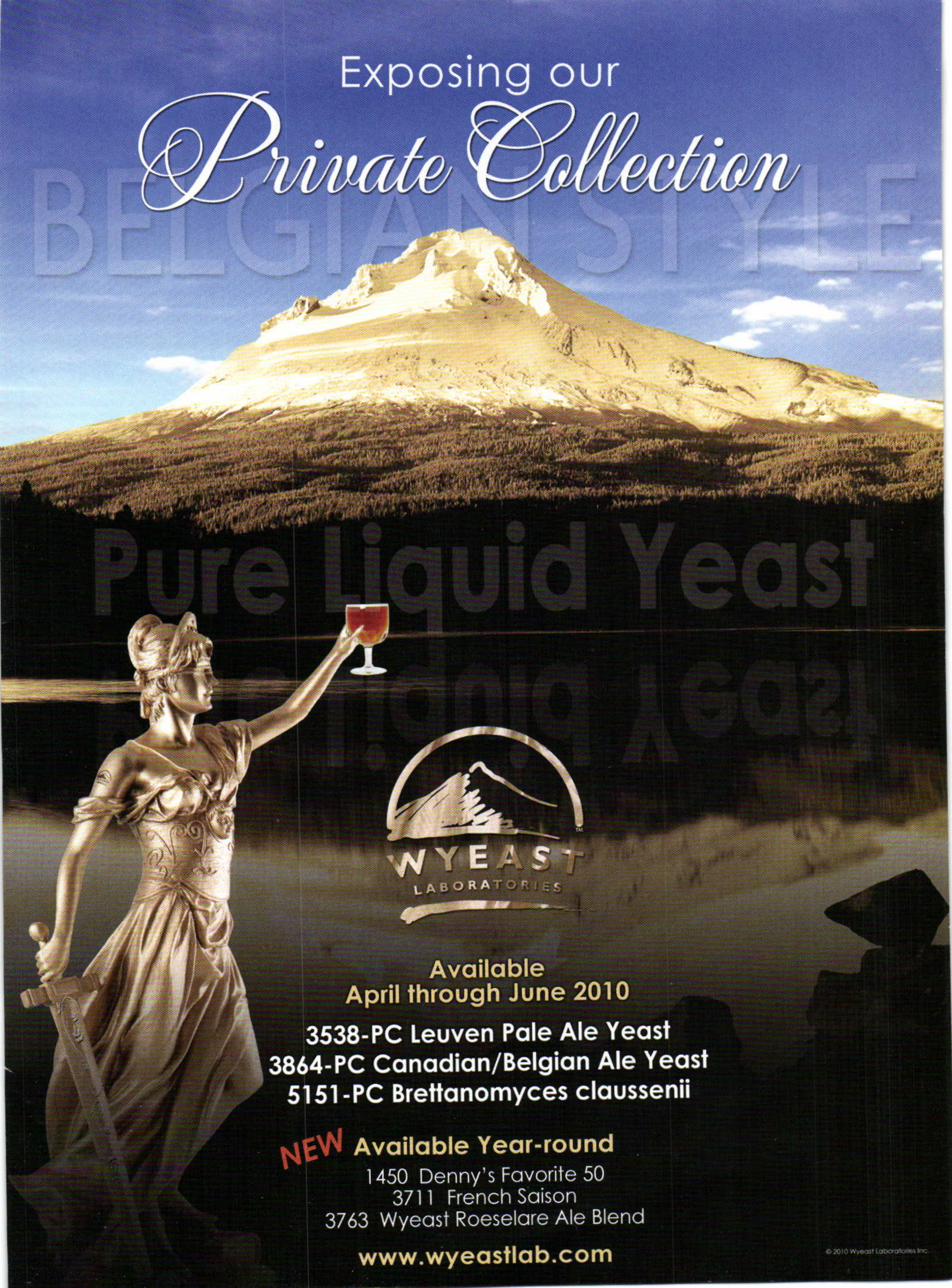
One of Will Wilson's homebrewing cartoons is inspired by brew club meetings.

Although the pursuit of cartoon topics and free beer have made me do things that others would question, I think the idea of grabbing a few 12-packs of something new and drinking them with friends under the guise of research is sort of funny. Even more so when we do it while our girlfriends are in the kitchen wondering why we're shirtless and watching Nickelodeon GAS channel. Research, babe. Research.

When you get to the root of these incognito brainstorming sessions, however, it is the comments that are most important: which jokes work, which don't. The same goes for a homebrew; deciding which tastes work and which tastes are desired. Feedback from others is the best thing that's happened to both my brews and my cartoons.

The smartest thing I've ever done for my homebrewing (and cartooning) was attending a brew club meeting. The first brew club I got involved with was the Central Vermont Brew Club and it was fantastic. Sure, you can give your beers to your brother, or your friends, and I'm sure they will love them — it's a free buzz. But getting constructive criticism from other brewers is invaluable.

In fact, brew clubs inspired one of my cartoons. I always admire "That Guy" at the meeting; the brewer doing something so obscure and weird, all the while flirting with the cusp of brilliance, brewing beers like mushroom and chili pepper stout, or pine needle and acorn pale ale. Those beers that make me think, "Oh man, do I really want to drink this?" More often than not, it's delicious . . . or at least interesting enough for a second sip! BYO



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