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MAY-JUNE 2006, VOL.12, NO.3

THE HOW-TO HOMEBREW BEER MAGAZINE

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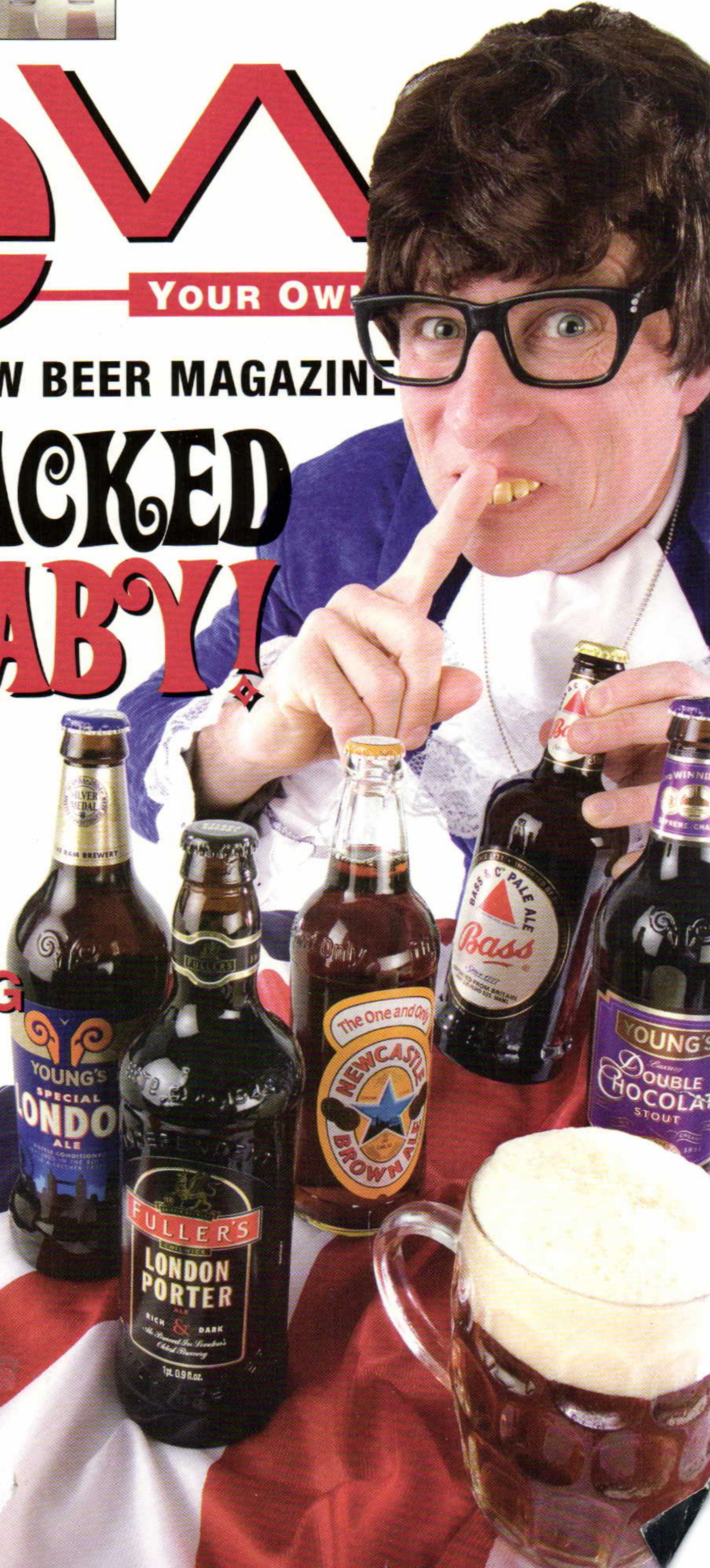

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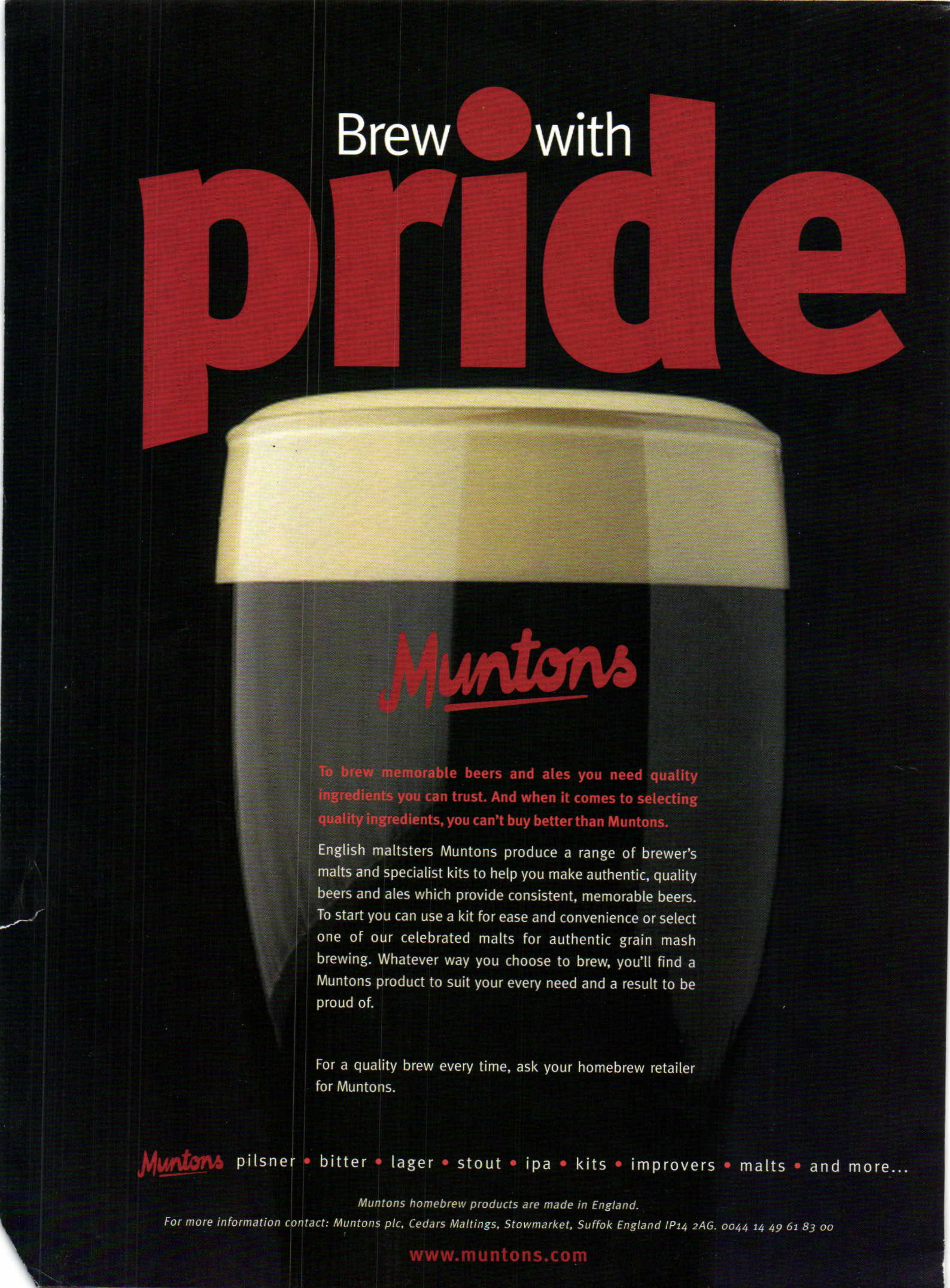

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MAY-JUNE 2006
Volume 12 Number 3

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THE HOW-TO HOMEBREW BEER MAGAZINE

Features

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IN EARLY 1933, BEFORE PROHIBITION COULD BE OFFICIALLY REPEALED, PRESIDENT ROOSEVELT SIGNED EMERGENCY LEGISLATION ESSENTIALLY DECLARING LET THERE BE BEER. IT WASN'T UNTIL DECEMBER THAT WINE AND HARD LIQUOR LEGALLY RETURNED. AFTER BEING DEPRIVED OF LEGAL ALCOHOL FOR 13 MISERABLE YEARS, THIRSTY AMERICANS NEEDED A BEVERAGE OF MODERATION.
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Brew YOUR OWN

THE HOW-TO HOMEBREW BEER MAGAZINE

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Add or Subtract?

I'm writing in regard to your March-April 2006, article "Calibrate Your Brewery." There is a mistake in the single point hydrometer calibration section. It states: ". . . your hydrometer reads 0.998 in pure water at 60 °C . . . This means that it's reading two "points" low and you should subtract two "points" from any reading you take in wort or beer. In other words, if your wort reads 1.050, your corrected reading would be 1.048." Actually, if your reading in pure water is low, you should add that amount to your reading.

Jamie Ruetz
BOTL (Brewers on the Lake)
Holland, Michigan

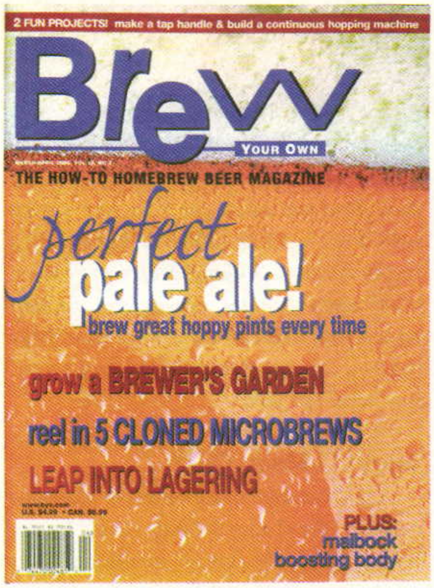
Author and BYO *Editor Chris Colby responds: "You're right, as several readers pointed out, the example is backwards. If your hydrometer reads low in pure water (i.e. 0.9999 or below) add the offset to your readings. If your hydrometer reads high in pure water (1.001 or above), subtract the offset. In the example I gave, in which the hydrometer read 0.998 (two "points" low) in pure water, I should have added two points to the uncorrected wort reading of 1.050, yielding a corrected value of 1.052."*

Wizards and Germans and Tannins . . . Oh My!

I read Mr. Wizard's answer to Darrin Walraven (in the March-April 2006 issue) who had a concern about decoction mashing extracting tannins from malt. While in college, I studied International Business with a double major in German, which has allowed me to read German brewing texts, particularly those by Narziss, Kunze, and Heyse.

Germans have developed specific mashing regimes to suit various beer styles. The basis for these differences often stems from the differences in phenolic character between low phenolic pale lagers and more phenolic amber or dark lagers. These differences deal largely with mash dilution, intensity of sparging, and decoction vs. infusion mashing.

Because Germans typically use multiple temperature rests, the mash has to be



thin and liquid so it can be easily stirred to distribute heat equally through the mash during temperature ramp ups.

However, Germans also use the mash thickness to influence the character of the beer. For a delicate Pils, they use a very thin mash with a water-grist ratio as high as 5:1 (weight to weight; approximately 2.4 qts./lb.). The thin mash not only promotes enzymatic activity that produces a highly fermentable wort, but the thin mash followed by minimal sparging tends to extract fewer phenols from the husks. The character of the wort from this procedure is described as "edel" (noble), because it contains few harsh tannins. As the Wizard pointed out, the more intense the sparging, the more tannins are leached from the grain.

Germans also recognize that the heat of decoction mashing extracts more character (i.e. tannins) than infusion mashing. The Wizard is again right, Germans don't always perceive this leaching as negative if applied to the appropriate style. Therefore, a pale lager might be brewed with an infusion mash, but if it is decocted, the decoction regime would involve boiling the mash for shorter periods and perhaps limiting the number of decoctions to just one. This limits the extraction of tannins and also the formation of color.

In contrast to delicate pale lagers, German texts indicate that dark beers benefit from thick mashes. A thick mash (e.g., 3:1; ~1.4 qts./lb.) reduces wort fermentability that contributes substance to the beer, and the greater quantity of sparge water that follows leaches out greater amounts of tannins. The result is greater color formation and a more dextrinous beer with a pleasing maltiness from the liberated phenols. Bold beers like Doppelbock may undergo a triple decoction, and each decoction may be boiled for extended periods of time to liberate the maximum amount of tannins and to also caramelize wort sugars.

The German term the Wizard may have been searching for was "*Gerbstoff,*" or tannins that add structure to robust beers. These tannins are said to lend a "*vollmundigen, kernigen Geschmack*" (full mouthfeel and grainy flavor) to the beer.

Perhaps it is the domination of light pale lagers during the last 100 years of American beer history that are not compatible with phenolic character, which has created the paranoia about tannins. Let's not forget that tannins are what contribute structure and character to red wines like Cabernet and Bordeaux. Makers of bold red wines intentionally leave the must in long contact with the tannic grape skins to increase the harsh phenolic character of their wines. (The grape skin is analogous to grain husks in contributing phenols and color.) Bold red wines can be much more tannic than even the stoutest beers, yet people still love them.

As the Wizard points out, Germans don't automatically view tannins as negative. In the correct proportions and in the right beer style, tannins can actually improve the character of certain robust beers.

Steve Holle
Kansas City, Missouri

Weld or Weldless?

In your article about building a counterflow wort chiller (in the January-February 2006 issue), you used JB Weld for connecting the copper fittings. My question is, could you solder the connections much like you would for household pluming?

Dennis Peterson
Cambridge, Minnesota

Author Reg Pope responds: "Absolutely, as a matter of fact my initial pro-

RECIPE INDEX

Page

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.

totype was soldered. Since I don't possess that skill, it was done for me at a plumber's shop. The JB Weld was my idea for a substitute for folks like myself who don't weld or solder or have access to the service. Nothing comes in contact with those unions except the cooling water, so no matter what method of joining you choose, there is no risk of contaminating the wort."

David R. Pratt
Canastota, New York

Editor Chris Colby responds: "I brew a fair number of 3-gallon (11 L) batches when doing test brews or experimental beers. I run my fermentation in a bucket, then rack to a 3-gallon (11 L) carboy for conditioning ("secondary fermentation"). A few years ago, I was lucky enough to find some 3-gallon (11 L) Cornelius kegs at my local homebrew shop, so I only have to clean one "bottle" when I brew at this scale.

"I convert 5-gallon (19-L) recipes to 3-gallon (11-L) recipes by simply multiplying every ingredient amount by ⅗ (3 gallons divided 5 gallons). I don't think you need to make any other adjustments when converting between batch volumes in this range.

"There are a few hidden benefits to making smaller batches. For one thing, if you don't make yeast starters, your pitching rate improves because you are pitching the same number of cells to a smaller volume of wort. For a 3-gallon (11-L) or smaller batch, a Wyeast XL smack pack or White Labs test tube will provide close to the optimal number of cells for moderate-strength beers.

"Likewise, stovetop brewers can boil a larger percentage of their wort, perhaps even moving up to a full-wort boil. A full-wort boil decreases wort darkening and increases hop utilization (both because the wort is boiled at a lower density and because it is diluted less, post-boil). Also, with a smaller volume of wort to handle, heating and cooling times are slightly decreased and it's easier to lift carboys.

"In addition, it is somewhat easier to manipulate the temperature of smaller volumes of beer. If you use the wet T-shirt method to cool your fermentation, there is a greater surface-to-volume ratio available for cooling, as well as a smaller volume of wort to cool. (Of course, your temperature swings may also be larger at smaller scales.)

"The major drawback, of course, to smaller batch sizes is that you spend almost the same amount of time on brewing, but you yield less beer. However, if you'd rather have more variety, but less volume of each kind of beer, try brewing smaller batches."

Should I Mash Out?

I just finished reading about pale ales in your March-April 2006 issue. In the Patrick Henry recipe, it mentioned that after the mash rested for 60 minutes and the starches were converted, to add boiling water to bring the mash temp up to 170 °F (77 °C). I brew with a three-tier gravity system and have burners under each vessel. When my mash has been converted, I usually start my sparge with water I've heated to 170 °F (77 °C). Being I have a burner under the mash tun, would it be better for me to raise the temp of my mash to 170 °F (77 °C), and then sparge, or should I continue to do it the way I'm doing it. Are there any benefits or drawbacks to doing this?

Kevin Rich
via email

Heating the mash to 168–170 °F (76–77 °C) is called a mash out. The primary benefit of a mash out is that it makes lautering easier. The heat makes the wort less viscous and therefore able to flow better. The mash out also moves the temperature above of the optimal ranges of the enzymes activated during the mash. (It doesn't completely inactivate all of them.) If you are mashing to obtain a particular level of wort fermentability, a mash out will help you "fix" the fermentability you ended up with at the end of your mash. If you can heat your mash tun (and stir to obtain even heating), raising the temperature would likely help your lautering.

Think Small?

I love to brew . . . and I love beer, but it takes me a long time to go through 5 gallons (19 L) of beer. If I could brew smaller batches, I could brew more often. How about some tips or an article about scaling recipes down?

While drinking some craft-brewed beer at BridgePort Brewing one day, **Marc Martin** found himself standing next to a man who told him it was possible to make beer like that at home. It was only after he had brewed his tenth batch that he discovered that the man was homebrew author Fred Eckhardt. In his 20 years in the hobby, Marc has brewed over 250 batches, taught over 50 people to homebrew, won over 100 ribbons and medals in competition, took a UC Davis Brewing Science course, judged at countless competitions and served as an officer in the Austin ZEALOTS and Plato Republic homebrew clubs.

Starting with this issue, Marc is looking forward to taking another step to promote this great hobby by writing the Replicator column. Check out his first recipe — Wynkoop's Patty's Chili Beer — on page 11 of this issue.

Glenn Burnsilver lives in Colorado with his wife and newly arrived baby. Glenn has written articles for a variety of publications and is a frequent contributor to *Brew Your Own* magazine. For several years, his articles for *BYO* have — by strange coincidence — appeared in the December issue. In the December 2002 issue, he wrote an article on brewing with coffee and in the December 2003 issue, he wrote about brewing with spices. In the December 2004 issue, he did double duty by contacting breweries and coming up with 12 holiday beer clones plus a piece inspired by his brewing in Colorado — how to brew at altitude. In 2005, Glenn authored a collection of dark beer clones in the September issue. In this issue, he describes how to make root beer — from extract and from scratch — in his article, "Down to the Root," on page 26.

Like Glenn Burnsilver (left), **Terry Foster's** publications in *BYO* have had a certain periodicity to them. In the September issues of 2003, 2004 and 2005, he wrote articles about pale ale, old ale and mild ale, respectively. (Of course, he also wrote a feature article on porter in the January 2003 issue and had a two-part series on brewing with malt extract starting in the October 2004 issue.)

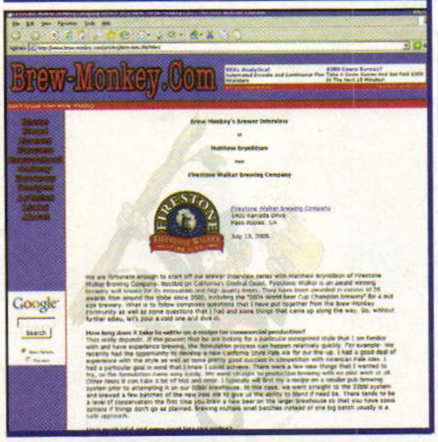
Foster was born in London and, although he has a PhD in chemistry from the University of London, in this issue he goes back to college — Queen's College at Oxford, to be exact. This college brewed its own beer from 1341 to 1939, and — in his article on page 32 — Dr. Foster explains how to brew the college's special seasonal beer, Chancellor Ale. Foster divides his time between the UK and New Haven, Connecticut, studying beer wherever he goes.

homebrew RESOURCE

Brew-Monkey.com • World Wide Web

Why is there a Brew-Monkey.com? Well, I got tired of searching all over the net to find the information I wanted on making beer. I wanted to know what was going on in the world of beer, have information on brewing and be able to discuss these things with other like minded people. I had a few extra minutes (well, not really) and took it upon myself to create something of my own, something different. I figured I can do this and started researching and writing some of the articles that make up the content on Brew-Monkey.com. Planning for the Site started in August 2003, went live in October 2003 and is now one of the more popular homebrew Sites on the Web. Brew-Monkey is meant to be a place to learn, share and explore information about homebrewing as well as a place that supports the promotion of real beer.

Brew-Monkey.com is a Web community of brewers who exchange information, ideas, recipes and expertise via a free membership discussion forum.



What can you find on Brew-Monkey.com? Beer news including a Really Simple Syndication (RSS) feed of brewing news, beer events and competition schedules, information on hops and yeast, brewing instructions for the new and progressing brewer, information on brewing water, product reviews, interviews with professional brewers, recipes in BeerSmith, BeerXML and html format, beer forums, an increasingly popular mead forum and of course monkeys!

About the founder

Brew-Monkey.com is owned, designed, maintained, broken and fixed by me, Chris Love. Occasionally, I put on beer classes to help further the knowledge and appreciation of good beer. Recently I was hired as a "beer expert" for conferences and other gatherings. I am also a BJCP Certified judge and continue to brew as much time will allow.

homebrew CALENDAR

May 6 (entry deadline)
Austin ZEALOTS Homebrew Inquisition
Austin, Texas

Homebrew contest with a unique, non-BJCP, format. Complete details and entry forms at www.austinzealots.com.

May 8 (registration due)
B.E.E.R.'s 10th Annual Brew-off
Smithtown, New York

Entries accepted through May 13. The event will be held May 20. All information can be found at www.hbd.org/beer.

May 26 (entry deadline)
11th Annual Big Batch Brew Bash
Houston, Texas

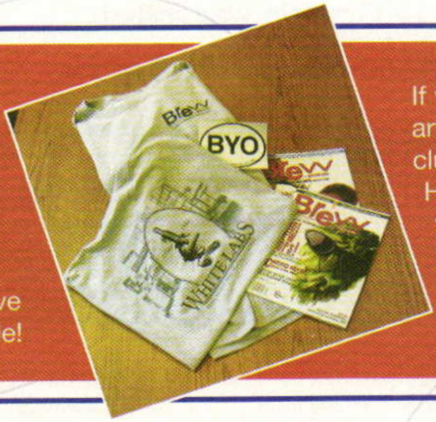
This single style competition will be held June 4. This year's style is Imperial IPA. For full information visit www.thekgb.org.

June 20 (entry deadline)
Ohio State Fair Homebrew Competition
Columbus, Ohio

Deadline for contest entries is June 20. For full information visit www.ohio-statefair.com.

we want you

Do you have a system or a gadget that will make our readers drool? How about a killer recipe or tip? Email a description and photos to **edit@byo.com** and you too may have a claim to fame in your brewing circle!



If we publish your article, recipe, photos, club news or tip in Homebrew Nation, you'll get a cool t-shirt (courtesy of White Labs) and a *BYO* Euro sticker.

brewer PROFILE

Matthew Beck • Folsom, California

It all started with a story about my trip to Germany. I spent most of my time in Nuremburg with my brother touring the city on foot and visiting the various beer gardens that boasted signs such as "Serving since 1516." We ordered beer by the mass *Krug* (~1 L) everywhere we went. My brother suggested trying a rauchbier, but insisted on ordering only half-liters. That half-liter of rauchbier was enough for a lifetime.

The kids sometimes think malt reminds them of their breakfast cereal.

Skip forward about 18 months and I find myself recounting this experience. A thought dawns on me: Why does smoked beer have to taste like liquid beef jerky? I began researching, and bought a book titled *Smoked Beers* by Geoff Larson. I decided at that time to establish a business called Smoked Malts to provide custom smoked grains to homebrewers.

As I began researching what it would take to accomplish this, I realized that it would be very difficult to convince homebrewers to order their custom smoked malts from a third party, and there was not much profit in selling wholesale to homebrew shops. I began to give up hope in my homebrew revolution until I learned that my local homebrew shop was for sale.

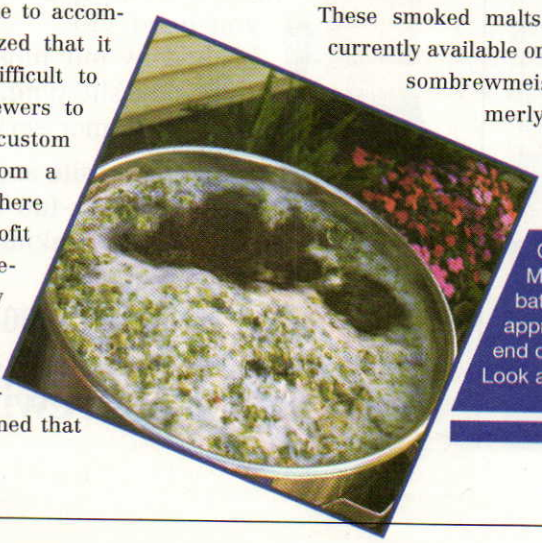
In a flash of brilliance (or stupidity, if you ask my wife) I bought the local homebrew shop, made some improvements, and began smoking and selling cherry wood smoked malt. I created a recipe for Cherry Wood Smoked Hefeweissen and brewed it a few times, both extract and all-grain, to get a feel for the flavor and effects of the smoked malt. It remains my favorite brew and one of the most popular kits in the shop. I expanded my inventory with maple wood smoked malt and alder wood smoked malt, pairing them with a brown ale and porter respectively.

It turns out that homebrewers are very receptive to the idea of trying new recipes (it didn't hurt to keep a keg of Cherry Wood Smoked Hefeweissen in the shop for samples) and I found myself working overtime to keep smoked malts in stock.

I have since sold the shop, due to time constraints, but continue to supply it with smoked malts. Someday I will chase down a commercial account and try to convince a small brewpub to smoke up one of their beers. Until then, I am content to change the brewing culture one homebrewer at a time.

The Cherry Wood Smoked Hefeweissen presents with a distinct cherry wood smoke aroma without overpowering your senses or palate. You may find yourself hesitant to taste, then returning for a full glass, then wondering why you've never found such full flavor in a hefeweizen before this.

These smoked malts and kits are currently available only at: www.folsombrewmeister.com (formerly www.becksbrews.com).



One of Matthew's batches approaches the end of the boil. Look at the hops!

reader RECIPE

Cherry Wood Smoked Hefeweissen

Yield: 5 gallons/19 L (extract plus steeping grains)

Ingredients:

4 lbs. (1.8 kg) cherry wood smoked malt
1 lb. (0.45 kg) malted wheat
6 lbs. (2.7 kg) liquid wheat extract
1 oz. (28 g) Hallertauer pellet hops (boil 60 mins.)
½ oz. Hallertauer pellet hops (boil 30 mins.)
½ oz. Hallertauer pellet hops (boil 5 mins.)
Irish moss (boil 15 mins.)
1 pkg. Wyeast 3056 Bavarian wheat blend

Step by Step

Steep all grains at 155–160 °F (68 °C) for 30 to 45 minutes then remove and rinse the grains. Dissolve the liquid extract and bring to a boil. Add first ounce of hops, and boil for 30 minutes before adding another ½ oz. of hops. Boil for 15 minutes and add Irish Moss. Continue the boil for 10 more minutes and add final hops. Boil for the final 5 minutes and turn off heat.

Cool, top up as necessary, take a gravity reading and pitch your yeast. Check gravity after four days and every day after that. Bottle or keg when the gravity reaches ideal level, 1.020 SG is recommended The original gravity is anticipated at 1.065.

All-grain version:

4 lbs.(1.8 kg) cherry wood smoked malt
2 lbs. 2-row malt of choice
4 lbs.(1.8 kg) malted wheat
1 oz. (28 g) Hallertauer pellet hops (boil for 60 mins.)
½ oz. (14 g) Hallertauer pellet hops (boil for 30 mins.)
½ oz. (14 g) Hallertauer pellet hops (boil for 5 mins.)
Irish Moss (15)
1 pkg. Wyeast 3056 Bavarian wheat blend

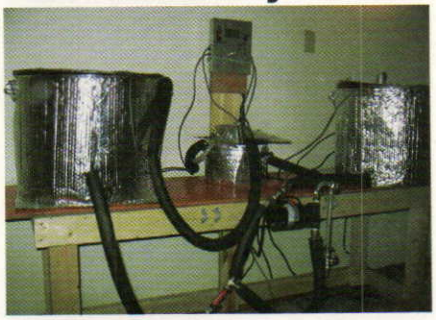
Step by Step

Mash grains at 155 °F (68 °C) for 90 minutes then sparge grains. Bring wort to a boil. Add first ounce of hops, boil 30 minutes. Add ½ oz. (14 g) of hops, boil 15 minutes. Add Irish Moss, boil 10 minutes. Add final hops, boil 5 minutes. The remainder of the recipe follows the partial mash instruction.

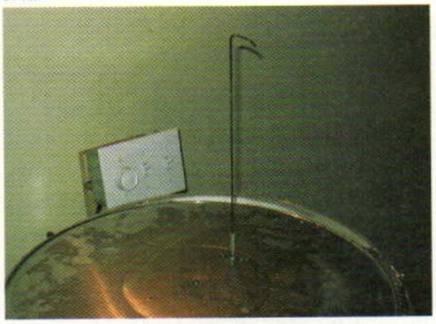
– Matthew Beck

homebrew systems that will make you DROOL

Mark Nesdoly • Edmonton, Alberta



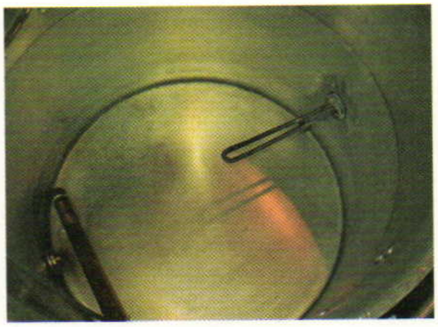
This is Mark's mash tun, heating element, lauter tun, pump and controller.



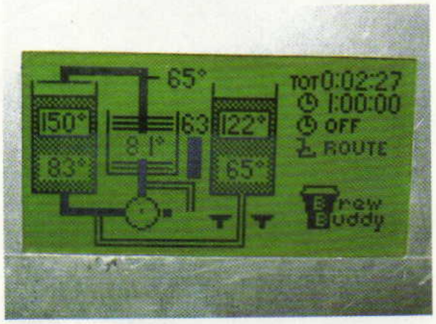
The stir sticks are constructed of coat hangers that are bent and cut to size.

This is the mash tun with a heat sensor and slotted manifold.

Here is the heat exchanger with a stirrer in the lid. The sensor protrudes from the front.



This is the inside of the lauter tun. A sensor rests in the tube with a 1,500-W element.



Here is a close up of the controller screen where all the components are monitored.

replicator

by **Marc Martin**

WYNKOOP BREWING COMPANY EST. 1988

Dear Replicator,

We used to live in Denver, Colorado and one of our favorite places to eat, as well as enjoy a fabulous beer, was Wynkoop Brewing Company in downtown Denver. Our absolute favorite beer was, and still is, Patty's Chili Beer. Replicator, please tell us that you can get this recipe! Being in the Seattle area, there are lots of places to get a decent beer and my husband's homebrew is really great, but we still crave a Patty's.

P.S. We have brewing friends in Boise, Idaho who are the ones who introduced us to Patty's and I am sure they would be extremely grateful for this recipe as well.

Erin and BJ
Auburn, Washington

I have to say thank you for making this request, as I too am a fan of this wonderful beer. While attending last year's Great American Beer Festival (GABF) I stopped by Wynkoop to sample their beers. While many chili beers are over the top in pepper profile, I found this one to be very well balanced. I believe I'll join you in brewing a batch.

My call to the Wynkoop brewery was enthusiastically answered by Thomas Larsen, the head brewer. Thomas has eight years of production brewery experience and, like many of us, began as a homebrewer. Impressed with his talents, management sent him to Chicago for the Siebel short course. Two years ago he was promoted to the position of head brewer and now oversees all production and recipe development.

Thomas reports that Patty's Chili Beer was originally meant to be a one-time only batch. A few local brewpub regulars kept demanding it until finally the brewery relented. Popularity has increased to the point that they now brew an 18-barrel batch almost every month!

Thomas describes this beer as a blond or golden ale with a "session beer" profile. Low original gravity and a dry finish help to highlight the mild pepper background. The use of low alpha Saaz hops provide for a solid malt to hop balance and accentuate the pepper flavor.

Thomas reports that he plans to enter this beer in the 2006 GABF. Fire up those kettles and maybe yours will be a medal winner too!

Wynkoop Brewing Company Patty's Chili Beer

(5 gallons/19 L extract with grains)

OG = 1.039 FG = 1.007
IBUs = 23 SRM = 4 ABV = 4.2

Ingredients

3.3 lbs. (1.5 kg) Coopers Light unhopped liquid malt extract
1.5 lbs. (0.68 kg) light dried malt extract powder
5.0 oz. (140 g) flaked oats
5.0 oz. (140 g) Munich malt
1 teaspoon. Irish moss (60 min.)
5.25 AAU Saaz hop pellets (60 min.) (1.5 oz./43 g of 3.5% alpha acid)
1.75 AAU Saaz hop pellets (10 min.) (0.5 oz /14 g of 3.5% alpha acid)
10 oz. (280 g) Anaheim peppers (end of boil)
½ of a medium sized roasted Ancho pepper (end of boil)
White Labs WLP002 (English Ale) or Wyeast 1098 (British Ale) yeast
0.75 cup (150 g) of corn sugar (for priming)

Step by Step

Steep the crushed grain and flaked oats in 3.0 gallons (11 L) of water at 160 °F (71 °C) for 30 minutes. Remove grains from the wort, add the liquid and dried malt extracts and bring to a boil. Add the first addition of Saaz hops and Irish moss and boil for 60 minutes. During the boil, use this time to de-seed the Anaheim peppers and chop them into ¼-inch (6-mm) pieces. Roast the ½ Ancho pepper over an open flame (gas stove or barbeque) until it is lightly charred. Chop it into ¼-inch (6-mm) pieces also. Add the second addition of Saaz hops for the last 10 minutes of the boil. Add the chopped peppers at the end of the boil, cover the boil kettle, and allow them to steep for 15 minutes. Now add the wort to 2.0 gallons (7.6 L) of cold water in a sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C), aerate the wort heavily and pitch your yeast. Allow the beer to cool over the next few hours to 68 °F (20 °C) and hold at this temperature until the beer has finished fermenting. Condition for 1 week then bottle or keg your chili beer and enjoy!

Note: When transferring the wort from your boil kettle to the fermenter, pour it through a sanitized strainer to eliminate the pepper pieces.

All-grain option:

Replace the malt extracts with 7.0 lbs. (3.2 kg) 2-row pale malt. Mash the two crushed grains and flaked oats together at 160 °F (71 °C) for 60 minutes and sparge with 175 °F (79 °C) water. Collect approximately 4.5 gallons (17 L) of wort, add water to make 6.0 gallons (23 L) and boil for 60 minutes. Reduce the first addition (60 minute) of Saaz hops to 4.4 AAU (1.25 oz./ 35 g) due to the higher utilization factor for a full wort boil. The remainder of this recipe is the same as the extract recipe.

Aeration 101

When your wort needs to get some air

by Garrett Heaney

Aside from sanitation, a strong fermentation is one of the most critical aspects of brewing. Fermentation depends on yeast and yeast depend on oxygen for health and vitality. While cool wort naturally contains an amount of oxygen, this amount can be inadequate to support the yeast that you will be pitching. Yeast absorb oxygen and begin a process called sterol synthesis that strengthens the cells' membrane health. This motivates the yeast to get to work in converting sugars to alcohol. A well aerated wort promotes low ester levels in the final beer and proper yeast attenuation. A poorly aerated wort is prone to off flavors, high ester levels and often produces overly sweet beer. The more oxygen in the wort, the faster the yeast will become active, so you need to find a way to add air to your fermenter. Luckily, there are three simple aeration techniques commonly employed by homebrewers: shaking, splashing and injecting. Note that oxygen typically has a negative effect on beer at every point in the brewing process post yeast inoculation, and air contact should be minimized (if not eliminated) after fermentation has launched. For now, we'll focus on the time after your wort has been properly cooled and is waiting to be blessed with a package of brewers yeast.

Shake, shake, shake . . .

Shake, shake, shake . . . shake your carboy. Shaking your carboy is an effective way to add oxygen to smaller volumes of wort, but is not suggested for batches over 6 gallons (23 L). The shaking method is exactly as it sounds and requires no equipment. Many brewers simply slide their foot under the carboy for support and vigorously rock the container back and forth. When doing this, it is important to hold on tightly and to accelerate the speed of rocking steadily to gain momentum. The place where shaking can have the biggest affect is in your yeast starter. In much smaller volumes of about a quart or liter, you can effectively shake oxygen throughout the entire bottle with little effort. So, while not the most efficient means to aerate your wort, shaking can improve the oxygen content.

Splish splash, I was making a batch . . .

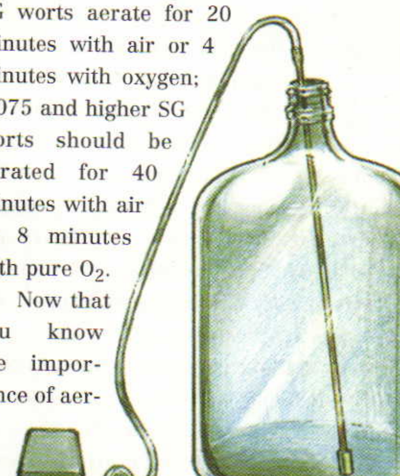
Repeatedly splashing wort from one bucket to another is a much more effective method of aeration, but it involves a greater risk for contamination from open air (which contains only ~20% oxygen and differing degrees of bacteria). This method can be enhanced as well by attaching (or having a buddy hold) a sanitized colander over the receiving bucket. This will break up the flow of the wort, giving it more opportunity to pick up oxygen with every splash. To minimize contamination risk, splash your wort in an area where you believe the air is cleanest and clearest. Overly dusty rooms or places where there are likely to be particles in the air are not recommended. Also, be sure to keep your hands out of the buckets and away from the wort, lest you get all your own dirty bacteria into the mix!

Injection junction, what's your function . . .

Injecting wort with oxygen is by far, the most effective and sanitary method available to homebrewers. The most common piece of equipment homebrewers use for this is an everyday aquarium pump and sanitized tubing. Many also use an inline filter and an aeration stone (typically constructed of stainless steel) to help expand the surface area of injection. Some brewers attach the tubing directly to an oxygen tank and push the gas through an aeration stone as well. This method is fast and painless. You can turn the air on and observe a layer of foam growing on the head of the wort. After about 5 to 15 minutes (the time is determined by your wort's gravity) you will have a well aerated and sanitary batch of wort that is ready for action.

If using pure oxygen as opposed to natural air from a pump (aquarium or otherwise), be careful not to over-aerate. Too much oxygen can result in shocked or over-stimulated yeast that can generate off flavors during fermentation.

In general, the following guidelines can guide you: 1.030–1.045 SG worts aerate for five minutes with air or one minute with pure O_2; 1.045–1.060 SG worts aerate for 10 minutes with air or two minutes with pure O_2; 1.060–1.075 SG worts aerate for 20 minutes with air or 4 minutes with oxygen; 1.075 and higher SG worts should be aerated for 40 minutes with air or 8 minutes with pure O_2.



Injecting air into your wort with a pump is an efficient way to aerate.

Now that you know the importance of aeration and the easiest ways to accomplish it, take some notes during your next few brew sessions to hone in the perfect aeration times and techniques for your personal brewing regimen. Cheers!

Step Mashing

Ramping up temperature for your grain bill

by Thomas J. Miller

Some brewers conduct single infusion mashes, with a rest at one temperature. While this process works absolutely fine for certain grain bills, at times, increasing the temperature of the mash at certain intervals (i.e. ramping up) and allowing multiple mash rests can modify the characteristics of your wort. This process is called step mashing and we talk to two professionals who believe in the method. Step up to the challenge!

Lee Chase is the head brewer at Stone Brewing Company located in Escondido, California.

Step mashing is a technique that starts at a lower temperature rest, then is "ramped up" or heated at a certain rate (degrees per minute) and allowed to rest at selected temperatures. The graphing of such a mash, using time and temperature on the axis, creates plateaus or steps, hence the term step mashing.

This method of mashing allows you to manipulate your malt to create a desired spectrum of substrate in the wort by focusing on the optimum temperature of different enzymes. There are primarily three rests that we focus on here at Stone and these accommodate the following enzymes: proteinase, beta-amylase and alpha-amylase.

The important thing to consider is that each of the enzymes has an optimum temperature, meaning they will tolerate higher or lower temperatures, but won't work as effectively. At lower temperatures they work slowly and they work faster as the temperature increases. As the temperature reaches an enzyme's threshold temperature range, the enzymes will denature and cannot be "re-natured" by cooling back down.

In a standard infusion mash, you would try to rest at a selected temperature, usually something that allows for both the alpha-amylase and beta-amylase enzymes to break down the starch into fermentable sugars. Because beta-amylase creates fermentable sugars exclusively, you may want to lean toward the beta-amylase optimum temperature if you want a more fermentable wort with a lower terminal gravity.

Conversely, if you are looking for a beer with more body, you may want to move your mash rest to focus on the alpha-amylase, which breaks the starch into smaller pieces, but not necessarily to fermentable-size chunks. Alpha-amylase is able to take a starch and break it into a lot of smaller pieces, but those are not fermentable in size. The benefit comes when beta-amylase work to make fermentables, while the alpha-amylase creates "loose ends." When this happens you can get fermentable sugars without too many large pieces of dextrin.

Beta-amylase functions optimally between 140–149 °F (60–65 °C) and is quickly denatured at 158 °F (70 °C). Alpha-amylase functions optimally between 162–167 °F (72–75 °C) and is denatured at 176 °F (80 °C). The key word here is "optimally," and there is some gray area in between.

If you have to choose between treating your alpha-amylase optimally (which will denature your beta-amylase), or treating your beta-amylase optimally, we choose the beta-amylase here at Stone. They give us the fermentable sugars. The alpha will still work at the lower temperature, but the beta will not work at the higher temperature.

Since we are considering a step mash, which always ramps upwards in temperature, we can rest our mash at the optimum temperature for both of these enzymes just to feel good, but most of the action on the starch is going to be done at the lower rest temperature.

However, our malt has the power to help us out: it has enzymes to break down the beta-glucan and protein, which will lower the viscosity of the wort, making the run off and filtration of the finished beer much easier. Also, with a high portion of wheat (which is husk-less), you will lose out on husk material, which acts as a filter bed and also makes run-off easier.

To put these enzymes to use, start your mash at the temperature for the enzyme with the lowest optimum temperature. The most common is the protein rest at 122 °F (50 °C). This temperature allows for proteinase enzymes to degrade protein. The length of time you rest at this temperature depends on what you are trying to achieve — the more wheat or protein in the mash, the longer you may want to rest. Most of the action happens pretty quickly — I'd give it no more than 30 minutes.

From the protein rest, you would add heat, stirring vigorously to get an even temperature rise throughout the mash. Be careful not to raise the temperature past your target rest temperature or you will denature the enzymes. Most likely, your next target will be at 144 °F (62 °C), which allows for optimum beta-amylase, as well as some slower-but-active alpha-amylase action.

Craig Burge is the Brewmaster at Sprecher Brewery Company. He started homebrewing in 1987 and was hired at Sprecher in 1990, starting on the bottling line. He has been in charge of brewing since 1993, winning a couple of gold medals, Small Brewery of the year and Brewmaster of the year at the GABF along the way.

Generally speaking, I believe by using a step mash program versus an infusion mash, this enables the brewer, professional or amateur, to more accurately brew many more styles of beer. In infusion mashing you are usually limited to a single temperature and only one conversion step (saccharification), whereas in step mashing you have unlimited options for changing time, temperature and rests to suit the needs of the particular style you are brewing.

Appearance is a very important factor in brewing. Infusion mashing typically means you will be dealing with plenty of protein hazes in your finished product due to the absence of the proteolysis rest, though it is worth noting that there is some controversy around this view (i.e. all brewers, whether infusion or step mash, risk haziness in beer if they do not take the necessary precautions.) In any case, the limited filtering capabilities of most homebrewers can be addressed to a certain degree through step mashing. In my opinion, even if you are using all well-modified malts, you should have at least some sort of protein rest to help with chill hazes and head retention.

The protein rest is also where you let the beta-glucanase enzyme degrade any beta-glucan gums. By doing this it decreases the wort viscosity and makes the lautering process easier.

If you are currently an infusion masher, you should be used to using mostly well-modified malts. Well-modified malts are those that have had significant enzymatic degradation during the malting process. Step mashing gives some leeway and opens the door to both well-modified malts and under-modified malts (and all of those in between) — allowing for conversions that were not completed in malting to happen during the mash. Step mashing takes care of this with a low temp rest around 118–120 °F (48–49 °C).

These days, most of the base malts you can use are well-modified, which means they are suitable for either step or infusion mashing. Step mashing even allows you to add well-modified malts later in the mashing process to avoid over conversion/degradation. Brewing good beer is all about the details and step mashing is a great example of this!

Mashing methodology

And a rundown on storage and aging

Mash mechanics

My mash system is nothing more than a 5-gallon (19-L) water cooler, a large nylon grain bag (that I hope will function the same as a false bottom) and a funnel connected to a piece of PVC pipe. The PVC pipe has holes drilled in it and functions as a sparger. I have never seen a mash, so how thick or thin should it be? I know that a rule of thumb is 1.25 quarts (~1.25 L) of strike water per pound (0.45 kg) of grist, but how thick should it be once the strike water and grist are mixed? My second question regards sparging. I know that once the filter bed is set up that disturbing it is not good, but I have read that some "rake the grain bed" during sparging in order to break up any channeling in the grain bed and to extract more from the grain.

Kevin Brock
Houston, Texas

The mash tun you describe sounds, how should I say, different. If I understand the design correctly, you plan on putting the large nylon bag in the water cooler and then will drain the wort off the bottom of the cooler. This may work to hold the grain in the bag and may even do a halfway decent job of yielding clear wort, but the efficiency will probably be dreadful! All mash tuns and lauter tuns have rigid bottoms and an open area beneath the bottom. The false bottom is usually slotted in commercial breweries and often perforated in homebrew set-ups.

The area beneath the false bottom is important as it separates the filter bed from the liquid flowing out of the filter. You could use a coffee filter, but you'd need some sort of holder. The filter holder in your coffee maker has ridges in it that separate the filter from the filter holder and allow coffee to flow out of the filter. It's fine to use a nylon bag to prevent fines (grain particles) from coming out of the grain bed, but you really need to get the bag off the bottom of the water cooler. The conventional way to do this is to use a false bottom. If you want your set-up to be different than the norm, I bet that lengths of PVC pipe could be used to support the nylon bag and provide the open area under the grain bed required for the unit to function as a filter.

The other questionable element of the design is the vertical sparge tube inserted into the grain bed. A sparging device should gently and evenly distribute the water over the surface of the grain bed. I have mentioned in many of my past articles that brewing methods often seem strange when scaled down from large, commercial operations. Sparging is one such technique. A typical lauter tun used in a brewery is between 10 and 40 feet (3-12 m) in diameter and has between about 75 and 1,250 square feet (23–380 sq. m.) of surface area (or the equivalent of a small office to a small house). The design of the sparge head is important here to ensure a uniform and gentle spray of water over this relatively large surface. The design of the system at home is less critical. In any case, the sparge device needs to provide water on top of the grain bed, not into the grain bed. One common feature of most sparge devices is that the water header is horizontal and parallel to the grain bed. Your design (if my understanding is correct) is almost guaranteed to unevenly distribute the sparge water. This will in all likelihood leave wanted extract (wort) at the perimeter of the grain bed — not the desired outcome.

OK, now that I have critiqued your design, let's get brewing! When you mash in you want to use anywhere from 2 to 4 parts water to 1 part grain (weight to weight basis). Like everything in life the metric system is much more convenient than the goofy system of measurements we use in the U.S. once you get accustomed to the numbers. Using the metric system, this mash thickness is equal to 2-4 liters of mash water per kilogram of malt. Converted into English units (not to be confused with Imperial units) this comes out to be 0.24–0.48 gallons per pound (0.96–1.92 quarts per pound). The mash does indeed resemble oatmeal, except in the case of brewing it's "malt-meal." The mash changes as the enzymes convert starch to sugar and this causes the mash to thin over the course of time and changes the appearance of the wort from cloudy to clear.

> The mash does indeed resemble oatmeal, except in the case of brewing it's "malt meal."

The wort may appear really thick or viscous in the pictures you have seen. In reality it is really not much more viscous than water and flows freely from the grain bed. Depending on the mash thickness, the wort density ranges anywhere from 16 °Plato (1.064 SG) to 25 °Plato (1.100 SG) at the beginning of wort collection and decreases upon sparging. Commercial brewers who use mash tuns in which mashing and wort collection occur in the same vessel rarely have the ability to cut the bed, whereas breweries that have a lauter tun routinely cut the bed during wort collection.

The main reason for cutting the bed is to help the wort flow's ability to increase the bed permeability — and as an added benefit, the resultant extract yield is typically improved.

The key with cutting the bed is to do it very gently and to not cut too deeply as deep and abrupt cuts do lead to cloudy wort. We have a lauter tun at Springfield Brewing Company and our rakes run during the entire wort collection period, but rarely cut deep and when deep cuts occur we can limit the depth so that wort clarity does not suffer. When deep cuts result in cloudy wort, a brewer must decide if the wort should be recirculated or collected. If wort is recirculated after sparging has begun it will likely result in reduced yield since strong wort is being mixed with water and weak wort on top of the grain bed. Most brewers try to avoid this conundrum by using techniques during wort collection that produce clear wort.

You are just getting into all-grain brewing and the best advice I can offer is to keep it simple at first and add more advanced techniques that improve yield as you become comfortable with all-grain brews. In the grand scheme of things you are not going to save much money at home by improving your yield. In fact, some yield-improving methods can really ruin a smooth brew day if you don't have command of the basics.

If I knew what I know now when I began all-grain brewing, I would start off simply. Infusion mashing works great for most beer styles. Once you have infusion mashing down, then you can add step mashing and decoction mashing to your bag of tricks. As far as cutting the mash bed and recirculating again after run-off begins, put that idea on the shelf as something to try in the future . . . no need to make your first all-grain brews overly complex. And finally, don't reinvent the wheel right from the start!

There is plenty of room for innovative designs when it comes to brewing, but in my opinion it's hard to build a better mousetrap until you understand the function and flaws of existing models that work well enough to be considered design standards.

How to store for more

Over the years I have collected a variety of rare bottles of beer that I am currently storing on the bottom shelf of my refrigerator for consumption in the future. Some of these bottles, such as the Samichlaus and Stille Nacht, may be in there for a couple of years before I get around to drinking them. Is this the best place to be storing them? Should I also wrap them in paper to keep the light from the refrigerator from spoiling them? I also have a room in my basement that is dark and usually stays around 50-55 °F (10–13 °F) in the winter and 65 °F (18 °C) in the summer — would this be a better place to keep them? Finally, is there a way to determine by alcohol content or beer type what beers will last longer in storage than others and how long they will last?

Josh Davis
Boalsburg, Pennsylvania

This question reminds me of an article written by G. Bruce Knecht and published in the *Wall Street Journal* on

January 30th. In his simple-minded article, Mr. Knecht criticized breweries that use cryptic code dates on their bottles and suggested that beer should have clearly printed expiration dates like bread and milk. "A loaf of bread has it. So does a carton of milk. But if you're looking for the expiration date on a bottle of beer, forget about it — for many brewers, that information is a closely guarded secret."

Something about this declaration triggered my gag reflex and pointed me toward my kitchen in search of expiration dates on the various items in my freezer, refrigerator and pantry. I left my kitchen and went to a grocery store for a more complete survey of food packages. As I expected the *Wall Street Journal* author used a bit of hyperbole in his opening paragraph. I found many "best before" dates and some "sell by" dates on the items in my kitchen and at the store, but no "expiration" dates. I even found some packages with dates stamped on them that are clearly in the future with no explanation of the date . . . consumers are left to interpret these dates as either best before or expiration dates and if the product sits around long enough the same stamp may appear to be a packaging date. One can even had a "born on date" on it and for a moment I thought perhaps I was supposed to burp it!

The shelf life of beer, like food, is hard to predict because several factors contribute to its deterioration. Furthermore, many food products can be safely consumed when their freshness begins to fade and the point in the decline of freshness where a food is no longer palatable is a matter of opinion. Some items — e.g. bread — get old and stale to the point of being totally disagreeable and then become the ideal ingredient for something truly delicious like a crouton.

Unfortunately, beer is not as forgiving as bread and when beer is passed its prime, it just tastes old and the consumer wishes they had consumed it earlier. I am, like Mr. Knecht, simple-minded but I view beer storage from the perspective of the brewer. When most beers leave the brewery they are ready to be consumed . . . otherwise no well-run brewery would put the beer out on the shelf to be purchased. In fact, the freshness clock begins ticking for most beer at the time of bottling. All the nurturing that the brewer feels is required is complete and it's time to bottle and drink the darn stuff!

The rule for these types of beers is to get 'em in the fridge and drink 'em as soon as possible because for certain, nothing good will happen to the beer by hanging on to it. The exceptions to this rule are with bottle-conditioned beers and some high alcohol beers. Obviously, with bottle-conditioned beers, the beer must carbonate in the bottle and this takes time. Meaning the beer improves for some time and then begins its downhill slide.

Some high alcohol beers improve with age and much of the improvement with these beers is actually a product of oxidation. Many aged big beers, such as barleywines, take on flavors reminiscent of sherry (that also gets much of its flavor from oxidation). I know of no rule of thumb matching the alcohol content of beer with its ability to age gracefully. I typically try to imagine how a beer would taste if it was "rounded out" by age. Many strong beers that do seem to benefit from age are big, malty and balanced by assertive hop bitterness when young. I think this is why many strong ales seem to improve with age. Strong lagers get their aging in the brewery and, to my palate, are best consumed when fresh.

The only reliable way to monitor a beer and determine when it reaches its peak is to taste it. This requires a whole bunch of the same beer and persistent quality control. Meaning you have to drink your stash and take notes on its progress. Ideally you will note the point when the beer is ever so slightly passed its peak and you can finish off the remainder before the flavor really begins to suffer. The same is true of many wines that are held in storage and many a collector has cursed himself for holding on to an excellent bottle of wine too long.

Aside from microbiological spoilers, the main things to keep away from beer during storage are oxygen, heat and ultraviolet light. Your question is about bottled beer and there is not much you can do to keep oxygen out of the beer other than not storing it for really long time periods. Remember that oxygen migrates into beer bottles through the crown liner and that carbon dioxide migrates out through the same line over time. Some liners contain molecules that scavenge oxygen, but you cannot differentiate these by sight.

Heat speeds up all chemical reactions, so whatever is going to happen to your precious bottle of brew over time will simply happen quicker as the storage temperature is increased. In my opinion, the only time a bottle of beer should be stored warm is if it is being bottle conditioned. Once the conditioning phase is complete, storing it cold will prolong its age. If you store your collection in your basement, aging will simply accelerate, especially in the summer when the temperature climbs to 65 °F (18 °C). I always store beer cold! Finally there is UV light, the causative agent of skunky beer. Brown bottles do a very good job of filtering UV light. I have had skunky beer from lightly tinted brown bottles, but that has been a rarity for me. If you are concerned about the bottle color, a bag will work great to protect your prized beer from light.

BYO Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard for the last ten years. Do you have a question for him? Send inquiries to *Brew Your Own*, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond personally. Sorry!

Belgian Golden Ale

The Belgians' classic blond brew

by Horst Dornbusch

The Belgian golden ale is a fairly recent development, considering the ancient roots of Belgian brewing. It evolved only about a hundred years ago. The brewers in Belgium came up with the golden ale probably because they had to, not because they were itching to add yet another creation to the sheer endless spectrum of their brews.

If Belgian brewing is known for anything, it is the vast and unique diversity of beer. It has been this way, it seems, forever. In that small country, roughly the size of Maryland, with a population only about twice that of Maryland, there are some 100 active breweries today, but around the beginning of the twentieth century, in 1907 to be precise, the count was an incredible 3,387 breweries (see "Belgium by Beer, Beer by Belgium" by Annie Perrier-Robert and Charles Fontain, Schortgen 1996). This was apparently the peak in numbers, but the low in profits for Belgian brewing. In the wake of the rise of heavy industry in Belgium (as elsewhere) in the last quarter of the Nineteenth Century, breweries had sprung up like mushrooms after a rain to slake the thirst of the hard-working (and hard-drinking) industrial laborers. Eventually, there were just too many breweries in the market — by some estimates three times as many as might have been sufficient — and not surprisingly, overproduction and competition pushed prices and profits down.

In addition, there was another enemy of Belgian brewing lurking outside the borders: The European lager revolution was in full swing at the turn of the century, propelled by such recent technological advances as refrigeration, indirect-heat malting processes, pure-bred yeast strains, beer filtration and an expanding rail network making long-distance beer transport possible. The early adopters of lager technology in central Europe started to send oceans of their blond, clear, bottom-fermented brews to all the regions of northwestern Europe that had steadfastly resisted the lager pull —mostly the Rhineland of Germany, Belgium, the Netherlands and the British Isles. As the public embraced the new bière à la mode in Belgium, life for the local traditional ale brewers became even more miserable than it already was.

On another front, French wine producers started to slash their prices in 1900 in an effort to get consumers in the north of France and in Belgium to switch from beer to wine, until then considered a luxury drink. As Belgians drank wine at meals in increasing numbers, beer became relegated more to the status of a refreshment than the natural part of the daily gastronomic ritual (as it once had). Clearly, Belgian brewers, beleaguered from all sides, had to come up with something new in their struggle for survival both with each other and with the deluge of foreign lagers and wines. Perhaps a completely new brew, some reasoned, might be the answer. It was within this context that the Belgian golden ale, also known as the Belgian blond or strong ale, was born. In typical Belgian nonconformist fashion, this new brew was a loosely defined style that could be brewed in many different variations. Like many Belgian brews, this style has fairly broad technical specifications (see the "Belgian Golden Ale by the numbers" box), yet the beers that fall into the category are all tied together by a few common ingredients and shared flavor characteristics.

Brewing techniques

The attempt by the Belgian brewers at beer resistance about a hundred years ago gave us a new blond ale style represented by a merry band of golden brands that have stayed the course and evolved

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Belgian Golden Ale by the numbers

OG approx.	1.064–1.096 (20–50 °P)
FG approx.	1.012–1.020 (3–5 °P)
SRM approx.	3–7,
IBU	usually in the range of 25–35
ABV	usually 5–8%

RECIPE

Belgian bière d'or (5 gallons/19 L, all-grain)

OG = 1.066 FG = 1.012
IBU = 30 SRM = 5–7 ABV = 7.1%

Ingredients

- 10 lb. 9 oz. (3.85 kg) Pils or pale ale malt (2–3.5°L)
- 1 lb. (0.45 kg) Dingemans Carapils (6–9°L), Briess Carapils® (1.5–2.5°L) or Weyermann Carafoam® (1.5–2.5°L)
- 1 lb. (0.45 kg) corn, beet or cane sugar (for the kettle boil)
- 6.67 AAU Styrian Goldings hops (60 mins) (1.25 oz./35 g of 5.25% alpha acid)
- 1 oz. (28 g) Czech Saaz hops (20 mins)
- 1 oz. (28 g) Czech Saaz hops (0 mins)
- 1 tablespoon Irish moss
- 1 package Wyeast 1388 Belgian Strong Ale, White Labs WLP570 Belgian Golden, or Wyeast 1728 Scottish Ale Wyeast
- 1 cup corn sugar (for priming)

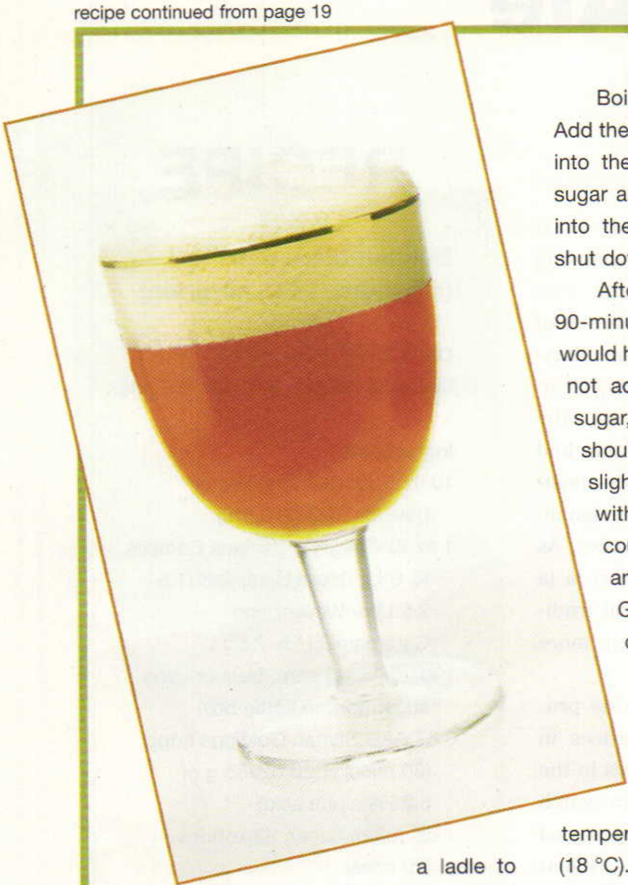
Step by Step

Mill the grain and infuse it with about two gallons (7.6 L) of unheated tap water for an extremely thick mash. Then heat another two gallons (7.6 L) to near the boiling point and keep it at this temperature. You will need this water for a four-hour continuous infusion during which the mash viscosity is gradually reduced (the mash becomes thinner) and the mash temperature raises gradually.

After the dough-in, start applying gentle external heat to your mash tun and infuse the grain bed slowly with the hot water while stirring the mash frequently to avoid scorching the grain at the bottom! You can use a sparge nozzle or just

recipe continued on page 20

recipe continued from page 19



a ladle to infuse the mash. Adjust the temperature and flow rate of your infusion water so that the grain bed reaches the mash-out temperature of about 170 °F (77 °C) without overflowing the mash tun, of course, in about four hours. For an explanation of the continuous infusion process, see the sidebar on p. 21. During a continuous-infusion mash, the grain bed undergoes an abnormal amount of agitation and has no chance to rest. It is, therefore, imperative that you recirculate the extract before running it off into the kettle.

This allows the grain bed to settle and serve as a filter for residual coagulates, gums, and other undesirable particulate. Once the extract runs clear, let the level in the mash tun drop until there is barely one inch (2.5 cm) of liquid above the grain bed.

The next step is to sparge with about two gallons or so (almost 8 L) of water (quantity varies with your system's extract efficiency) at the mash-out temperature. Stop the sparge when the kettle gravity reaches approximately 1.050.

Boil the wort for about 90 minutes. Add the bittering hops about 30 minutes into the boil; the flavoring hops, corn sugar and Irish moss about 70 minutes into the boil; and the aroma hops at shut down.

After evaporation during the 90-minute boil, the kettle gravity would have been at about 1.056 had we not added the corn sugar. With the sugar, the wort's OG at shut-down should be at the required 1.066 or slightly above. Liquor the wort down with cold water if necessary. Of course, you could always go ahead and just ferment a heavier beer. Given the golden ale's wide range of specifications, no harm would be done.

Let the wort rest for about 30 minutes to allow the trub to settle, then heat-exchange it to a primary fermentation temperature of approximately 65 °F (18 °C).

Belgian strong ale specialists such as White Labs WLP570 (Belgian Golden Ale) or Wyeast 1388 (Belgian Strong Ale) yeasts are good choices. Alternatively, in deference to Moortgat, which ferments its Duvel with ale yeast bred from the Scottish McEwans brewery, you can also use Wyeast 1728 (Scottish Ale) yeast.

Primary fermentation should be complete within 6 to 8 days. Rack into a secondary fermenter for a month-long lagering, preferably at 27 °F (-3 °C) or as close to the freezing point as your setup allows.

Rack the brew again and add the priming agent. Package in bottles or a Cornelius keg and condition roughly at room temperature for 3 to 4 weeks. Finally, age the brew at about 40 °F (4 °C) for at least 6 weeks before serving it at that temperature.

Belgian bière d'or Ale

(5 gallons/19 L, extract-plus-grain)

OG = 1.066 FG = 1.012
IBU = 30 SRM = 5–7 ABV = 7.1%

Ingredients

7.7 lbs. (3.5 kg) pale ale or Pils liquid malt extract (brewer's choice)
1 lb. (0.45 kg) Dingemans Carapils (6–9°L), Briess Carapils® (1.5–2.5°L) or Weyermann Carafoam® (1.5–2.5°L)
1 lb. (0.45 kg) corn, beet or cane sugar (for the kettle boil)
6.67 AAU Styrian Goldings hops (60 mins) (1.25 oz./35 g of 5.25% alpha acid)
1 oz. (28 g) Czech Saaz hops (20 mins)
1 oz. (28 g) Czech Saaz hops (0 mins)
1 tablespoon Irish moss
1 package Wyeast 1388 (Belgian Strong Ale), White Labs WLP570 (Belgian Golden), or Wyeast 1728 (Scottish Ale) yeast
1 cup corn sugar (for priming)

Step by Step

Coarsely mill or crack the Carapils® or Carafoam® and place in a muslin bag. Steep in about a gallon of 162°F (72°C) water for about an hour for maximum conversion of starches into unfermentable sugars for extra body and mouthfeel. Lift the grain out of the steeping liquor and rinse with several cups of cold water without squeezing the bag. Discard the grain.

Meanwhile, heat about four gallons (roughly 16 liters) of water to the boiling point. Shut down the heat and stir in the LME. Then add the steeping liquor. Bring back to a boil. From here on, follow the equivalent instructions for the all-grain version.

Belgian bière d'or

(5 gallons/19 L, all-extract)

OG = 1.066 FG = 1.012
IBU = 30 SRM = 5+ ABV = 7.1%

Ingredients

Simply use the extract-plus-grain recipe above, but omit the steeped grain. Using 8.5 lbs. (3.9 kg) of liquid malt extract overall will produce a slightly thicker and darker version of the all-grain brew, but it will still be within the Belgian golden ale specifications.

continued from page 19

into one of the world's great classic brews. A Belgian golden is usually fuller in body and mouthfeel than a Pilsener against which it was designed to compete. With an alcohol content normally of between 5 and 8% ABV (though some golden ales may go up as high as 12% or higher), it is also stronger than the ordinary 5% brew. In "un-Belgian" fashion, this Belgian ale is lagered for almost a month around the freezing point like an Altbier and a Kölsch. But after lagering, this golden is back to being a Belgian: It is primed and bottle-conditioned — first at room temperature for about 10 days, then at a refrigerator or low cellar temperature for another month and a half. The most authentic malt choice for the Belgian golden is of course a grist from Belgium, but other malts work well, too. Perhaps the most readily available Belgian malts for homebrewers are those from the family-owned Mouterij Dingemans, founded in 1875 in Stabroek, in Flanders, northwest of Antwerp, near the Dutch border. This maltery makes a full range of base and specialty malts using grains from Belgium, France, Holland, England and Germany.

Compose your grain bill very simply from top-quality pale ale or Pils malt (Dingemans, Briess, Muntons, Weyermanns, et al.), optionally augmented by about 10% light-colored caramel malts such as Dingemans Carapils or, if difficult to come by, Briess Carapils® or Weyermann Carafoam® (each at approx. 1.5–2.5°L). Note that the Belgian Dingemans pale ale (2.7–3.8°L) and pale caramel (6–9°L) malts will push the beer color more towards 7 °L, perhaps even a bit beyond, while the American Briess or German Weyermann malts will push the color closer to 5 °L.

For extra body, head and alcohol, add some clean-tasting sugar, such as corn, beet or cane sugar to the kettle In our recipe (see p. 19), one pound of sugar bumps up the ABV from 5.8% to approximately 7.1%.

The best hop choices for the Belgian golden are such aromatic varieties as English East Kent Goldings, Slovenian Styrian Goldings and Czech Saaz, either singularly or in combination.

The yeast ought to be a very clean-fermenting alcohol-tolerant specialist ale strain such as a Belgian strong ale yeast or a Scottish ale yeast.

The process for making a Belgian golden is elaborate, as the Moortgat brewery in Breendonk (north of Brussels), hints at on its Website. Moortgat is the maker of Duvel, the classic and most successful example of Belgian golden ales. This beer style requires a very extensive mash regimen. At Moortgat it is a four-hour multi-step infusion, in which anything that can be converted will be. To replicate the complex infusion mash employed by Duvel, I use a continuous infusion mashing technique that starts out with an extremely thick dough-in with about two gallons (nearly eight liters) of straight cold tap water. The precise mash temperature at this stage is irrelevant.

After the dough-in, I very slowly infuse the mash with a constant trickle of near-boiling water for four hours while applying gentle heat to the mash tun from below to the mash-out temperature of about 170 °F (77 °C). As the mash heats and thins slowly, it will pass through all the relevant temperature bands for activating all the grain's enzymes (for details, see sidebar to the right).

For information on extract brewing of the Belgian golden, see our recipe. Also, for those looking for a quick and easy Belgian golden ale, there is a golden ale brew kit available from BrewFerm.

The golden taste of the Belgian golden

The result of the golden ale's lengthy brew house and fermentation ritual is a clean-tasting beer, low in phenolic astringency, full-bodied and effervescent. The brew's fine, péttilant, champagne-like effervescence produces a rich and stable head — one of the tallest, sturdiest and creamiest heads of any beer in the world. When you poor a Belgian golden, therefore, always use a larger glass than you may think you need to allow for the beautiful foam. The beer is surprisingly easy-drinking and refreshing. The beer's bouquet and finish are slightly spicy, aromatic and reminiscent of an Alsatian eaux-de-vie.

Horst Dornbusch writes "Style Profile" in every issue of Brew Your Own.

Continuous Infusion Mash Explained

A continuous infusion mash is ideal for big, complex, higher-gravity, highly attenuated beers, especially when decoction is not an option. Continuous infusion involves doughing in with cold liquor (the temperature is not important) to create as thick a mash as possible and then gradually — very gradually — heating and thinning the mash through direct heat and a trickling infusion of hot-water until the grain bed reaches the mash-out temperature. This mashing technique is very labor-intensive because of the need to stir the mash frequently. It also requires constant attention to avoid scorching the grain. On the plus-side, however, it gives the grain plenty of time to hydrate, which increases enzymatic and extract efficiency. Finally, a continuous infusion mash takes the grain bed slowly through all temperature ranges to activate all enzymes in the grain. Among the more important enzymatic activities in the mash are the following:

- At 95 °F (35 °C), gum converting enzymes kick in. These enzymes peak at 113 °F (45 °C) and stop at 131 °F (55 °C).
- At 100 °F (38 °C), which happens to be around body temperature, phytase enzymes become active. These enzymes slightly acidify the mash.
- At roughly 104 °F (40 °C) protein-converting proteolytic enzymes become active. They peak at 122 °F (50 °C), weaken at about at 140 °F (60 °C) and become denatured at 176 °F (80 °C) — which is well above the typical mash-out temperature.
- Also at roughly 104 °F (40 °C), the starch-converting diastatic enzymes beta amylase kick in. They produce a lot of fermentables for plenty of alcohol later on. Beta amylase activity peaks as the mash approaches 149 °F (65 °C), after which these enzymes slow down. They all but stop working at 158 °F (70 °C).
- At 140 °F (60 °C), alpha amylase, the enzymes that produce complex, unfermentable sugars kick in. These peak at 162 °F (72 °C) and stop working at the same temperature as do the proteolytic enzymes, at 176 °F (80 °C).

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DOWN TO THE ROOT

At some point, you may look at your brewing equipment and wonder what else you can do with it besides making beer. Some homebrewers branch out into other fermented beverages such as cider, mead or wine. However, you can also take a cue from many commercial breweries — including Tommyknocker (Idaho Springs, Colorado), Sprecher (Milwaukee, Wisconsin), Abita (Abita Springs, Louisiana), Old Dominion (Washington, DC), Millstream (Anama, Iowa), Stevens Point (Stevens Point, Wisconsin), Goose Island (Chicago, Illinois) and Saint Arnold (Houston, Texas) — and make a non-alcoholic brew, root beer.

The basic idea behind brewing root beer is that you choose your flavorings, sweeten the beverage and then carbonate it. Just as with real beer, making homemade root beer can be an easy or complex process. Beer brewers may choose either extract or all-grain methods of making beer. When making root beer, you have a similar choice. There is a simple method in which your flavors come from root beer extract. Alternately, you can boil various roots, barks, herbs and spices to obtain your flavoring. You also have options with regards to your choice of sweetener and how to carbonate.

For my first batch of root beer, I took the easy route and used an extract promising "Old Time Flavor." I used conventional granulated sugar and standard Red Star baking yeast and in about 20 minutes I had 1 gallon (3.8 L) of root beer ready for bottling. So why go the extra mile and make the product from scratch? The root beer brewers contacted for this article agreed that the final results of a from-scratch method are generally better — especially if the highest quality ingredients are used. The nutty, natural flavors stand out and remain truer to the earthy nature of the drink, when it truly earned the name root.

Getting to the root of root beer

So where did this drink come from? Beer, it is widely believed, was accidentally invented during Mesopotamian times more than 5,000 years ago when grains sitting in some liquid fermented in a warm clay pot. Gradually, the process was refined into a (more or less) calculated product suitable for popular mass consumption. Root beer, in contrast, required a conscious effort from the start and was in part developed by brewers out of the need for a non-alcoholic beverage that was suitable for children when drinking water was potentially a risky proposition. (Homemade root beer that gets its carbonation from fermentation in the bottle generally has less than 0.25–0.35% alcohol. Force carbonated root beer is entirely non-alcoholic.) Other scholars believe root beer has its genesis in the early American colonies, initially developed because of the lack in traditional beer-making ingredients. Adventurous brewers blended herbs and barks with sweeteners like honey and tree saps to make root beer.

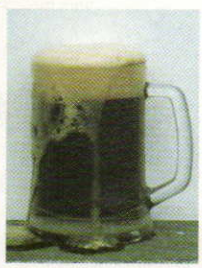
Root beer gained in popularity during Prohibition, when many breweries turned to making this soft drink — instead of "hard" beer — to stay afloat.

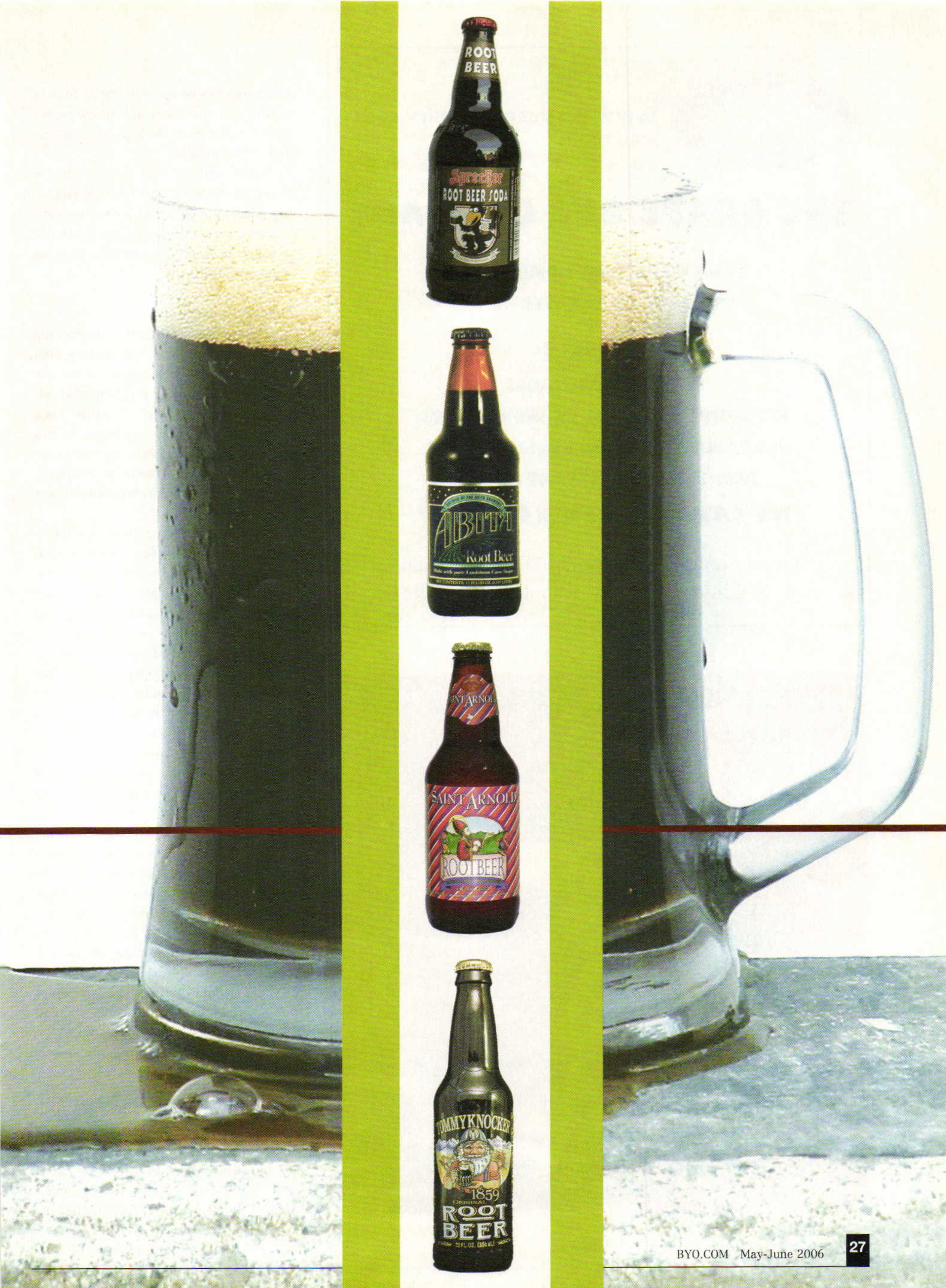
Water

Choosing your water when making root beer is easy. You can use bottled spring water or filtered tap water. As long as it tastes good, you're good to go. Water

by GLENN BURNSILVER

MAKE YOUR OWN rooTbEEr

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treatments can be applied, just as in beer making, but make sure any additives dissolve completely. Avoid high levels of calcium or magnesium.

When making root beer with the extract, there is no "root wort" to boil, so any particles might find a way into the finished product. However, the water will be boiled for most "from scratch" versions of this soft drink.

Sweeteners

There are numerous sweetening options when it comes to making root beer: cane sugar, corn sugar, corn syrup (including the favorite of commercial soft drink makers — high fructose corn syrup), malt extract (maltose), brown sugar, beet sugar, maple syrup (use grade B for better flavor), honey or molasses. You can even use low-calorie sweeteners such as Splenda.

Working with the extract, the directions do not seem to play a favorite, simply calling for "sugar or sweetener." One brewer tossed out the possibility of mixing in some lactose for a creamier finish and increased mouthfeel. And, he hypothesized, this might also decrease the formation of alcohol in the final product, as lactose sugar is non-fermentable. Each of these sweeteners will impart a distinctive, though subtle, flavor and level of sweetness.

Steve Indrehus, head brewer at Tommyknocker Brewery swears by maple syrup as the perfect sweetener for his "1859 Root Beer," while Heath Greenwald owner of Palisade Brewery and Jackson Hole Soda Company in Palisade, Colorado will use nothing less than pure cane sugar in his root beer. "Only pure cane sugar," Greenwald explains. "It has a real rich, thick, creamy flavor. It makes all the difference." Fans of Mexican Coca-Cola or Dr. Pepper from the original Dr. Pepper bottling plant, in Dublin, Texas — both of which use cane sugar in place of the cheaper high-fructose corn syrup — also claim that cane sugar makes for a better soft drink.

Nutritional labeling reveals that most commercial sodas contain around 36–46 g of carbohydrate per 12-oz. (355-mL) serving. This translates to 10–14 °Brix (SG 1.040–1.044). Translated to homebrew-scale production, 1 pound of sugar per gallon (0.12 kg/L) yields a 12 °Brix (approximately SG 1.048) solution. However, the main reason some people make root beer (or other sodas) at home is to make a version that is less sweet.

Carbonation

There are two ways to carbonate your soda — force carbonation or bottle conditioning. To force carbonate root beer, just rack it to a Cornelius keg, refrigerate and apply carbon dioxide pressure. Most commercial sodas are carbonated to around 3.5 volumes of CO_2, higher than most beers excepting certain Belgians. At 40 °F (4.4 °C), standard refrigerator temperature, you would need to apply 22–24 PSI of pressure. You may also wish to have a longer dispense line to get a good pour at this pressure, which is elevated compared to the pressure beer is typically stored under. Force carbonated root beer has no alcohol in it.

The second way to carbonate root beer is to transfer the sugary solution to bottles and add yeast. The yeast will begin to consume the sugar, making carbon dioxide and a small amount of alcohol. When the proper amount of carbonation is reached, the bottles are refrigerated and consumed quickly, before dangerous amounts of carbonation build up.

Just like in making beer, the selection of yeast is also very subjective. Many root beer extracts call for using bakers yeast. Bakers yeast is grown aerobically and is packed full of glycogen. However, once this glycogen is expended, it is a poor fermenter. As such, it is the safest choice for bottle conditioning soda as it would likely be the slowest to reach excessive levels of carbonation. Add the yeast at a rate of around ⅛ to ¼ teaspoon per gallon.

Many brewers, however, may want to use beer or wine yeast and the one you use can make a big difference. The difference is not so much in flavor (you wouldn't want to use a spicy Belgian ale yeast for root beer anyway), but in the levels of carbonation and temperature that fermentation can take place. A neutral ale yeast, like Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) are generally recommended.

"From my beer-making experience I'd say you want a low attenuation, low temperature tolerant yeast so it doesn't have a lot of impact on the flavor," Indrehus says. "A low attenuation yeast that is a highly flocculent yeast so it isn't cloudy is good too."

The root of the sassafras plant (*Sassafras albibum*), once a main ingredient in root beers, is now deemed a carcinogen.

photo courtesy of University of South Sewanee

Fermentation with ale yeast generally all but ceases once the bottles are in the refrigerator. If left out, even at room temperature, the high volume of sugar in root beer allows fermentation to continue unimpeded and the bottles may explode. It is recommended that fermentation take place at room temperature. Open one bottle every day (or perhaps even one every 12 hours) and then refrigerate all the bottles once your desired level of fizziness is reached. Bare this in mind when deciding what size batch to make.

Champagne yeast is recommended in many recipes and provides more than ample carbonation, but it also ferments at colder temperatures — as low as 45 °F (7 °C). This means caution must be used as the explosive risk increases. Even when storing the root beer in the fridge, some fermentation can take place. Similarly, lager yeast, while having a dry, often neutral flavor, also can ferment at low temperatures and is not recommended.

Although many sources recommend using thick glass beer bottles — such as German wheat beer bottles — when bottle conditioning root beer, *Brew Your Own* recommends that you use plastic soda bottles. Gas pressure from yeast activity can easily cause glass bottles to explode and this is a fairly common occurrence when the bottle-conditioning method of carbonation is used.

Plastic bottles can also rupture if enough pressure builds up, but they can generally withstand higher pressures and will not give off "shrapnel," as a glass bottle would. As an added benefit, you can squeeze the bottles to get some idea of the level of carbonation building up.

pop **CULTURE**
FLAVORS, FIZZ, ZIP AND KICK

Once you understand how to make root beer, it's immediately obvious how to make any kind of soft drink. All you need to do is combine some flavorings, sugar and carbonation. Colas are usually flavored with vanilla, cinnamon, lemon oil and orange oil, with caffeine from kola nuts and color from caramel. Many popular soft drinks are citrus flavored, incuding lemon-lime drinks such as 7-Up or Sprite. Mountain Dew is flavored with concentrated orange juice. (The color comes from FD&C Yellow #5.) Most grape sodas, such as Grape Crush or Welch's Grape Soda, feature the flavor of Concord grapes. Recently, "energy drinks" such as Red Bull or Crunk!! have become popular and these contain a variety of ingredients, including guarana, ginseng, vitamin B, ginkgo biloba . . . and lots of caffeine. Exact formulas for commercial products are closely guarded secrets.

The amount of carbonation greatly effects how the beverage is perceived and often is tailored to match the type of soft drink. Fruity soft drinks may have as little as 2 volumes CO_2 whereas ginger ale can have up to 4 volumes. Higher levels of carbonation can lead to a "carbonic bite," which may or may not be appropriate, depending on the other flavors.

In many soft drinks, sweetness is offset by some acidity. In most varieties of soda, especially those with a citrus component, citric acid is added. In colas, phosphoric acid is used instead. Malic acid is used in sodas with a berry-based flavor. All of these acids can be found in homebrewing or winemaking shops. Citric and malic acids are sold as white crystals. Phosphoric acid is usually sold in a 10% solution. For 5 gallons (19 L) of soda, use 0.15–1.0 ounces (4.3–28 g) of citric acid or around 0.75 ounces (21 g) of malic acid. If you are making a cola, use 2.1 ounces (60 g) (by weight) of 10% phosphoric acid. (Coke has a pH of 2.5.) For root beers, citric acid is preferred.

Caffeine is a popular ingredient in many kinds of soft drinks. It does not add any flavor, but is present for its stimulant effects. The concentration of caffeine in soft drinks varies quite a bit, with the average being near 40 mg per 12 oz. serving. This translates to 2,133 mg per 5 gallons (19 L). Ten 200 mg caffeine pills, available at many stores that sell excercise supplements, would work for this. Jolt cola and many energy drinks have around twice this amount. A small amount of citric acid (roughly equal to the amount of caffeine) helps the solubility of the caffeine. Root beer, as well as most lemon-lime soft drinks, typically do not have added caffeine.

— Chris Colby

"The traditional flavor of 'old time' root beer came from sassafras root, often paired with sarsaparilla root."

The root of the matter

The most fundamental difference in methods of root beer production is how the flavoring is obtained. Brewing root beer from extract is very quick and root beer extract can be found in most homebrew shops.

Brewing a root beer from scratch takes more time and some effort — especially in finding some of the less common ingredients if there isn't a well-stocked natural foods store nearby. If you can't find an ingredient you want locally, a search of the internet almost always yields multiple sources.

There are a wide variety of ingredients possible for root beer, depending on which recipe you follow. The main ingredient in most modern root beers is wintergreen, often accompanied by vanilla. A popular ingredient in chewing gum, wintergreen has a fresh, lively flavor and pungent aroma. When mixed with the additional ingredients in the soda, the wintergreen also provides a nice balance against the sweetness.

The traditional flavor of "old time" root beer came from sassafras root, often paired with sarsaparilla root. However, in 1960, the Food and Drug Administration banned the use of sassafras in processed foods — including commercial root beer — after it was found to cause cancer in laboratory rats. It is still legal to sell the root and bark. Many recipes still call for this ingredient, but don't despair; there are now extracts available with the safrole (the carcinogenic substance in sassafras root) removed that will still impart the proper flavor. Other possible root beer ingredients include vanilla, ginger, licorice root, anise seed, birch bark, juniper berries, star anise, chirreta, yerba mate, dog grass, wild cherry bark and roots of sarsaparilla, burdock, yellow dock, dandelion and spikenard. Hops are also found in many recipes and are used to balance the sweetness with a touch of bitterness and the bark of a South American tree called *Quillaia saponica* is sometimes used as a heading agent. If there is a particular commercial root beer you enjoy, take a look at its label. Most simply list "natural and artificial flavors," but a few — including the German "gourmet" root beer, Virgil's — give all their ingredients.

With ingredients in hand, the usual procedure is to boil (or simmer) the ingredients to extract their flavor. You may boil the ingredients in a volume of water equal to your batch size, or you can make a flavor concentrate by boiling them in less water. Boil times vary from a few minutes to several hours. You can always take a small sample — cooled and perhaps sweetened — and taste it to assess your progress during the boil.

When finished, the solids are strained out of the liquid, sugar is added and the solution is cooled and transferred to a keg or bottles. The recipes on this page give the amounts and boiling procedures for many of the most common root beer ingredients. In addition, numerous recipes can be found on the internet or in books on soda making, such as "Homemade Root Beer, Soda & Pop," by Stephen Cresswell (1998, Storey).

Note that it is easy to make small-scale test batches of root beer. Even uncarbonated, a cooled and sweetened sample will tell you if you are on the right track. You can even boil individual roots and bottle each extract in sanitized bottles (without any sugar). You can then use these extracts to concoct your root beer. Most root beers are colored with caramel coloring and you can use this, or molasses, to give yours a darker color.

Cleaning

As when making beer, you need to clean and sanitize your equipment when making root beer. After kegging root beer, your keg will need to be cleaned thoroughly before using it for beer again. Although the stainless steel itself can be cleaned (and perhaps soaked in a baking soda solution overnight) to remove any flavors, the rubber O-rings will need to be replaced. If you can keep a dedicated root beer keg, you can avoid accidentally producing a root beer Kölsch.

There you have it, the basic knowledge to make root beer. Heck, it might just be the thing to keep the significant other happy and obliging in your beer pursuits. Now bearing that in mind, isn't it worth at least a try?

Glenn BurnSilver wrote "10 Clones from the Dark Side" in the September 2005 issue of Brew Your Own.

None of the root beer brewers contacted for this story would divulge their secret ingredients, nor provide a recipe. That's OK; there are plenty on the Internet to choose from that range from simple to extremely complicated. Here are a few that will get you going. Most of the herbs and roots can be found at natural food stores.

Extract Root Beer (5 gallons/19L)

Ingredients

4 fl. oz. (117 mL) root beer extract
5 lb. (2.3 kg) cane sugar
1/2 pkg (~5 g) ale yeast (optional)

Step by Step

Add 2 gallons (7.6 L) of water to your brew kettle and begin heating it. Gradually stir in sugar and bring solution to 160 °F (71 °C), add root beer extract and hold for 15 minutes. (This will sanitize the solution.) Cool the solution by placing your brewpot in a sink full of cold water. (Don't risk staining and flavoring your copper wort chiller for this.) Let cooled solution sit for 5 minutes to let any particles settle out. Siphon to a keg and add water to make 5 gallons (19 L). Or, add water in your brew kettle to make 5 gallons and stir in yeast. Siphon directly to plastic bottles. (As with your wort chiller, don't risk a permanent root beer flavor by using your bottling bucket.) Cool keg and force carbonate or let bottles condition at room temperature until carbonated. To make only one gallon (3.8 L), divide all ingredients by five.

Half and Half Root Beer (5 gallons/19 L)

Half of the flavor — (artificial) sassafras and vanilla, plus spruce and birch — in this recipe comes from root beer extract. The other half comes from boiling various ingredients. The licorice root and anise lend a licorice-like flavor (not unlike that in IBC), while the star anise and hint of wintergreen round out the flavor profile.

Ingredients

2 fl. oz. (59 mL) Zatarains root beer extract
2 oz. (56 g) licorice root
1.5 oz. (43 g) anise seed
0.5 oz. (14 g) star anise
0.25 oz. (7 g) dried wintergreen leaves
4.4 lbs. (2.0 kg) cane sugar
up to 2.5 tsp. citric acid (to taste)
1/2 pkg (~5 g) ale yeast (optional)

Step by Step

Heat 2 gallons (7.6 L) of water to a boil, turn off heat and add licorice root, anise, star anise and wintergreen. Let this solution simmer for 30 minutes, then strain out as much of the solids as is feasible with a kitchen strainer. Stir in sugar and check that temperature is at 160 °F (71 °C) or higher. Let sit for 15 minutes, covered, then cool brewpot in your kitchen sink. Siphon cooled root beer to keg and add water to make 5 gallons (19 L). Taste root beer and add citric acid, if desired, to taste. Cool root beer overnight and force carbonate to 3–3.5 volumes of CO_2. Alternately, add yeast and bottle.

Old Prospector Root Beer (5 gallons/19 L)

Ingredients

4 oz. (113 g) dried sarsaparilla root
2 oz. (57 g) dried burdock root
2 oz. (57 g) dried yellow dock root
2 oz. (57 g) dried spikenard root
1 oz. (28 g) hops (your choice)
8 cups sugar
12 fl. oz. (355 mL) molasses
1/2 pkg (~5 g) ale yeast (optional)

Step by Step

Simmer herbs in water for 30 minutes. Add sugar and molasses, stir to dissolve, and let sit for 15 minutes above 160 °F (71 °C). Cool root beer, siphon to keg and add water to make 5 gallons (19 L) . Force carbonate. (Or, add yeast and bottle.)

Birch Bark Canoe Root Beer (5 gallons/19 L)

Ingredients

4 oz. (113 g) birch beer extract
2 inches (5.1 cm) cinnamon stick
3.5 lbs. (1.6 kg) corn sugar
1.0 lb. (0.45 kg) honey
1/2 pkg (~5 g) ale yeast (optional)

Step by Step

Boil cinnamon stick for 15 minutes, add sugar, honey and birch beer extract and let sit for 15 minutes. Cool, add water and either keg or bottle condition.

photo courtesy of britainonview.com

by **TERRY FOSTER**

CHANCELLOR ALE

For almost 600 years, the individual colleges which made up Oxford University in England had their own breweries. By the second half of the Nineteenth Century, however, the colleges had largely ceased to brew for themselves. But Queen's College (founded and brewing since 1341) soldiered on, brewing its own beer until 1939.

Queen's brewed two products, an "everyday" College Ale and Chancellor Ale — brewed only once a year in October. Two separate mashes were carried out and boiled separately, with the transfer from underback to copper being achieved by means of a hand pump — which was made in 1778! (The underback is a vessel that collects wort from the lauter tun and, of course, copper is another word for kettle.) Cooling was done in long shallow vessels, known as coolships, although by the Twentieth Century cooling was actually controlled by a movable cold liquor coil. The cooled liquor was ladled(!) into wooden casks for fermentation. The yeast worked through the bunghole into a trough, from which clear beer was ladled back into the casks. After about six days, the beer was ladled to 3-barrel casks, dry-hopped, then left to mature for two to three weeks in the case of College Ale, or a year or more in the case of Chancellor Ale.

The recipe for Chancellor Ale looks very much like that used for October beer in various early eighteenth century publications, notably William Ellis' *Town and Country Brewer*. Recipe? Yes, you heard me correctly, we actually have a recipe for this beer. This is unusual for an "archaeological beer." In reproducing old beers, it is usually necessary to make some educated guesses from the original documentation. In this case, because the beer survived pretty much unchanged into the nineteenth century, there are two sources that literally give College and Chancellor Ale "by the numbers":

	College Ale	Chancellor Ale
OG	1.068 (1070)*	1.135 (1140)*
FG	1.018	1.054
ABV	6.3%	10.6%

[*The figures in parentheses are from H. Lloyd Hind's "Brewing Science and Practice," 1938. Other figures are from a 1927 article in *Brewers Journal*.]

That's not much of a recipe at first sight. Color analysis was done by an obsolete method, but we know the grist was only pale malt. The quantities of malt needed will depend on your extraction efficiency and the differences in OG from the two references indicates that there were often variations in extract. We do not have IBU numbers either, but hop rates were at 8 lbs. per British barrel in the boil. We don't know what the alpha-acid level of the hops (likely Goldings) was, but even if it was as low as 2%, calculated IBUs would have been around 90. We are also told that the beer was dry-hopped in cask with "a few handfuls of hops."

(Back in 1340, no hops would have been used, and they would have been ales in the original sense of the word.)

Wort Preparation

To make 5 gallons (19 L) by mashing, you are going to need to handle over

25 lbs. (12 kg) of grain. For me, a 3-gallon (11 L) brew length makes things more manageable. So that's what my recipes are based on.

There are several ways to prepare the wort for this beer:

1.) Take only the first high-gravity runnings from a big mash, and either discard the rest or make a "small beer."

2.) Do a normal mash and collect the first two gallons or so, which should be around 1.100 (24.8 °P), and put them aside. Then sparge and collect all the runnings and boil until their SG is close to 1.100 (24.8 °P). Add the first runnings, and proceed with the boil. This is tedious, but it makes it easier to get close to both your target gravity and target volume.

3.) Split the mash into two sessions.

4.) Do an all-extract brew. This offers the possibility to achieve better hop utilization if a portion of the extract is added close to the end of the boil. However, this method can result in poor attenuation in

Chancellor Ale

(3 gallons/11 L, all-grain)
OG = 1.141 FG = 1.060
IBU = 90 SRM = 20+ ABV = 10.6%

Ingredients

16.9 lb. (7.7 kg) 2-row pale malt
7.4 AAU Target hops (90 mins)
(1.5 oz./43 g at 11.6% alpha acid)
1 oz. (28 g) Fuggles hops (0 mins)
2/3 tsp. Irish moss
White Labs WLP007 (Dry English Ale) yeast (two 1.6 qt./1.5 L starters)

Step by Step

Mash in at 148–150 °F (64–65.6 °C), using about 1.2–1.4 quarts of water per pound of grain (2.5–2.9 L/kg). After 90 minutes, run off the first 2 gallons (7.6 L) and set aside; these should have an SG of 1.090–1.110 (22.4–27.1 °P). Sparge to collect a further 5 gallons (19 L) or so, by which time the runnings should be around SG 1.010–1.012 (2.6–3.1 °P); do not go any lower or off-flavors may result. Measure the total volume and SG of the second wort. [Calculate total gravity by multiplying the volume of each wort times its gravity (in "gravity points" (GP) — i.e. 1.056 = 56 GP) then add these two numbers. Divide the sum by 140, yielding the final volume you need to reach in order to have an OG of 1.140 (34 °P).] Boil the second wort until the SG is around 1.090–1.110 (22.4–27.1 °P), then combine with the first wort. Boil vigorously for an hour or so, then add the bittering hops and boil for another hour or so, or until you have reached the desired final volume. Add the Irish moss 10–20 minutes before the end of the boil. As you turn off the heat, add the finishing hops; adjust the volume with cold, sterile water if required. Cool to 70 °F (21 °C), and pitch the yeast starters. Oxygenate for 3-4 minutes after pitching. When primary fermentation is complete, rack to secondary; if the SG of the beer is 1.070 (17.1 °P) or higher, re-pitch with a fresh yeast starter. Rack again after 2–3 weeks, preferably into a stainless steel soda keg, and leave to mature in a cool, dark place. This beer is best bottled by means of a counter-pressure filler. You don't want to add priming sugar to the bottles, as there may still be a slow fermentation taking place. Over a maturation period of a year or so this can result in overly high bottle pressures.

Chancellor Ale

(3 gallons/11 L, grains plus sugar)
OG = 1.141 FG = 1.050
IBU = 90 SRM = 20+ ABV = 12.1%

Ingredients

14.0 lb. (6.4 kg) 2-row pale malt
1.5 lb. (0.68 kg) dark brown sugar
17.4 AAU Target hops (90 mins)
(1.5 oz./43g at 11.6% alpha acid)
1 oz. (28 g) Fuggles hops (0 mins)
2/3 tsp. Irish moss
White Labs WLP004 (Irish Ale) yeast (two 1.6 qt./1.5 L starters)

Step by Step

Exactly as in the previous recipe, except that sugar is added at the end of the boil; take great care to stir thoroughly and make sure that all the sugar is dissolved.

Chancellor Ale

(3 gallons/11 L, extract plus sugar)
OG = 1.140 FG = 1.061
IBU = 90 SRM = 20+ ABV = 10.4%

Ingredients

10.5 lb. (4.8 kg) pale malt extract syrup
1.5 lb. (0.68 kg) dark brown sugar
17.4 AAU Target hops (90 mins)
(1.5 oz./43g at 11.6% alpha acid)
1 oz. (28 g) Fuggles hops (0 mins)
2/3 tsp. Irish moss
White Labs WLP007 (Dry English Ale) yeast (two 1.6 qt./1.5 L starters)

Step by Step

Carefully dissolve 5 lb. (2.27 kg) of extract in 3.5 gallons (13L), bring to a boil and add the bittering hops. After 45 minutes, turn off the heat and very carefully dissolve the remainder of the malt extract and the sugar. Then turn on the heat and boil for a final 15 minutes, adding Irish Moss for the last 10 minutes, and the flavor hops when you turn off the heat. Cool, ferment and mature as for the grain recipes.

fermentation, depending upon the extract used. It may also result in a paler beer, and because of the shorter boil time there will be less wort caramelization.

5.) With any of the mashing approaches, you can also adjust the wort gravity with the addition of sugar or malt extract. If you add sugar, it will help with attenuation, making the beer a little drier. This is not a bad thing, as such beers can be quite sweet. However, limit the amount of sugar to a maximum of 15% of total fermentables.

Ingredients

The malt bill is very simple — 100% pale malt; US or English 2-row are fine, with Maris Otter being the top of the line. You should aim for a mash temperature of 148–150 °F (64–65.6 °C).

In the case of extract, use a British extract if possible. If not, then simply go for a pale unhopped extract.

Earlier on, I suggested that this beer was hopped to around 90 or more IBU. That was a little misleading, for I was assuming a standard level of hop utilization (25%). However, in a wort of this gravity, utilization is going to be lower than normal. Since we do not know hop alpha-acid or IBU levels for Queen's Chancellor Ale, we are in the realm of guesswork. One option is to use 9 ounces (0.26 kg) of whole hops in 3 gallons (11 L), as the Queen's brewers did. I opted instead for high-alpha pellet hops (Target at 11.6%) and aimed for 80–90 IBU, assuming 20% utilization. This way, I would get just about all the bitterness I could in this beer and would lose less wort in the trub. I also added some Fuggles as aroma hops at the end of the boil. If you wish, you can also dry-hop the beer with about ½ oz. (14 g) of Fuggles or Goldings in the fermenter.

Fermentation

If you do not get good fermentation, and the yeast fails to give good attenuation, this beer is going to be sickly-sweet. It may also be very dangerous to bottle it! Use a good, strong ale yeast, preferably one that previously worked well for you with strong beers.

You must pitch plenty of yeast, so it is essential to make an active starter. I like to use two vials to make two separate starters of 1.6 quarts (1.5 L) each. Just make 3.2 quarts (3 L) of wort at around

SG 1.040 (10 °P) and split it into two suitable vessels. Pitch the yeast when the wort is cool, then oxygenate for 2–3 minutes. Do this 2–3 days before you plan to brew. When the wort is ready, decant off most of the liquid from the starters, and pitch the sediment.

Oxygenate your main wort thoroughly (for 3–4) minutes after pitching. It does not matter if the fermentation temperature goes as high as 80 °F (27 °C) — it probably went this high in the Queen's brewery.

The numbers for Queen's College version indicate about 60% attenuation. If you get only 40–50%, re-pitch a fresh starter of yeast. Don't use Champagne yeast at this stage, as it is likely to give something that is neither beer nor wine!

Maturation

This is a beer meant to be kept for a year or more, before being drunk. This can cause some problems. There will still be some yeast remaining after racking to the final vessels. Because of the high terminal gravity, further fermentation may take place with the risk of bottles exploding. The best approach is to keep the beer in keg for a year, then bottle. (I used my 3-gallon (11-L) kegs for this.) If you insist on bottling, then keep the beer in secondary for 2–3 months, and check that there has been no change in SG over several weeks before bottling. Carelessness on this point could result in flying glass and loss of eyesight or other serious injuries!

Conclusion

Chancellor Ale is a historical beer for which we have rather an unusual amount of information, so we can be sure that our reproduction is as authentic as possible. It is also a very strong beer, rich and complex despite the simple malt bill, with lots of promise for flavor development as it matures. It would be interesting to make one such brew every year for a number of years, and see how each develops with time. I can't tell you any more about my own brews yet — they're still only a few months old! For the record, all the recipes are exactly as I have brewed these beers, within the space of one month in December 2005.

Terry Foster wrote about mild ale in the September 2005 issue of BYO.

BRITISH

The location of *Brew Your Own's* scientific lab complex is a closely guarded secret. (OK, it's in my kitchen.) There, a team of scientists (actually, it's just me) works ceaselessly (when I feel like it) on a variety of brewing projects. Last year, the team decided to clone (find an excuse to drink) some classic British ales. In order to increase their chances of success (out of laziness), the team decided early on to only attempt clones of beers for which a lot of information was available. Information was gleaned from the worldwide web (www.englishgirlsgonemild.com), the collected works of Michael Jackson (insert your own joke here) and other homebrew sources. Extensive research (glug, glug) was done on the beers themselves, including estimating their color, measuring their final specific gravity and assessing their flavor profile (a-gluggity, gluggity, glug, glug). From a list of 20 or so candidate beers, the field was whittled down to just five beers — **BASS & CO'S PALE ALE, YOUNG'S DOUBLE CHOCOLATE STOUT, NEWCASTLE BROWN ALE, YOUNG'S SPECIAL LONDON ALE AND FULLER'S LONDON PORTER**. With the information on these beers (and a pint of ale) in hand, the team crunched the numbers in spreadsheets and compared the results to previously brewed beers. Then testing began. Grains were mashed! Hops were boiled!! Beers were brewed!!! Soon, the secrets of these British brews were unveiled for all to see. (Eat your heart out, Watson and Crick.) The results of this historic research are presented here as a testament to the scientific method (and to prove to my wife that all the tasting and brewing sessions were "for science"). Cheers.

by **Chris Colby**

Clone recipes for: Bass & Co's Pale Ale, Young's Double Chocolate Stout, Newcastle Brown Ale, Young's Special London Ale and Fuller's London Porter

PHOTOS BY CHARLES A. PARKER

CLONES

In order to get the most of these clones, you should keep in a mind a few things. Most importantly, in order to get good performance from your yeast, you need to pitch an adequate number of cells. In a few of these recipes, the yeast strain specified is known (or suspected) to be from the brewery in question. In the other cases, a strain showing similar characteristics was chosen. In either case, the characteristics the yeast strain gives off during fermentation and conditioning depend on you pitching an adequate amount of yeast. Suggested yeast starter sizes are given for each beer. Following those suggestions should lead you to a good fermentation and better beer compared to just pitching the contents of your smack pack or tube.

You should also aerate your wort well and hold the fermentation temperature as constant as possible. For beers with some adjunct in the grain bill, a small amount of yeast nutrients are recommended in the ingredient list.

For all-grain brewers, wort production should be very straightforward. All these clones specify single infusion mashes and a 65% extraction efficiency is assumed. If you know your system's efficiency and it differs, adjust the amount of base grains to account for this.

Extract brewers should be prepared to steep a fairly large amount of grain. These are actually small partial mashes, so follow the amount of water and temperatures specified as closely as you can practically manage. A little deviation is OK — don't sweat the small stuff — but don't purposely stray too far.

Your brew kettle should be big enough to begin boiling 3 gallons (11 L) of wort. Expect to end up with 2.5 gallons (9.5 L) after the boil. (Add boiling water, heated in a separate pot, if the wort dips below this level.) If you follow these wort volume recommendations, and add your extract late (as described in the instructions), your beer color and hop utilization should be fine.

Finally, cool your wort before moving it to your fermenter; don't rely on the topping up water to cool it down. If you don't have a wort chiller, cool your brewpot in your sink. Wait until the side of the brewpot is cool to the touch before transferring the wort to your fermenter.

Bass & Co's Pale Ale clone

(5 gallons/19 L, all-grain)
OG = 1.049 FG = 1.010
IBU = 32 SRM = 17 ABV = 5.0%

A trip to Bass's web site led to the inclusion of this clone in this collection. On their site, they mention a "light burnt roast aroma" to Bass. The next day, I grabbed a bottle from my local supermarket. I searched for the roast aroma and you know what? It's there. I also noticed how Bass's color has a distinct copper shade to it, suggesting a small addition of dark grain. Michael Jackson claims that Bass uses a single addition of Challenger and Northdown hops. He's probably right, but I think two Northern Brewer additions capture the minty flavor and aroma of Bass's hop presence in a homebrew clone. This clone is for the bottled version of Bass Pale Ale available in the U.S.

Ingredients

7.0 lbs. (3.2 kg) 2-row pale ale malt
2.0 lbs. (0.91 kg) flaked maize
1.0 lb. (0.45 kg) crystal malt (60 °L)
0.75 oz. (21 g) roasted barley (300 °L)
8.0 AAU Northern Brewer hops (60 mins)
(0.89 oz./25 g of 9% alpha acids)
2.0 AAU Northern Brewer hops (15 mins)
(0.22 oz./6.3 g of 9% alpha acids)
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
White Labs WLP023 (Burton Ale) yeast (1.25 qt./~1.25 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Make 13 gallons (49 L) of brewing liquor with 100–150 ppm Ca^{2+} and a slightly lower level of carbonates. If you start with very soft, distilled or reverse osmosis (RO) water, use 5 teaspoons of gypsum and 4 teaspoons of chalk for your 13 gallons (49 L). (Yes, Burton-on-Trent's water is harder than this, but you don't need "extra chunky" water for a great clone.) Heat 12.5 quarts (11.8 L) of water to 163 °F (73 °C). Mash in grains and maize to 152 °F (67 °C) and rest for 1 hour. Collect around 5.5 gallons (21 L) of wort, add brewing liquor to make 6.5 gallons (25 L) and boil for 90 minutes. Add hops, Irish moss and yeast nutrients at times indicated. Cool wort, aerate well and pitch yeast. Ferment at 68 °F (20 °C).

Bass & Co's Pale Ale clone

(5 gallons/19 L, extract with grains)
OG = 1.049 FG = 1.010
IBU = 32 SRM = 16 ABV = 5.0%

Ingredients

0.5 lbs. (0.23 kg) Muntons Light dried malt extract
3 lb. 12 oz. (1.7 kg) Alexander's Pale liquid malt extract (late addition)
1.0 lbs. (0.45 kg) 2-row pale ale malt
1 lb. 6 oz. (0.62 kg) corn sugar
1.0 lb. (0.45 kg) crystal malt (60 °L)
0.75 oz. (21 g) roasted barley (300 °L)
8.0 AAU Northern Brewer hops (60 mins)
(0.89 oz./25 g of 9% alpha acids)
2.0 AAU Northern Brewer hops (15 mins)
(0.22 oz./6.3 g of 9% alpha acids)
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
White Labs WLP023 (Burton Ale) yeast (1.25 qt./~1.25 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Add 6 gallons (23 L) of soft, distilled or RO water to a clean brewing bucket and add 1 teaspoon of gypsum and 0.5 teaspoon of chalk to make your brewing liquor. Place crushed grains in a nylon steeping bag. Heat 3 quarts (2.9 L) of brewing liquor to 163 °F (73 °C) and submerge bag. Steep grains at 152 °F (67 °C) for 45 minutes. Rinse grains with 1 quart (~1 L) of water at 170 °F (77 °C). Add brewing liquor to "grain tea" to make 3 gallons (11 L) of wort. Add dried malt extract and corn sugar and bring to a boil. Add first charge of hops and boil for 60 minutes. Add other hops, Irish moss and yeast nutrients at times indicated. With 15 minutes left in boil, shut off heat and stir in liquid malt extract. Resume heating and finish boil. Cool wort and transfer to fermenter. Top up to 5 gallons (19 L) with brewing liquor, aerate wort well and pitch yeast. Ferment at 68 °F (20 °C).

Young's Double Chocolate Stout clone

(5 gallons/19 L, all-grain)
OG = 1.053 FG = 1.013
IBU = 28 SRM = 35 ABV = 5.2%

Young's website claims that their Double Chocolate Stout is made from pale, crystal and chocolate malts, with a "special blend of sugars." This stout is fairly sweet and I suspect the brewery probably adds sugar before bottling and then pasteurizes the beer. I went with a bit of lactose, which brewers yeast cannot ferment, instead. Young's also adds "real dark chocolate and chocolate essence" to this beer. You can add more or less chocolate extract to taste.

Ingredients

6 lb. 14 oz. (3.1 kg) 2-row pale ale malt
11 oz. (0.31 kg) crystal malt (60 °L)
13 oz. (0.37 kg) chocolate malt
12 oz. (0.34 kg) lactose
8.0 oz. (0.23 kg) invert sugar
4.0 oz. (0.11 kg) cane sugar
6.0 oz. (0.17 kg) cocoa powder
0.33 oz. (9.4 g) liquid chocolate extract
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
7 AAU Fuggles hops (60 mins)
(1.4 oz./40 g of 5% alpha acids)
1.25 AAU Kent Goldings hops (15 mins)
(0.25 oz./7 g of 5% alpha acids)
Wyeast 1318 (London Ale III) yeast
(1.5 quart/~1.5 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Heat 10.5 quarts (9.9 L) of water to 164 °F (73 °C). Stir in crushed grains and mash at 153 °F (67 °C) for 60 minutes. Collect 4.25 gallons (16 L) of wort, add 2.25 gallons (8.5 L) of water and boil for 90 minutes. Add hops at times indicated in ingredient list. Add sugars, Irish moss and yeast nutrients with 15 minutes remaining in the boil. Dissolve cocoa in hot water and also add with 15 minutes remaining. Cool wort, aerate and pitch yeast. Ferment at 68 °F (20 °C). Add chocolate essence in secondary.

Young's Double Chocolate Stout clone

(5 gallons/19 L, extract with grains)
OG = 1.053 FG = 1.013
IBU = 28 SRM = 35 ABV = 5.2%

Ingredients

0.5 lbs. (0.23 kg) Muntons Light dried malt extract
4 lb. 2 oz. (1.9 kg) John Bull Plain Light liquid malt extract (late addition)
8.0 oz. (0.23 kg) 2-row pale ale malt
11 oz. (0.31 kg) crystal malt (60 °L)
13 oz. (0.37 kg) chocolate malt
12 oz. (0.34 kg) lactose
8.0 oz. (0.23 kg) invert sugar
4.0 oz. (0.11 kg) cane sugar
6.0 oz. (0.17 kg) cocoa powder
0.33 oz. (9.4 g) liquid chocolate extract
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
7 AAU Fuggles hops (60 mins)
(1.4 oz./40 g of 5% alpha acids)
1.25 AAU Kent Goldings hops (15 mins)
(0.25 oz./7 g of 5% alpha acids)
Wyeast 1318 (London Ale III) yeast
(1.5 quart/~1.5 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Place crushed grains in a nylon steeping bag. Heat 3.0 quarts (2.8 L) of water to 164 °F (73 °C) and steep grains for 45 minutes at 153 °F (67 °C). Rinse grain bag with 1.5 quarts (~1.5 L) of water at 170 °F (77 °C). Add dried malt extract, sugars and water to make 3 gallons (11 L) and bring to a boil. Add hops and boil for 60 minutes. With 15 minutes left, turn off heat and stir in liquid malt extract. Add cocoa powder (dissolved in hot water), second dose of hops, Irish moss and yeast nutrients and resume boiling. Cool wort, transfer to fermenter and top up to 5 gallons (19 L). Aerate and pitch yeast. Ferment at 68 °F (20 °C). Add chocolate extract in secondary.

Newcastle Brown Ale clone

(5 gallons/19 L)
OG = 1.044 FG = 1.007
IBU = 24 SRM = 25 ABV = 5.2%

Newcastle Brown Ale — called simply Newkie by many fans of this ale — is actually a blend of two beers. Brewers blend a strong, dark ale that has been aged and a smaller, younger amber ale. As a consequence, this average-strength brown ale shows some plum and raisin characteristics more frequently encountered in an old ale. The strong dark beer is not sold separately, but the amber ale is (as Newcastle Amber Ale). A few sources give enough information to come up with a decent clone of the amber ale. From there, I made some inferences about the attributes of the strong ale from what's known about Newcastle Brown.

You can make 5 gallons (19 L) of this beer in one fermenter by adding the ingredient list of two of the component beers and dividing by two. However, don't expect the characteristics of an aged dark ale to appear.

Ingredients

2 gallons (7.6 L) old ale
(Newkie Component #1)
3 gallons (11 L) amber ale
(Newkie Component #2)
0.75 cups corn sugar (for priming)

Step by Step

Brew old ale (see recipe below) and let condition in secondary for about 2 months, preferably below fermentation temperature. Brew amber ale (recipe below), ferment for 3-4 days and rack to secondary. Once amber ale falls clear, rack 2 gallons (7.6 L) of old ale to your keg. Rack 3 gallons (11 L) of amber ale into it. Alternately, rack beers to bottling bucket, stir gently and bottle. Keg or bottle remaining old ale and amber ale and enjoy separately. [Option: you can combine 5 gallons (19 L) of amber ale with 3.33 gallons (12.6 L) of old ale to make 8.33 gallons (32 L) of brown ale, leaving 1.66 gallons (6.3 L) of old ale.]

Newcastle Brown Ale clone Component #1 (Old ale)

(5 gallons/19 L, all-grain)
OG = 1.064 FG = 1.013
IBU = 32 SRM = 40 ABV = 6.6%

Ingredients

9.0 lbs. (4.1 kg) British 2-row pale ale malt
2 lb. 8 oz. (1.13 kg) flaked maize
1 lb. 5 oz. (0.60 kg) crystal malt (120-150 °L)
5.0 oz. (0.14 kg) chocolate malt
0.75 oz. (21 g) roasted barley (300 °L)
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
8.25 AAU Fuggles hops (60 mins) (1.65 oz./47 g of 5% alpha acids)
1.25 AAU Kent Goldings hops (15 mins) (0.25 oz./7 g of 5% alpha acids)
Wyeast 1099 (Whitbread ale) or White Labs WLP017 (Whitbread Ale) yeast (2 quart/~2 L yeast starter)

Step by Step

Heat 16.5 quarts (15.6 L) of water to 163 °F (73 °C). Mash grains at 152 °F (67 °C) for 60 minutes. Collect 7 gallons (26 L) of wort. Boil wort for 120 minutes, adding hops at the times indicated in ingredients list. Add Irish moss and yeast nutrients with 15 minutes left. Ferment at 71 °F (22 °C). Rack to secondary and let condition in a cool place.

Newcastle Brown Ale clone Component #1 (Old ale)

(5 gallons/19 L, extract with grains)
OG = 1.064 FG = 1.013
IBU = 32 SRM = 40 ABV = 6.6%

Ingredients

1 lb. 4 oz. (0.57 kg) Muntons Light dried malt extract
4 lb. 12 oz. (2.2 kg) Northwestern Gold liquid malt extract (late addition)
4 oz. (0.11 kg) British 2-row pale ale malt
1 lb. 11 oz. (0.77 kg) corn sugar
1 lb. 5 oz. (0.60 kg) crystal malt (120-150 °L)
5.0 oz. (0.14 kg) chocolate malt
0.75 oz. (21 g) roasted barley (300 °L)
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
8.25 AAU Fuggles hops (60 mins) (1.65 oz./47 g of 5% alpha acids)
1.25 AAU Kent Goldings hops (15 mins) (0.25 oz./7 g of 5% alpha acids)
Wyeast 1099 (Whitbread ale) or White Labs WLP017 (Whitbread Ale) yeast (2 quart/~2 L yeast starter)

Step by Step

Place crushed grains in a nylon steeping bag. Heat 2.9 quarts (2.75 L) of brewing liquor to 163 °F (73 °C) and submerge bag. Steep grains at 152 °F (67 °C) for 45 minutes. Rinse grains with 1.25 quarts (~1.25 L) of water at 170 °F (77 °C). Add water to "grain tea" to make 3 gallons (11 L) of wort. Add dried malt extract and corn sugar and bring to a boil. Add first charge of hops and boil for 60 minutes. Add other hops, Irish moss and yeast nutrients at times indicated. With 15 minutes left in boil, shut off heat and stir in liquid malt extract. Resume heating and finish boil. Cool wort and transfer for fermenter. Top up to 5 gallons (19 L) with brewing liquor, aerate wort well and pitch yeast. Ferment at 71 °F (22 °C). Rack to secondary and let condition in a cool place.

Newcastle Brown Ale clone Component #2 (Amber ale)

(5 gallons/19 L, all-grain)
OG = 1.031 FG = 1.007
IBU = 19 SRM = 16 ABV = 3.1%

Ingredients

5 lb. 2 oz. (2.3 kg) British 2-row pale malt
12 oz. (0.34 kg) crystal malt (90 °L)
0.5 lb. (0.23 kg) flaked maize
0.75 oz. (21 g) roasted barley (300 °L)
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
5 AAU Challenger hops (60 mins) (0.71 oz./20 g of 7% alpha acids)
Wyeast 1099 (Whitbread ale) or White Labs WLP017 (Whitbread Ale) yeast (1 quart/~1 L yeast starter)

Step by Step

Mash grains at 152 °F (67 °C) in 8.0 quarts (7.6 L) of water. Mash for 60 minutes. To avoid oversparging the small grain bill, collect only about 3.5 gallons (13 L) of wort. [Alternately, monitor the specific gravity of your runnings and stop collecting wort when they fall below SG 1.010 or the pH climbs above 5.8.] Add 3 gallons (11 L) of water and boil wort for 90 minutes, adding hops, Irish moss and yeast nutrients at the times indicated in ingredients list. Ferment at 71 °F (22 °C). Rack to secondary and let the beer fall clear prior to blending.

Newcastle Brown Ale clone Component #2 (Amber ale)

(5 gallons/19 L, extract with grains)
OG = 1.031 FG = 1.007
IBU = 19 SRM = 15 ABV = 3.1%

Ingredients

9 oz. (0.26 kg) Muntons Light dried malt extract
2 lb. 4 oz. (1.0 kg) John Bull Plain Light liquid malt extract (late addition)
1.0 lb. (0.45 kg) British 2-row pale malt
8 oz. (0.34 kg) crystal malt (90 °L)
0.33 lb. (0.15 kg) corn sugar
0.75 oz. (21 g) roasted barley (300 °L)
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
5 AAU Challenger hops (60 mins) (0.71 oz./20 g of 7% alpha acids)
Wyeast 1099 (Whitbread ale) or White Labs WLP017 (Whitbread Ale) yeast (1 quart/~1 L yeast starter)

Step by Step

Place crushed grains in a nylon steeping bag. Heat 2.7 quarts (2.6 L) of brewing liquor to 163 °F (73 °C) and steep grains at 152 °F (67 °C) for 45 minutes. Rinse grains with 1.25 quarts (~1.25 L) of water at 170 °F (77 °C). Add dried malt extract, corn sugar and water to make 3 gallons (11 L). Bring to a boil, add first charge of hops and boil for 60 minutes. Add other hops, Irish moss and yeast nutrients at times indicated. With 15 minutes left in boil, shut off heat and stir in liquid malt extract. Resume heating and finish boil. Cool wort and transfer for fermenter. Top up to 5 gallons (19 L) with brewing liquor, aerate wort well and pitch yeast. Ferment at 71 °F (22 °C). Rack to secondary and let the beer fall clear prior to blending.

Young's Special London Ale clone

(5 gallons/19 L, all-grain)
OG = 1.064 FG = 1.015
IBU = 30 SRM = 14 ABV = 6.4%

Young's Special London Ale is a well-balanced strong ale made with 100% malt, just pale and crystal. (The website specifies Maris Otter malt, but does not give the maltster.) Fuggles and Goldings are used in the kettle; Goldings and Target are dry hopped. The beer is bottle conditioned, just as most homebrewers' beer is, and keeps for months.

Ingredients

12 lb. 3 oz. (5.5 kg) Maris Otter malt
15 oz. (0.43 kg) crystal malt (60 °L)
7.0 AAU Fuggles hops (60 mins)
 (1.4 oz./40 g of 5% alpha acids)
2.5 AAU Goldings hops (15 mins)
 (0.5 oz./14 g of 5% alpha acids)
0.5 oz. (14 g) Goldings hops (0 min)
0.25 oz. (7 g) Goldings whole hops
 (dry hop)
0.25 oz. (7 g) Target whole hops
 (dry hop)
1 tsp. Irish moss (15 mins)
Wyeast 1318 (London Ale III) yeast
 (1.75 qt./~1.75 L yeast starter)
0.75 cup corn sugar (for priming)

Step by Step

Mash grains at 153 °F (67 °C) in 16.5 quarts (15.5 L) of water. Mash for 60 minutes. Collect 6.5 gallons (25 L) of wort. Boil wort for 90 minutes, adding hops at the times indicated in ingredients list. Ferment at 69 °F (21 °C).

Young's Special London Ale clone

(5 gallons/19 L, extract w/grains)
OG = 1.064 FG = 1.015
IBU = 30 SRM = 14 ABV = 6.4%

Ingredients

2 lb. 9 oz. (1.2 kg) Coopers Light dried
 malt extract
4 lb. 12 oz. (2.2 kg) Muntuns Light liquid
 malt extract (late addition)
1 lb. 1 oz. (0.48 kg) Maris Otter malt
15 oz. (0.43 kg) crystal malt (60 °L)
7.0 AAU Fuggles hops (60 mins)
 (1.4 oz./40 g of 5% alpha acids)
2.5 AAU Goldings hops (15 mins)
 (0.5 oz./14 g of 5% alpha acids)
0.5 oz. (14 g) Goldings hops (0 min)
0.25 oz. (7 g) Goldings hops (dry hop)
0.25 oz. (7 g) Target hops (dry hop)
1 tsp. Irish moss (15 mins)
Wyeast 1318 (London Ale III) yeast
 (1.75 qt./~1.75 L yeast starter)
0.75 cup corn sugar (for priming)

Step by Step

Put crushed grains in a nylon steeping bag. Steep at 153 °F (67 °C) in 3.0 quarts (2.8 L) for 45 minutes. Rinse grains with 1.5 quarts (1.4 L) of water at 170 °F (77 °C). Add dried malt extract and water to make 3 gallons (11 L). Boil for 60 minutes, adding hops at the times indicated. With 15 minutes left, turn off the heat and stir in the liquid malt extract. Add Irish moss and resume heating. Cool wort and transfer to fermenter. Add water to make 5 gallons (19 L) of wort. Aerate wort and pitch yeast. Ferment at 69 °F (21 °C).

Fuller's London Porter clone

(5 gallons/19 L, all-grain)
OG = 1.056 FG = 1.014
IBU = 35 SRM = 62 ABV = 5.4%

I brewed a porter recipe of mine for years until I happened to try it side-by-side with Fuller's London Porter. They were very similar. All it took was a couple obvious tweaks and I had a beer with the same chocolatey aroma and dark grain flavor. Brewed correctly, this clone tastes and smells almost exactly like the real thing. (Be sure, however, to make a yeast starter.)

Ingredients

9 lb. 12 oz. (4.4 kg) British 2-row pale
 ale malt
14 oz. (0.40 kg) crystal malt (60 °L)
7.0 oz. (0.20 kg) chocolate malt
7.0 oz. (0.20 kg) black patent malt
4.0 oz. (0.11 kg) roasted barley (500 °L)
8.5 AAU Kent Goldings hops (60 mins)
 (1.7 oz./48 g of 5% alpha acids)
1.25 AAU Kent Goldings hops (15 mins)
 (0.25 oz./7 g of 5% alpha acids)
0.25 oz. (7 g) Kent Goldings (5 mins)
0.25 oz. (7 g) Kent Goldings (0 mins)
1 tsp. Irish moss (15 mins)
Wyeast 1968 (London ESB) or White
 Labs WLP002 (English Ale) yeast
 (1.5 qt./~1.5 L yeast starter)
0.75 cups corn sugar
 (for priming)

Step by Step

Use moderate to highly-carbonate rich water (75–125 ppm). Mash grains for 60 minutes at 156 °F (59 °C). Collect 6.5 gallons (25 L) of wort. Boil wort for 90 minutes. Ferment at 70 °F (21 °C).

Fuller's London Porter clone

(5 gallons/19 L, extract w/grains)
OG = 1.056 FG = 1.014
IBU = 35 SRM = 62 ABV = 5.4%

Ingredients

1 lb. 10 oz. (0.91 kg) Muntons Light
 dried malt extract
4 lb. 5 oz. (2.0 kg) Muntons Light liquid
 malt extract (late addition)
1.0 lbs. (0.45 kg) British pale ale malt
14 oz. (0.40 kg) crystal malt (60 °L)
7.0 oz. (0.20 kg) chocolate malt
7.0 oz. (0.20 kg) black patent malt
4.0 oz. (0.11 kg) roasted barley (500 °L)
8.5 AAU Kent Goldings hops (60 mins)
 (1.7 oz./48 g of 5% alpha acids)
1.25 AAU Kent Goldings hops (15 mins)
 (0.25 oz./7 g of 5% alpha acids)
0.25 oz. (7 g) Kent Goldings (5 mins)
0.25 oz. (7 g) Kent Goldings (0 mins)
1 tsp. Irish moss (15 mins)
Wyeast 1968 (London ESB) or White
 Labs WLP002 (English Ale) yeast
 (1.5 qt./~1.5 L yeast starter)
0.75 cups corn sugar (for priming)

Step by Step

Steep crushed grains in 4.5 quarts (4.3 L) of water at 156 °F for 45 minutes. Rinse grains with 2 quarts (~2 L) of water at 170 °F (77 °C). Add dried malt extract and water to make 3 gallons (11 L) of wort. Bring to a boil. Add first addition of hops and boil for 60 minutes. With 15 minutes left in boil, turn off heat and stir in liquid malt extract. Resume heating and add Irish moss and second addition of hops. Add remaining hops at times indicated. Cool wort and siphon to fermenter. Add water to make 5 gallons (19 L), aerate wort and pitch yeast. Ferment at 70 °F (21 °C).

SPEEDbrews

by **Steve Piatz**

minimize your grain to glass time

LET'S SAY YOU PROMISED to bring a keg of homebrew to a party. It's now the weekend before and all your kegs are empty. What do you do? Bring some commercial beer? Skip the party? How about brewing a quick turnaround beer — a beer that can be ready in a week (or even less)?

It is possible to produce beer that is ready to drink in as little as four or five days. However, there are limits on the styles you can produce this quickly.

Here is a recipe for a very quick turnaround beer referenced in "Early American Beverages," by John Hull Brown.

GOOD, WHOLESOME SMALL BEER: *Take two ounces of hops, and boil them, three or four hours, in three or four pailfuls of water; and then scald two quarts of molasses in the liquor, and then turn it off into a clean half-barrel, boiling hot; then fill it up with cold water; before it is quite full, put in your yeast to work it; the next day you will have agreeable, wholesome small beer, that will not fill with wind, as that which is brewed from malt or bran; and it will keep good till it is all drank out.*
"American Economical Housekeeper," 1850

OK, perhaps our ancestors had a slightly looser definition of beer than we do these days. But you have to admit, one day from brewing to drinking is about as quick as you can get for a fermented beverage.

To minimize the time between the kettle and a glass of modern homebrew, you have to eliminate a number of styles that are at odds with a quick turnaround process. If you really want to quaff your beer quickly, you need to forget about true lagers, high gravity beers and sour beers. All of these take extended periods of time to ferment or condition. This leaves low to moderate gravity ales as your best choice. A typical ale fermentation finishes in two to five days. Ale strains operate at a warmer temperature than lagers and are more conducive to quickly reaching the final specific gravity.

Pitch Enough Yeast

There are several techniques to reduce the overall time until fermentation is finished. The first, and most important, of these is to pitch an adequate amount of yeast. For a 5-gallon (19-L) batch of low to moderate gravity ale, you need to make a 1–2 quart (~1–2 L) yeast starter. Make your starter with a specific gravity around 1.030-1.040, aerate it well and perhaps add a pinch of yeast nutrients. Pitching a bigger starter may help speed the fermentation a bit, but there's no need to greatly overdo it.

Another way to be sure you have enough yeast to get a rapid onset of fermentation is to pitch your new batch onto the yeast from a prior batch. While it is best to pitch the new batch right after the first batch finishes fermentation, even if you are a couple of days late, you will still get a fairly quick onset of fermentation. Likewise, if you know other homebrewers in your area, or are friendly with a brewpub brewer, you may be able to get yeast from them. For a 5-gallon (19-L) batch, one cup of yeast slurry should yield around the optimal number of cells.

Of course, if you are pressed for time, taking a day or two to make a yeast starter may not be a viable option. Pitching two packs or tubes of liquid yeast is another option — this should give you around 200 billion cells, easily enough for 5 gallons (19 L) of quick turnaround ale. Alternately, you may want to pitch a couple packets of dried yeast, if an appropriate yeast strain is available. Be sure to rehydrate the yeast properly before pitching it.

Most ale strains will ferment quickly when pitched to a low to moderate gravity wort. However, if you are looking to absolutely minimize your turnaround time, look

It's Just A Starter (6-Day Mild Ale)

(5 gallon/19 L, all-grain)
OG = 1.036 FG = 1.007
IBU = 24 SRM = 31 ABV = 3.6%

The name reflects the use of my most recent batch of mild. I needed to grow enough yeast to make a batch of OG 1.116 barleywine for filling a bourbon barrel. The mild was made one weekend and was racked to a keg the following weekend while the mash was underway for the barleywine. The chilled barleywine wort was then transferred onto the yeast cake from the mild and a little oxygen was added. There was activity in the airlock within about an hour.
— Steve Piatz

Ingredients

4.66 lbs. (2.11 kg) 2-row pale malt
0.97 lbs. (0.44 kg) crystal malt (55 °L)
0.40 lbs. (0.18 kg) chocolate malt
1.17 lbs. (0.53 kg) flaked corn
0.25 lbs. (0.11 kg) crystal malt (150 °L)
6.2 AAU Fuggles hops (60 mins)
(1.55 oz./44 g of 4% alpha acid)
Wyeast 1968 (London ESB) or
White Labs WLP002 (English Ale) yeast
0.66 cups corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C) for 45 minutes with 1.33 quarts of water per pound of grain — 2.48 gallons (9.4 L) overall. Sparge with 168° F (75 °C) water until you collect 6.5 gallons (25 L) of wort. Boil the wort for 60 minutes. Chill to primary fermentation temperature and pitch your yeast. After 6 days, you can rack the beer out of your carboy and into a keg. Force carbonate to about 2 volumes of CO_2 and enjoy.

Bonneville Flats Bitter

(5 gallon/19 L, extract with grains)
OG = 1.040 FG = 1.009
IBU = 27 SRM = 9 ABV = 4.0%

I brewed this beer on a Sunday and served it to my homebrew club the next Saturday. I thought it would still be green at that point, but it actually tasted finished Friday evening. I designed the recipe and procedures to not only yield a beer that would ferment and condition quickly, but one that would be quick to put together on brew day. — Chris Colby

Ingredients

0.5 lb. (0.23 kg) Briess Light dried malt extract
3.3 lbs. (1.5 kg) Alexander's Pale liquid malt extract (late addition)
0.5 lbs. (0.23 kg) corn sugar
1.5 lbs. (0.68 kg) 2-row pale ale malt
0.25 lbs. (0.11 kg) crystal malt (30 °L)
0.25 lbs. (0.11 kg) crystal malt (40 °L)
1 tsp. Irish moss (15 mins)
1/8 tsp. yeast nutrients (15 mins)
6.4 AAU First Gold hops (45 mins)
(0.8 oz./23 g of 8% alpha acids)
2.0 AAU First Gold hops (15 mins)
(0.25 oz./7 g of 8% alpha acids)
0.75 oz. (21 g) First Gold hops (0 mins)
2 pkg. Nottingham dried yeast (rehydrated)
0.75 cups corn sugar (for priming)

Step by Step

Make your brewing water by combining 6 gallons (23 L) of soft, distilled or RO water with 1.5 tsp. gypsum. Steep grains in 2.0 qts. (1.9 L) of this water at 158 °F (70 °C). Steep for 30 minutes, then rinse with 1.0 quart (0.94 L) of water at 170 °F (77 °C). Add dried malt extract, corn sugar and water to make 2.0 gallons (7.6 L) of wort and bring to a boil. Once initial foaming subsides, add bittering hops and boil for 45 minutes. Do not let the wort volume dip below 2.0 gallons (7.6 L) during the boil. Add boiling water to make up volume if this happens. With 15 minutes left in boil, turn off heat and stir in liquid malt extract, Irish moss and flavor hops. Stir until extract is dissolved, then resume heating. (Keep the boil clock running.) Add aroma hops at end of boil. Cool your 2 gallons (7.6 L) of wort (in sink or with chiller). Once cool, let sit (covered) for 15 minutes. Transfer wort to fermenter, leaving the majority of the sediment in brewpot behind. Add water to make 5 gallons (19 L), aerate and pitch yeast. (Rehydrate yeast — in a clean, sanitized measuring cup — as described on package.) Ferment at 72 °F (22 °C) until fermentation is complete — about 3 days, when I brewed it. Taste small sample. If you don't taste diacetyl, rack the beer directly to keg or bottling bucket. If kegging, force carbonate beer for 3 days at around 30 PSI. When done, release pressure from keg and adjust regulator to proper dispensing pressure for your system. If bottling, keep bottles warm (74–80 °F/23–27 °C) for five to six days, then chill in refrigerator for two to three days before opening.

for a strain that ferments hard and has a high flocculation. Also, since contact time with the beer is going to be minimal, a good diacetyl reducing strain is a plus.

Aerate Well

Aerating the wort thoroughly before fermentation is required to help the fermentation proceed quickly. If you use oxygen, give the wort a one-minute shot, swirling your fermenter as you go. If you use air — for example, pumped with an aquarium pump through a HEPA filter — let it go for 5–10 minutes, swirling the wort occasionally. (You may have to stop a few times to let the foam subside.)

For a low-to moderate strength ale, one shot of aeration should be sufficient. Longer aeration times will not make your fermentation start or proceed faster and multiple aerations before fermentation starts may cause more problems than benefits in a quick turnaround beer.

Fermentation Temperature

Every yeast strain has a temperature range in which it produces the best beer. For most English ale strains, this is around 68–72 °F (20–22 °F). For a quick turnaround beer, you will want to ferment in the middle to high end of your yeast's range as colder temperatures cause fermentations to proceed more sluggishly. Putting a sweatshirt over the fermenter may help retain some heat, if needed.

Fermenting an ale at a higher than recommended temperature will make the fermentation go faster. However, the resulting beer will likely be too fruity from the overproduction of esters. It may even be undrinkable due to the presence of higher alcohols ("fusel oils").

Pitching enough yeast, aerating adequately and fermenting above the low end of the yeast's temperature range should yield a fermentation that proceeds as quickly while still yielding good quality beer. Attempting to rev the yeast up excessively — for example by grossly overpitching or running the fermentation too hot — will decrease fermentation time, but the resulting beer will almost assuredly suffer.

Packaging

With the exception of a few styles like like German wheat beer, you want the beer to be clear by the time it is served. Most ale yeast strains are flocculent and will drop out of suspension quickly once the fermentation is over. If a fermentation is finished and you want to package the beer before it drops clear, you can consider filtering. Filtration is an everyday practice in commercial breweries, but most homebrewers aren't equipped to filter. Filtration can also remove all the yeast, making it difficult to bottle condition unless you pitch some bottling yeast.

Another alternative to accelerate development of a clear beer is to chill the beer until it drops clear. As homebrewers, our fermenters and kegs are small when compared to commercial equipment, so the process can go quickly. Again, crash cooling can present problems if you want to bottle condition the beer since the cold temperature can cause the yeast to go dormant. Also, you do need to make sure any remaining diacetyl has been reduced before chilling.

Cask Beers

For the British session beers, a little haze can be tolerated and the cask-conditioned versions can be fined with isinglass. The cask-conditioned beers have another advantage for quick turnaround; they don't need much carbonation and rather depend on the hand pump and perhaps the attached sparkler to introduce some sparkle to the beer at serving time.

Kegged Beers

If you keg your beer, you can chill it and force carbonate. The method that allows you to reach the desired CO_2 level most quickly is to use a carbonation stone at the bottom of the keg. A few minutes of bubbling CO_2 through the keg will carbonate the beer. If you don't have a carbonation stone, you can still accelerate the carbonation of the keg by shaking the keg while applying the appropriate CO_2 pressure.

Quicker methods of carbonation typically yield coarser foam in your beer. If you can manage it, it helps to let the keg sit for at least 24 hours at the proper level of carbonation, temperature and CO_2 pressure before serving the beer. If you inject CO_2 or shake the keg to carbonate, try to do so at least a day before the keg will be tapped.

Bottle Conditioning

You can spend a couple of weeks waiting for a bottle conditioned beer to develop the proper carbonation level as the yeast cells left in the bottle slowly consume the priming sugar and produce the carbon dioxide needed to achieve the carbonation. You can accelerate the bottle conditioning by keeping the beer warm after bottling. In Belgium, where commercially produced bottle conditioned beers are still fairly common, I have seen commercial producers hold the just bottled beer at 80 °F (27 °C) or warmer. Once the yeast has consumed the priming sugar, you can lower the temperature to a serving temperature.

Appropriate Styles

One good style for a quick turnaround beer would be German (Bavarian) wheat beer. The German wheat beer yeast strains Wyeast 3068, Wyeast 3638, White Labs WLP300 and White Labs WLP380 all work fast and the fact that the beer can be slightly cloudy works in your favor. Even though the style is traditionally served bottle conditioned, you can get the beer ready to drink in just four or five days if you force carbonate. American wheat beers are likewise a style that can be turned around quickly. American wheat beer yeast choices include White Labs WLP320, Wyeast 1007 and Wyeast 1010.

Other good choices for quick turnaround beers are the so-called session beers, such as British bitters and milds. For these, you can allow three to four days of fermentation and another three days for conditioning. Producing ales in such a short time does require the use of a flocculent yeast strain. For quick turnaround ales, Wyeast and White Labs recommend Wyeast 1968, Wyeast 1187, Wyeast 1099, Wyeast 1332, White Labs WLP002 or White Labs WLP007. These session beers have relatively low original gravities — from 1.030 to 1.040 — so the yeast can finish their job quickly. The acceptability of fruity esters in these styles also means that it is possible to ferment at the high end of the yeast's temperature range.

As you move up to higher gravity ales, you increase the amount of time until you can quaff the beer. Add a few more days to a week to your schedule and you can brew styles such as English brown ales, Irish dry stout, and even some of the American ales. These beers are relatively clean ales and therefore can't be fermented overly warm, but they still can be fermented quickly with the proper yeast strain.

As homebrewers, we are used to giving our beers time to develop. Commercial brewers, on the other hand, need their beers to be ready as quickly as quality allows. Beyond a certain point, of course, beer cannot be rushed any further. If you follow the instructions here, and are prompt about racking or kegging, you can be drinking good beer in the minimal amount of time.

Steve Piatz wrote about Brettanomyces *in the October 2005 issue.*

Mash Variables

Get the most from your grains

by Chris Colby

In the March-April 2003 issue of *Brew Your Own*, I wrote an article entitled "Infusion Mashing." In it, I gave a "cookbook" introduction to performing an infusion mash. That article could have been titled, "Your First Mash." If I had called it that, I would have titled this piece, "Your Second Mash."

As I said in my first article, mashing is just soaking crushed grains in hot water, then draining off the unfermented beer. The ancient Sumerians supposedly discovered the process by accident, and brewers throughout the centuries honed the process to what it is today. Most homebrewers roughly retrace this historical sequence when learning to mash — they don't exercise a lot of control over their first few mashes, but gradually they fine tune their process.

In this article, I'll discuss the refinements you can make once you've got your first few mashes under your belt. I'll describe the variables that have the biggest impact on your finished beer and also touch on some of the practical aspects of being an all-grain brewer.

Buying and storing grain

One benefit of all-grain brewing is that your per-batch cost is lower than in extract brewing. (Of course, this is partially offset by the one-time cost of new equipment.) You can save even more money if you buy some of your grains by the sack. A sack of grain usually weighs either 50 or 55 lbs. (23 or 25 kg) and your cost per pound is less than a buck. Many all-grain homebrewers buy a sack of base grains, then buy the specialty grains for each batch as they go. Keep in mind, though, that malt is a food product and does go stale over time.

Also remember that rodents and insect pests would love to get into your grain, and they will if you don't store it properly. Many homebrewers buy a 55-gallon (208 L) plastic garbage can with a sealable lid to store their grains in. This will keep pests out and — if located in a cool, dry place — your (uncrushed) grains should keep for about a year.

The crush

One thing you can do that greatly affects your brewing is to get a good crush. The degree your malt is crushed affects many aspects of your mash, and the wort you yield from it.

The fineness of a crush varies from the grain kernels barely being disturbed to the grain kernels being ground into a uniformly fine powder. The optimal crush, as you no doubt suspect, lies between these two extremes. The finer you crush, the higher your extract yield. However, with finer crushes, it is harder to collect your wort as the grain husks are too small to act as an efficient filter. In addition, the more pieces the grain husks are broken up into, the more tannins and other unwanted husk components will end up in your wort. Ideally, you want to crush finely enough that you get a good extraction efficiency, but coarsely enough that you can lauter with ease and minimize off flavors and astringency. So how do you do that?

The biggest variable affecting your crush is your mill gap — the space between the rollers in your grain mill. It would be nice if there was an optimal mill gap, but the best gap size depends on the grains you are milling and — to a lesser extent — the speed at which the rollers on your mill rotate. In general, however, a mill gap between 0.035 and 0.050 inches (0.89 and 1.3 mm) is thought to be a good, all-purpose setting for barley malt.

A second variable affecting your crush is the speed that the rollers rotate. The rollers on hand cranked mills rotate much slower than the rollers of commercial mills. (Their average speed is 400 RPM, for the optimal 9.8 inch (250 mm) diameter rollers). As such, hand cranked mills crush more coarsely when set to the same gap size. In contrast, home malt mills powered by a portable drill greatly exceed the proper speed and may crush too finely. To get the proper grain mill speed, you need to get a motor and control the speed with "pulleys," more properly called sheaves. (See the October 2003 issue of *BYO* for more.)

Most homebrew malt mills are suboptimal in one or more respects when

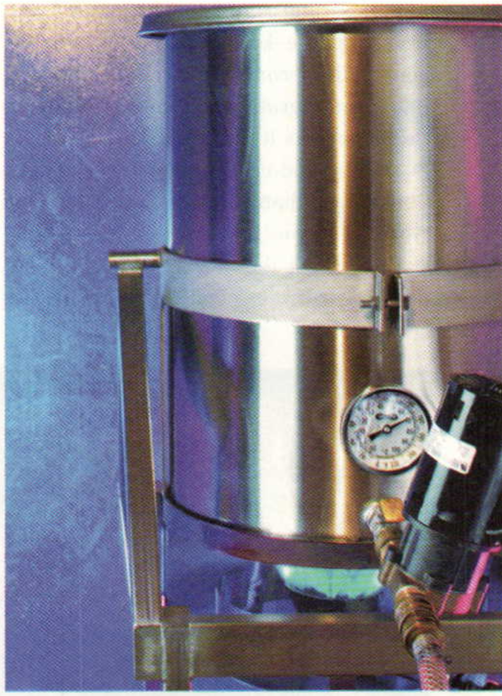


photo by charles a. parker

compared to full-size commercial mills. Most are either hand cranked or drill powered (i.e. rolling too slowly or too quickly). The diameter of the rollers on homebrew mills is frequently smaller than on commercial mills. And, many mills have a fixed gap, so the mill cannot be adjusted for different grains. Still, most all-grain homebrewers manage to get crushes that yield extract efficiencies in the same ballpark as most brewpubs or microbreweries. How is this?

You can judge the quality of your crush by examining the grain discharged from the mill or by brewing with it. What you want to see is few or no uncrushed kernels, plenty of kernels broken into two to four pieces and a minimal amount of flour. If you think your grain looks like it is crushed too finely — or you get high efficiencies, but stuck mashes and astringent beers — you have a couple options. You can switch to a larger gap setting, if your mill is adjustable, or start hand cranking, if you were using a drill to power your mill.

Conversely, if your grain looks undercrushed — or you get low efficiencies, but have no problems lautering (even when you run the wort off quickly) — you can set a smaller gap or motorize your mill.

In the case of undercrushed malt, you can also mill the grain twice. Even if you have a non-adjustable, hand-cranked mill, a second run through the mill will break up the kernels a bit further. Of course, the second crush can be a bit of a pain, as the grain won't flow as easily in the hopper as it did when it was whole. So, the second crush may take considerably longer than the first. But, it can be worth it if you are brewing a big beer (and need all the extract efficiency you can get) or if your efficiency is very low.

The point is, although we homebrewers typically use mills that commercial brewers would deem sub-standard, there are workarounds we can use to get a decent crush. These operations would be impractical for commercial brewers who crush much larger amounts of grains and, for economic reasons, need to do so quickly (thus ruling out hand cranking or milling the grain twice). But, when milling less than 20 lbs. (9.1 kg) on Saturday morning, it's usually not that much of a hassle.

Temperature differences

Everyone knows that temperature is important in mashing. However, one temperature-related aspect of mashing is usually left for the homebrewer to figure out on his own — temperature consistency and stability.

It's fairly easy to end up with temperature differences in your mash. Variables that increase the potential for temperature differences include: direct heating of the mash, thicker mashes, less stirring of the mash, large initial temperature differences between your grains and strike water and large temperature differences between your target mash temperature and your mash tun.

If you have a mash tun that you can heat, be sure to stir well when doing so. You may even want to stir for a minute or so after you turn off your burner as heat can continue to flow into the mash through the metal near the burner.

Most homebrewers mash fairly thickly, with mash thicknesses around 1.25 quarts of water per pound of grain (2.6 L/kg or a 2.6:1 ratio) being popular. However, if you are going to be heating the mash, you may want to go with a bit thinner mash. For example, if you were doing a heated step mash, a mash with a thickness around 1.9 qts./lb. (4 L/kg, or 4:1) would be easier to even out than a thicker mash. (This is because water conducts heat better than grain solids.)

When mashing in, your crushed grains are going to be much cooler than your strike water. Ideally, mixing the two should yield a mash right at your target temperature. For grains stored at around room temperature, heating your brewing liquor 10–11 °F (5.5–6 °C) over your target temperature will get you in the right range (assuming a roughly average mash thickness). Some software packages will calculate your ideal strike water temperature based on temperature and weight of your grain and target mash thickness. You can also determine the correct temperature by trial and error. Note your strike water temperature and initial mash temperature for two or three brewing sessions and you'll quickly get a good feel for what your strike water temperature needs to be. The closer your strike water is to the correct temperature, the quicker your mash in will be. Also, a little stirring should quickly even out any temperature differences in the mash.

The temperature of your newly mixed mash can potentially be affected by the temperature of your mash tun. Ideally, you want to heat the mash tun to right around your target mash temperature prior to mashing in. Filling your mash tun with brewing liquor heated to a few degrees above your target mash temperature should do the trick. Let the water sit for a couple minutes, then return it to your hot liquor tank to be used later as sparge water. If you mash in a non-heated mash tun, the sides of your mash will quickly become cooler than the middle of your mash.

Temperature stability

Once you are mashed in, your grain bed will start losing heat. The better insulated your mash tun is, the less heat loss you'll suffer. Temperature losses will be greatest near the edges of your vessel. You can insulate your mash tun simply, for example with towels, with a fitted "jacket" that goes over the vessel or by wrapping it in fiberglass insulation. Even if your mash vessel is fairly well insulated to begin with — for example, if you mash in a converted picnic cooler — adding a little extra insulation will help you retain more heat.

So essentially, differences in mash temperature may exist initially within the mash and can form during mashing due to heating or cooling. In all cases, stirring thoroughly will even out the mash temperatures.

However, as you need to open your mash tun to stir, you'll also lose heat each time you do. As such, you'll want to add some heat each time you stir. If you are mashing in your kettle (or have a heatable mash tun), just heat the mash as you stir. If you can't apply direct heat, you'll have to add near-boiling water. In the latter case, you should only open the mash vessel and stir if you suspect significant temperature differences exist. The only way you'll have any idea if this the case is to take good notes the first few times you mash. Take the temperature at several places once you are mashed in. Stir until the temperature differences even out and seal the mash tun. After 15 minutes, open up your mash vessel and take the temperature near the middle and near the edges, then add some boiling water and stir to bring the temperature back to your original target. If the temperature changed little and showed little differences from the middle to the edge over 15 minutes, next time let the mash rest longer before opening it up. If you're losing significant heat in under 15 minutes, you'll definitely want to insulate your mash vessel to a greater degree.

On a 5-gallon (19 L) scale, I try to keep my mash within 3 °F (1.5 °C) of my target temperature and keep temperature differences under 2 °F (~1 °C). I mash in my kettle and have a fitted "sleeve" I throw over it for insulation. To keep within my 3 °F (1.5 °C) target, I need to open up, heat and stir every 20 minutes. You'll have to decide for yourself what amount of temperature deviance you are willing to put up with. The tighter the control you seek, the more you are going to have to monitor, stir and heat your mash. Also, if you are adding hot water to keep your temperature up, you may end up thinning the mash too much or running out of room in your mash vessel.

Wort collection

Once the mash is over, the mash out has taken place and the wort is recirculated, wort collection begins. One factor that greatly affects the quality of your beer is how much wort you collect. The first bit of wort you run into your kettle is high in gravity (up to SG 1.100, depending on your mash thickness) and contains no undesirable elements extracted from the husks. As you continue to run off wort and rinse the grain bed with hot water (sparge), the gravity of the runnings drops and, at some point, the extraction of unwanted husk materials begins. Thus, for every unit of grain you mash, there is a volume of wort you can collect that yields the maximum amount of extract before wort quality suffers.

To find your proper volume of wort to collect per weight of grains mashed, you need either a hydrometer or a pH meter. Measure the specific gravity or pH of the runnings as you collect the wort. When the specific gravity drops to 1.010 or the pH rises to 5.8, stop collecting wort and make note of the volume of wort in your kettle. Divide this volume by the amount of grains you mashed. For example, let's say you mashed 12 lbs. (5.4 kg) of grains and collected 6.5 gallons (25 L) of wort before stopping. This means that you collected 0.54 gallons of wort per pound of grain (4.5 L/kg). Finding this ratio on your system will allow you to plan ahead of time how much wort to collect from any grain bill by multiplying the weight of your grains by this number. From this, you can figure if you'll need to add water to your wort, based on your expected boil time. This may be necessary when brewing low-gravity beers from small grain bills. On the other hand, with strong beers — brewed from correspondingly large grain bills — you can use this calculation to predict how long you will need to boil to reduce your wort volume.

In the next installment, we'll delve further into mashing in an article I won't call "Your Third Mash."

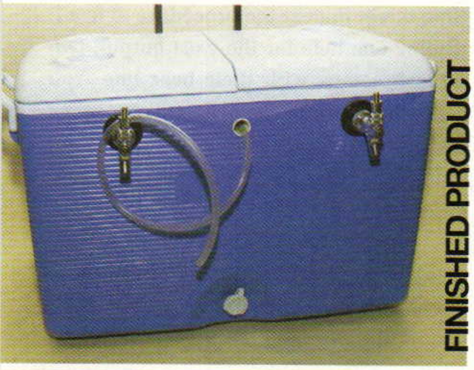
Chris Colby is the editor of BYO.

Dubbel Dip Jockey Box

Chill your wort and beer with one device

Story and photos by Thom Cannell

Everyone who wants a really cool wort chiller, hold up your hand. Now, everyone who wants an even cooler summer beer dispenser (a.k.a. jockey box) hold up his or her hand. All of you with both hands in the air, do a big hands-in-the-air whoopin' an' hollerin' victory dance 'cause we've got you covered — an ice chest on wheels that will dispense two beers today and chill a batch of wort tomorrow.



Ever want a portable cooler to serve your kegged brew? Ever want a handy device to chill your wort? Cover both with this project!

The similarities of a jockey box, essentially a copper or stainless steel coil, to an immersion wort chiller are inescapable. The difference is the amount of energy to exchange: wort is generally at boiling temperature while beer is typically under room temperature. Thus, boiling wort has a lot more heat to exchange than beer. To address this, we're going to give the wort more contact time. We're building a twin-coil beer cooling system that can, on brew day, become a singe coil wort chiller.

The stage being set, here are the necessary parts: one large (~60 quarts or 60 L) ice chest on wheels, two 50-foot (~15 m) stainless-steel or copper tubes and connectors (note: while copper is the most economical material to use, it can affect flavor, so brewers wishing to avoid this should opt for stainless-steel). We've also chosen to design the system using CPC quick disconnects sold by many homebrew shops.

Our multi-purpose device will have three input lines, two with keg-end connectors (i.e. beer-out lines) and one wort input line. Output lines will be connected to tap handles or "cobra" picnic taps and a third line will discharge freshly chilled wort into a pre-sanitized fermenter.

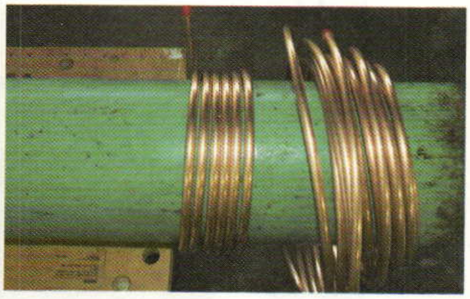
As an option, a temperature measurement device can measure wort output temperature, vital for hitting preferential fermentation temperatures.

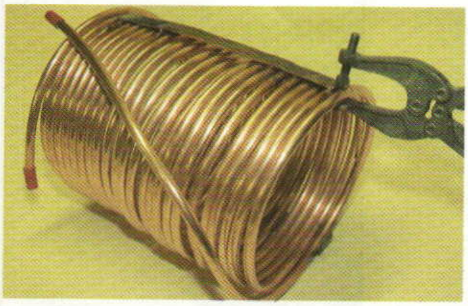
Building chilling coils

Before forming chilling coils, measure the side-to-side, front-to-back and height of your ice chest. You don't want to wind your coils and not have them fit the chest. Also, both coils should be completely immersed in ice and water at all times. Chilling speed will be determined by incoming liquid temperature and rapidity of flow.

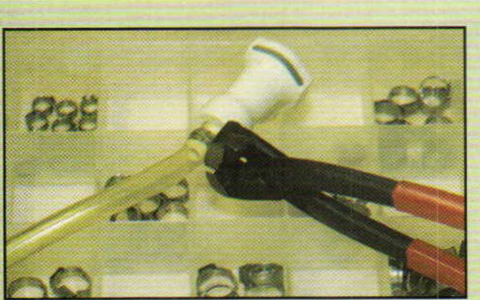
I slipped the coil, all of it, over a steel cylinder of argon gas. Most welding gas and even your CO_2 tank will likely be of similar diameter. You could even use a Cornelius keg, but it is larger.

Step one: If you can slip the coil over the cylinder, anchor one end and slowly and carefully wind the tube onto the cylinder. It has enough spring to come off easily, so don't worry. If you have to roll the tubing onto a larger cylinder, like a keg, you'll need an assistant to help dispense the stainless or copper tube without kinking. Leave 12–14 inches (~30–36 cm) of tube unwound, you need to orient both the input and output sides "up" for convenience when connecting coil-to-coil. Oh, and if you're really lazy and buy a really big cooler, you won't even have to mess with rewinding the coil — you can use it as is.





(top and second): Here's what you'll need: stainless or copper tube, beer line, some clamps and basic hand tools.
(bottom photos): Wrap the chilling coil around a cylindrical object to form shape. We used an argon gas tank. With the coil complete, attach a piece of flattened tube to the coil.



(top): Be sure to clamp every connection as you will be moving near-boiling wort through the tubing.
(bottom): With the coils complete, insert them and attach all your lines and quick connects.

Step two: Attach coil supports (optional)
I strongly suggest you attach supports to the coiled tube on opposite exterior sides. I soldered mine, but if you have some scrap ⅜-inch tube, cut a length that is approximately 4 inches (~10 cm) too long and beat it flat. Then form a hook at one end and slip it over the top of the tubing coil. Do NOT attach within 6 inches (~15 cm) of the input and 12–14 inches (~30–36 cm) of the output tube end. You'll need some flexibility at the tube ends.

Once the hook is in place, pull the tubing coil tight and mark where your flattened tube overlaps the other end. Mark this and bend a right angle. Once this is accurately fit, finish wrapping it around the tube coil. Two such wraps will prevent damage to your coiled tube.

You could also do as I did and solder two stainless or copper strips (I used flattened tube) to alternate coils. This really makes the coil secure from damage.

Drill drain and input holes

Imagine the ice chest filled with ice and water. As boiling wort flows through the coil, its heat is given up to the ice. That ice will melt and the water has to go somewhere. How about out a drain hole? And how about some nice entry holes for twin beer lines and the wort-in line? If we drill through the sides of the ice chest, near the top, we can insert pieces of PVC tubing to act as drain and ports.

Step one: A pilot hole ⅛-¼" is suggested to guide your larger hole. Most of us have regular twist drills and spade bits. A few will have old-fashioned augers and bits, which may not benefit from a pilot hole.

Step two: Once the full-sized hole is drilled (to the diameter of your tubing), cut and insert a length of PVC tubing the thickness of the cooler wall, securing it and sealing it with clear or white silicone sealant.

Step three: Repeat the procedure in front; drilling one hole for the wort output, two for cobra taps with their beer line. You can store excess beer line from cobra taps inside the cooler. If you choose to utilize standard tap handles, larger holes will be needed. Remember, plastic coolers have thin plastic sides sandwiching insulation; you will need to form thin, sturdy backing and fronting plates to keep the taps from crushing the walls. Plates could be constructed of Lexan®, Plexiglas®, aluminum, even thin plywood if waterproofed.

Hose construction

The last bit of do-it-yourself is making the input, output, and jumper lines. You may choose to simply make the hoses 12 inches (~30 cm) longer than necessary and cut off 1 inch (~2.5 cm) every time you change duties between brewing and dispensing. If so, be sure to properly clamp the PVC or beer line every time. Hot wort will expand the plastic, soften it, and you'll either lose beer or end up in the emergency room with severe burns from boiling wort. Two bits ($0.25) worth of clamps per juncture (about $3.00 U.S. total), could literally save your hands and arms from burn.

If you've made the decision to invest in CPC quick disconnects you'll connect the barb fittings to heat resistant beer line with stainless steel clamps. Again, no skimping on quantity or quality. In my opinion, "radiator" screw clamps are the least suitable clamps — they are not designed for this small diameter application, plus most will quickly rust. The same thing goes for low-pressure pinch clamps, they're made of steel and will rust, plus their clamping force is minimal. My design calls for using 12 quick disconnects, six male and six female. The coils each have a male and female and you'll need a jumper to connect the two cooling coils in series. I've chosen to use female body (CPC#83200) connectors at the back end where wort or beer enters the chilling device, and male (CPC#83100) connectors where wort or beer leaves the chiller for dispensing. Each coil will require one of each, as will the jumper. The chosen connectors are heat resistant polysulfone (CPC HFC35 series).

The next process is to make two

PARTS:

• ice chest, 60-quart (~60 L) on wheels	$28.00
• 3/8" i.d. (1/2" o.d.) copper tube two 50-feet (~15 m) lengths	$38.00
• CPC quick disconnects available at brew shops and online	$18.50
• heat rated beer tube (silicone or braided PVC) 25'	$8–16.00
• stainless steel clamps Oetiker-style preferred	$0.30 ea.
• two taps, either cobra style for	$ 7.00 ea.
or beer taps for	$35.00 ea.
• two beer-out keg connectors	$7.00 ea.
• thermometer (we used a Blichmann ThruMometer)	$30.00
• pump — high temperature pump recommended	prices vary
• quick disconnect: 3/8" x 1/2" NPT (We used Blichmann's as well)	$19/pair

keg-out to quick disconnect (female body connectors) combinations using any beer hose. Heat will not be an issue for beer. The third should incorporate a heat resistant tube like silicone or less expensive braided PVC.

Step one: Cut two pieces, 5–6 feet long (~2 m) of 3/8" i.d. beer tubing and connect each to a Cornelius keg beer-out connector. Cut one 5- to 6-foot (~1.5–2 m) length of 3/8" heat resistant wort input tube. Be sure to clamp the tubes to the barbed connector. Slip each bare tube end through one of the penetrating tubes you have (optionally) built into the cooler. (The middle wort-in tube will connect to your pump, kettle, or siphon, depending on your system design.)

Step two: Attach a female body connector to each of the three tubes and clamp.

Step three: Attach 12–20 inches (~30–51 cm) of heat resistant tubing (3/8") to the input and output side of each chilling coil; clamp. Since heat rises, push the beer in at the top of the coil.

Step four: Attach one male and one female quick disconnect to each chill coil tubing end and clamp.

Step five: Make a jumper of 12–20 inches (~30–51 cm) of heat resistant tubing with one male and one female quick disconnect and clamp.

Step six: Cut two pieces of beer line (non-braided) 12–24 inches (~30–60 cm) in length and attach a male quick disconnect. Attach the other end to your tap handle, or run through one of the (optional) front-mounted PVC tube-lined holes placed in the front and attach to a cobra head tap.

Step seven: Cut one length of beer line 24–60 inches (~75–200 cm) in length as a wort discharge tube. Attach a male quick disconnect to one end and run the other through the (optional) PVC tube-lined hole placed for wort output.

That's it, you're done and ready! Well, ready to sanitize the whole thing with a trial run (no cooling) of a cleaner, followed by heated water and finally sanitizing solution (and don't forget to rinse everything with water).

Just remember three things: One, a dry run is always necessary to ensure everything works and doesn't leak. Two, for beer dispensing when using this new jockey box your CO_2 pressure will have to overcome greater resistance (line length,) so remember to increase CO_2 pressure to push beer through. Remember to reduce keg pressure and bleed off excess CO_2 when you stop using the jockey box lest you dispense only foam with your normal, shorter, tap line. Finally, when it's time for fermentation, adjust flow rates for wort cooling to dispense properly chilled wort for ale (58–68 °F or 14–20 °C) or lager (48–70 °F or 9–21 °C) depending on your preferred process.

***Thom Cannell writes the "Projects" department in each issue of* BYO.**

Turning Pro

Or, homebrewing at work

by Bill Pierce

"*When the going gets weird, the weird turn pro.*" — Hunter S. Thompson

At one time or another, most avid homebrewers probably harbor thoughts of brewing professionally. The allure of having hundreds or even thousands of appreciative beer drinkers consuming the fruits of your labor is great food for fantasy. Visions of massive stainless steel conical fermenters and multiple serving tanks full of your brew are the stuff of dreams — and the occasional reality for a number of people who have made the transition from brewing as a hobby to doing it for a living. About two-thirds of professional craft brewers got their start as homebrewers.

While the economics of professional brewing are beyond the scope of this article, a few cautions are in order before you trade the tools of your current occupation for a pair of rubber boots and a mash paddle. For one thing, a brewer's salary may not be enough to support you in the style to which you are accustomed. Many assistant brewers, the usual starting rung at brewpubs and small microbreweries, earn little more than minimum wage, with matching benefits. And should you wish to start your own operation at the top as an entrepreneur, the financial investment can be considerable, along with numerous legal and regulatory obstacles that must be overcome.

Brewing at the very largest breweries is an entirely different matter. Production brewers are often union members who advance through the ranks, while technical and supervisory employees are typically hired as recent college graduates with science and engineering backgrounds, and promoted as they gain experience.

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Where the boys are

By and large, craft brewing is an occupation for young, single males. There are exceptions — a few early retirees do it part-time and about two percent of brewers are female. However, the generally low pay, hard work and relative lack of job security make it difficult for those who have extensive personal responsibilities. Small microbreweries and brewpubs are often undercapitalized; the lack of automation and labor-saving equipment is overcome by the brawn of the brewer. As a result, brewers tend to be fit. A workday spent lifting 50 lb. (23 kg) bags of malt, lugging heavy hoses, shoveling wet spent grain into barrels, and washing, filling and stacking 15.5 gallon (59 L) kegs offers a better workout than the health club.

There is also a bit of male bonding and hazing in most commercial breweries. Assistants and newer brewers are generally assigned the harder tasks and expected to earn their way to easier duties and more responsibilities.

Try before you buy

It's worth making the acquaintance of the brewers at your own local brewpubs and microbreweries. These are typically small operations with minimal bureaucracy and overhead. Show up at the back door and introduce yourself. The nature of brewing somehow seems to make it a morning activity, although some breweries operate around the clock. There is a fraternity among brewers that extends from amateurs to professionals alike. If they are not too busy at the moment, professional brewers usually will be happy to talk and show you around. Be polite and respectful and defer to their judgment. Once they realize you share an interest and a passion in common, they are often very open and forthcoming. Understand this is their job rather than a hobby as it is for you, but don't be afraid to ask questions. By the way, the contribution of local craft brewers as the occasional source of ingredients such as fresh yeast, as well as opinions and advice, can be invaluable.

Once you are on a first name basis with your local brewers, if you are truly interested in learning about the work, ask if you might be able to "ride shotgun" during a brewing session. Offer to help for free in exchange for the favor; you'll likely be rewarded with samples later. Be willing to adjust to their schedule. It's something of a traditional ritual for assistants, both paid and unpaid, to shovel out the mash tun, so don't be afraid of a little physical labor.

Seems like home

You will find a lot in common between small-scale craft brewing and homebrewing. Any all-grain brewer will easily recognize the basic processes of mashing, sparging, boiling, chilling and fermenting the wort. The equipment and batch sizes, typically from 3 to 15 barrels (90–450 gallons or 350–1,750 L), are certainly larger, but not so much that the scale seems out of proportion. About the same amount of time as for homebrewing applies to each stage of the brewing process. A typical brewing session, including cleanup, is seven to eight hours, and the beer is ready for serving or packaging in from one to several weeks or longer, depending on the style.

The ingredients of course are the same, merely in larger quantities. Many craft breweries employ a mill to grind the grain, while some use pre-crushed malt and adjuncts. Typically an auger or grain elevator feeds the crushed grain to the mash tun. Sometimes it is mixed with hot water as this occurs, in order to reduce the amount of stirring, but some arm-twisting with a paddle in the mash tun is usually necessary to complete the process.

Small craft brewing systems achieve roughly the same mash efficiencies as homebrew systems, typically in the 70–80% range. This means that homebrew recipes scale rather easily to small commercial batch sizes. Some of the best-known craft beers originated in the minds of homebrewers, and the prototypes for a brewery's beers may in fact have been brewed on a homebrew system. There is some difference in hop utilization between homebrew and craft brewing systems. Typically, larger kettles extract a little more of the alpha acids from the hops, so it may be necessary to scale back the hopping rates somewhat.

The one area where commercial breweries often enjoy an advantage over homebrewers is in yeast management. Because they tend to brew regularly, professional brewers usually have a ready supply of healthy yeast from a previous fermentation that can be pitched into fresh wort. However, most breweries tend to maintain only one or two regular "house" strains, which limits the variety. And periodically (typically anywhere from every 5 to 20 batches) they like to start from a fresh culture, which means stepping up the population from a smaller source volume, much in the same way as homebrewers make yeast starters. In fact, the yeast in more than a few brewpub seasonal beers may have had its origins in a vial or smack pack that originally fermented a 5-gallon (19-L) batch of homebrew.

Don't try this at home

There are a few major differences, however, between homebrew and craft brewing techniques. For homebrewers, it's generally a simple matter to take a dirty piece of equipment, even a relatively large pot or fermenter, to the sink for cleaning. (A laundry tub or utility sink may increase the convenience factor.) The sheer size, weight and lack of portability of commercial brewing vessels make this either extremely impractical or altogether impossible. As a result, special measures for cleaning and sanitation have had to be developed, many of them adapted from the food processing and pharmaceutical industries.

> Professional brewers use few glass vessels, but the danger of burns increases with the batch size. Moreover, many commercial kettles and HLTs use steam as the heat source, which is under pressure and even hotter than boiling water.

Among these is what is known as "clean in place" or CIP. The brewing vessels are fitted so that they can be closed and sealed, while cleaning solution (usually hot) is pumped and forced through an internal spray ball at relatively high pressure. This results in a spray pattern that scrubs the interior of the vessel clean. Think of it as being much like an automatic dishwasher. Once the cleaning has finished (it typically takes from 10 to 30 minutes), a similar process is performed for rinsing and for sanitizing. Some manual cleaning may be necessary for areas not easily reached by the spray, and vessels such as mash tuns cannot be readily fitted for CIP applications. They may have to be cleaned by hand, which can require literally climbing inside.

Brewing requires relatively large amounts and a ready source of hot water. An important feature of most craft breweries is the hot liquor tank (HLT), which is used for heating sparge water, as well as water for cleaning and sometimes sanitizing. Typically the water is heated prior to a brew session and the temperature is controlled via a thermostat. Additionally, the brew kettle may be used as an auxiliary HLT when not boiling the wort.

Homebrewers often rely on gravity and siphons to move liquids. This is less than practical in many commercial situations. Consequently, pumps are used extensively in most breweries. As many as three or four pumps are employed to perform tasks such as moving the wort from the mash tun to the kettle to the chiller to the fermenter, and the beer to the serving tank or kegs, in addition to the various CIP procedures.

Safety first

Professional brewing entails greater safety risks. The two major categories of homebrewing injuries are cuts from glass breakage and burns from hot liquids. Professional brewers use few glass vessels, but the danger of burns increases with the batch size. Moreover, many commercial kettles and HLTs use steam as the heat source, which is under pressure and even hotter than boiling water. Most professional brewers have a few scars and horror stories; the vast majority are not life threatening, but they underscore the importance of safety. The relaxed attitude of having a few homebrews during a brewing session is conspicuously absent from almost all commercial brewhouses. The risks are too great and workplace safety regulations in many locations forbid it.

Other dangers include some you may not have thought of. For example, the concentration of CO_2 in a large brewing vessel can reach levels where it displaces oxygen in the lungs and can potentially asphyxiate a brewer. It's important to purge and equalize the pressure in vessels before opening them. Large vessels under pressure have special safety concerns. Excess pressure can turn covers and doors into missiles when opened improperly, while a vacuum can crumple a vessel like a tin can. The caustic chemicals and acids used in brewery cleaning and sanitation can irritate and burn the skin, nasal passages, lungs and eyes. Proper safety equipment and procedures are required.

My own personal entry in the annals of strange brewing injuries came while doing some manual cleaning of a conical fermenter. The scrubbing pad I was using dropped from my hand and, rather than disassemble the bottom fitting, I leaned deep into the fermenter. The opening was just slightly wider than my torso. Blocking out all light, I was immediately plunged into darkness; the effect was disorienting and claustrophobic. I instinctively jerked myself backwards and my rib cage caught on the thick stainless steel lip of the opening. I felt and heard two distinct "pops" as my lower ribs cracked. Suddenly I was standing back in the daylight in pain, clutching the pad in my hand. Gritting my teeth, I managed to finish the job and my shift and went home. Fortified with painkillers, I was able to continue working during the healing process, but with considerable soreness for almost six weeks. Obviously, professional brewers need to be constantly aware of the dangers that surround them.

Brewing hot and cold

Perhaps less familiar to homebrewers is what occurs on the "cold side" of craft brewing. The fermented beer has to be transferred to a conditioning or lagering tank, and finally to a vessel from which it is ultimately served, kegged or bottled. Sometimes the beer is also filtered. All of this is known collectively as "cellaring" and is an integral — if somewhat less visible and glamorous — part of professional brewing.

Often the cellaring is accomplished during slack periods that occur in the brewing day. Craft brewers have to become adept at multi-tasking. For example, it's sometimes necessary to ready the filter for one beer in the cellar and prepare a serving tank to receive it, all while sparging another batch in the brewhouse. Later the first beer is filtered and pumped to the serving tank, while the wort rests after the boil. Such is the life of a professional brewer: there's no rest for the wicked, as one head brewer used to say.

Don't quit your day job

While a career as a professional craft brewer may remain a dream rather than a reality for most homebrewers, consider the honest labor and admirable results of the effort. The dedication to quality, consistency and taking pride in the work is highly regarded and worthy of emulating. And you can rest assured that many professional brewers indulge in nearly the same ritual as you do at the end of the day — that is, they relax, don't worry and have their own beer. We could do much worse. Here's to all those who make the beer we drink!

Bill Pierce discussed how to brew great lager beers in the March-April 2006 issue of Brew Your Own.

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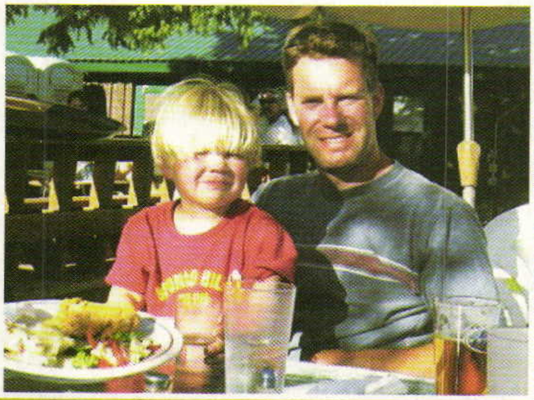
Fare Thee Well

Our "Tips From the Pros" columnist says so long

Thomas J. Miller • Carmel, Indiana

We were driving to Montana when I saw the light. And, for that matter, a specific brand of light. It was in St. Louis, during a tour of America's biggest brewery, and all of the sudden the realization struck me: somehow, somebody makes all this beer. Not knowing the first thing about the brewing process, I spent the rest of that summer driving a tour bus in Glacier National Park wondering how the heck all the beer I was drinking actually made its way into the bottle. I must have made my intentions clear, because at the end of the summer I was presented with a gift: a how-to book on brewing beer.



I came back to college in Bowling Green, Ohio, and wasn't home for a couple weeks before visiting a brew shop near Detroit. I launched my homebrewing career with gusto, making extract brews and quickly switching to partial mash.

All this enthusiasm for beer led to the logical conclusion that I steer my German graduate studies toward beer and German culture. Why not, right?

So when I had the chance the following year to do graduate work in Munich, I was ready. I left early and pounded the pavement, going from brewery to brewery until I found work. It was a temporary position, sure, but I was officially employed by the Augustiner Braeu in Munich, in the malt house, for about five months. Good pay, and lots of great beer.

I left that job when school started, and penned a paper for the German literary magazine, "*Literatur in Bayern*." My piece was entitled, "*Auf Sanfter Brust gleitet das Wies'n Bier zum Tisch*." Quick translation: "Oktoberfest beer floats to the table on the soft breasts of the servers."

You might think publishing a paper would have kept me engaged with the graduate program, but it didn't. The siren song of brewing drew me away, so after returning home, I applied for jobs and eventually landed work at Snake River Brewing Company in Jackson Hole, Wyoming. Later I sold beer for Otto Brother's Brewing Company (also in Jackson Hole) and around that time started writing for the now defunct industry magazine, *BrewPub*.

Somewhere in that convoluted process I realized my passionate edge for brewing was eroding and so I stepped away. As the old saying goes: don't turn your hobby into a job. It was (to my own surprise) very true for me.

Tom Miller began writing for *Brew Your Own* in 1998. His debut column "Brewing on the Snake" (October1998) presented advice from Snake River Brewing Company via then head-brewer Will Gilson. Tom wrote the column for the next eight years, his final appearing on page 13.

But writing for *BrewPub* and then *Brew Your Own*, kept me in the loop. Better yet, in the "Tips from the Pros" column I was able to interview my former professional peers, so I always felt like I was on the cutting edge of what was new and currently practiced on the production level.

Even more exciting was converting professional practices into practical homebrew methods. Aeration comes to mind — this was a practice I always read about as a homebrewer, and remember feeling like the old "paddle stir" would be enough to mix oxygen into my wort. But having worked at the production level, I had seen the equipment used to inject that oxygen and learned how vital the process actually was.

So, when brewer Wil Gilson sent me a sketch with his mechanism for injecting oxygen, and described it over the phone, I believed it would be a rousing "Tips from the Pros" success.

There were plenty of other topics I found exciting, of course. For me, they usually encompassed some unusual element of homebrewing — something I haven't done yet, and would like to try. It's the romantic in me.

Take hop growing for example. I now live in a part of the country where I could set up a trellis system and give it a shot. Part of me wants to do it and I know I have the pro insights to get me started. That's the great thing about the "Tips from the Pros" department: it gives you enough to get started, while generating the interest to make *BYO* readers want to learn more.

I haven't planted hops, though, for the same reasons I am retiring as the author of the *Tips* column. Life has continued to change, and with three children under the age of eight and a busy new job, I realized it was time to hand over the reins to someone who could devote the time necessary to ensure the quality of the column.

I do so with a heavy heart, but with full confidence in my successor: Associate Editor Garrett Heaney. Is it a ritual at *Brew Your Own* that, when a writer retires, the editors send him a six-pack of their favorite Vermont beer? Now that's an idea I'd raise a glass to!

– Zum Wohl! (Cheers!)

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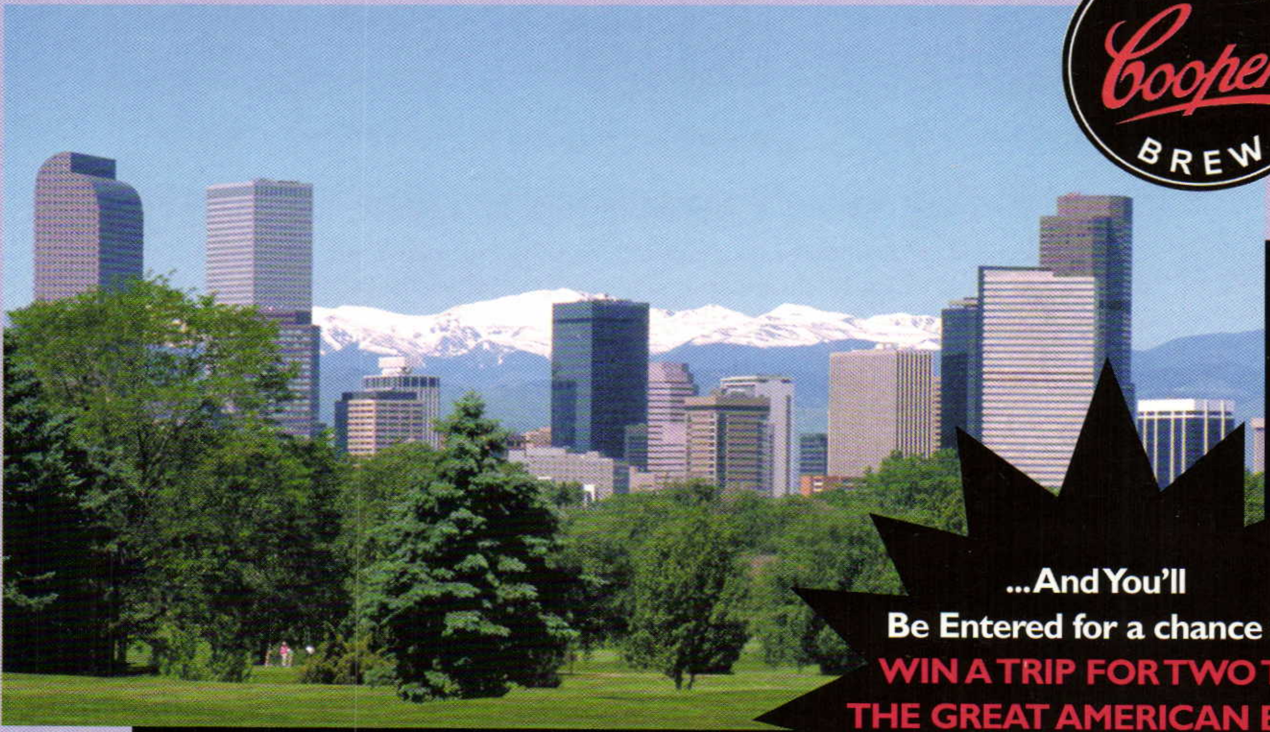

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