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MARCH-APRIL 2006, VOL.12, NO.2

THE HOW-TO HOMEBREW BEER MAGAZINE

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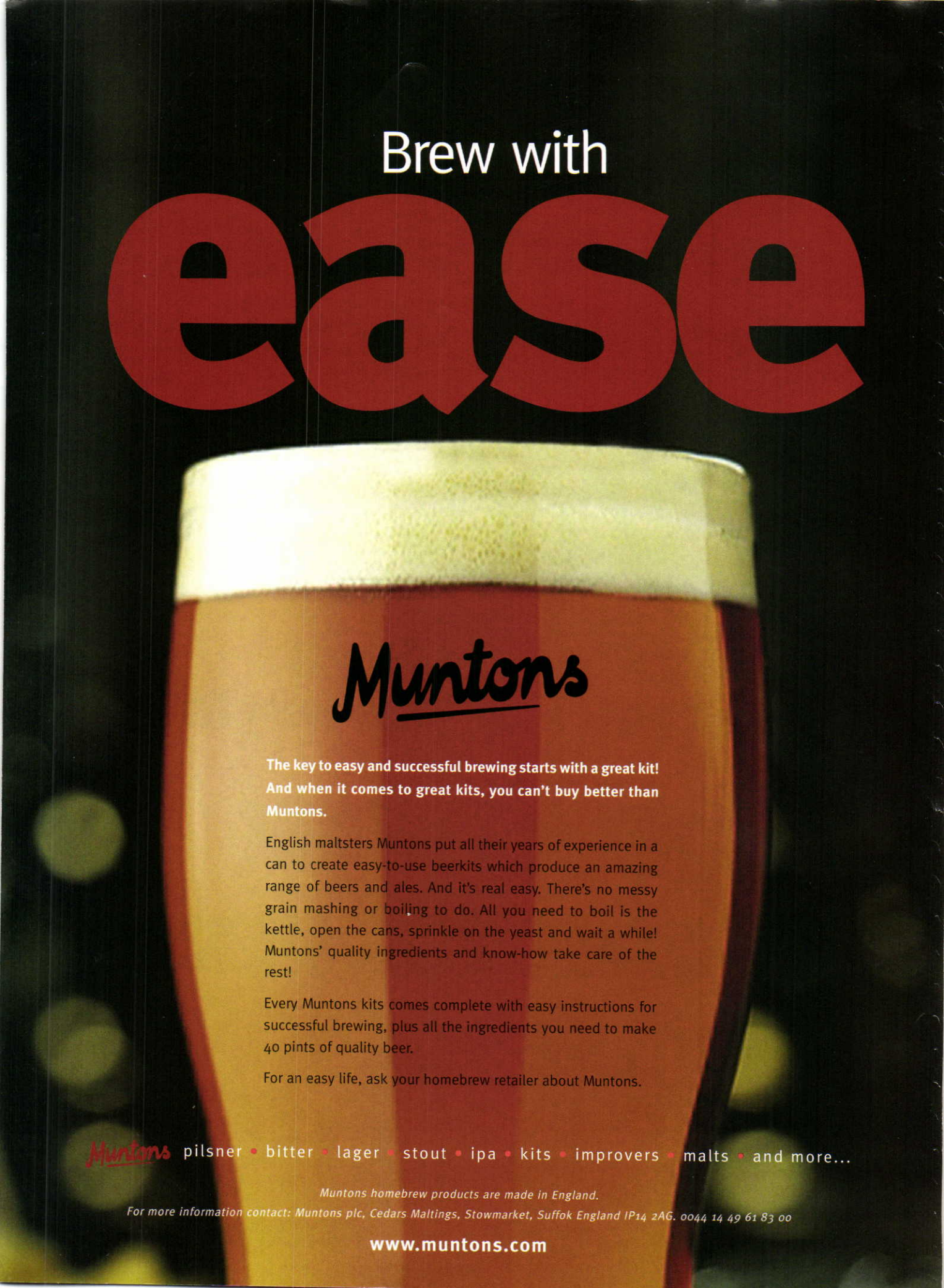
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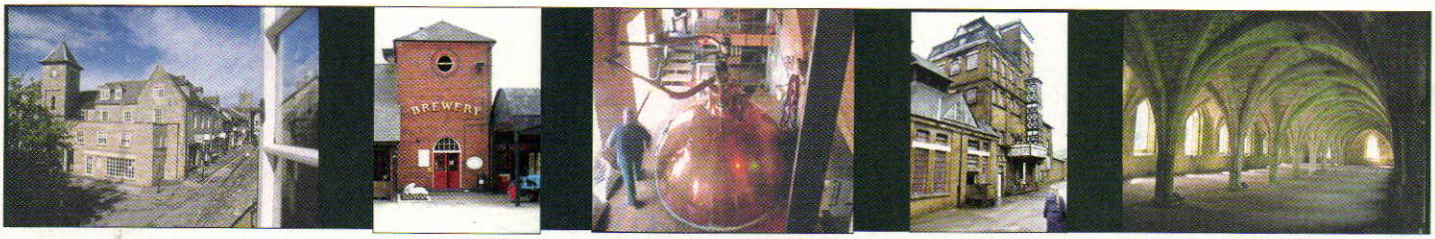

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MARCH-APRIL 2006
Volume 12 Number 2

Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

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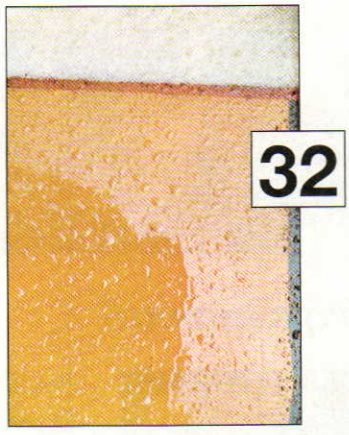

Where to find it

Brew Your Own's 11th Annual Homebrew LABEL Contest

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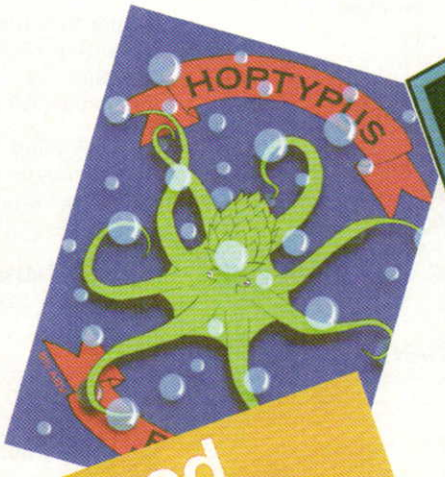

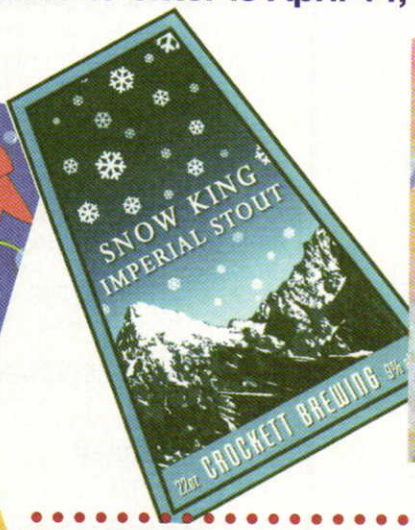

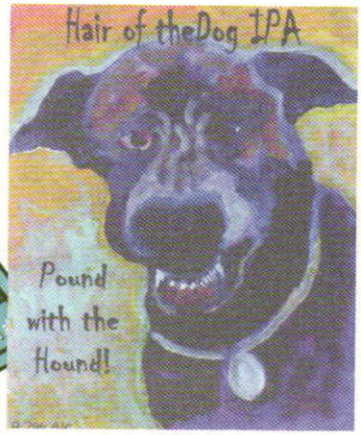

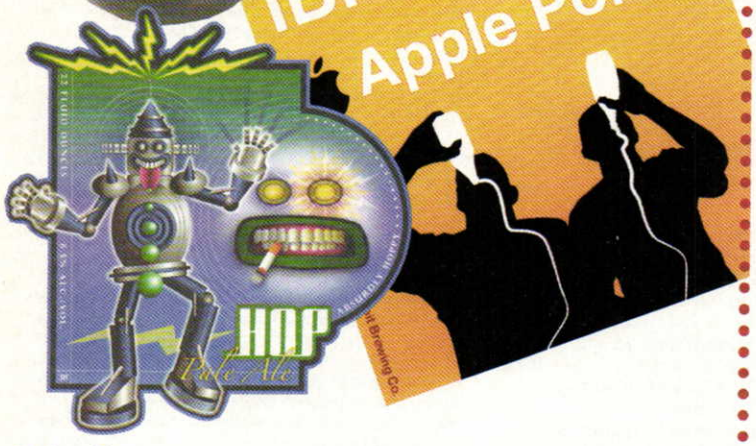

Rules: Entrants can send labels or labels already stuck to bottles. The bottles can be full of beer. No digital or electronic files will be accepted. All other rules are made up by the editors of *BYO* as we go along. Labels are judged in one category, open to graphic artists and amateurs alike, so ultimate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

BrewYour Own
THE HOW-TO HOMEBREW BEER MAGAZINE

Label Contest Entry Form

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Daytime Phone _____

All original artwork? Y or N (circle one)

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Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

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Editorial and Advertising Office
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Tel: (802) 362-3981
Fax: (802) 362-2377
E-Mail: BYO@byo.com

Advertising Contact
Kiev Rattee
kiev@byo.com

Editorial Contact
Chris Colby
chris@byo.com

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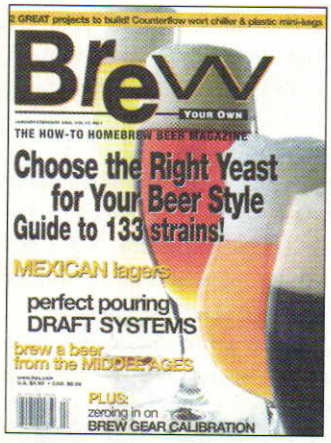
Yeast Strain Switcheroo

I just received my copy of the latest *BYO* (January–February 2006). I appreciate the yeast reference. However, it looks like the two Brewferm yeasts are switched around. Not a big deal, but I thought you might like to know.

Mike Gutenkauf
Aberdeen, South Dakota

Yep, the descriptions of the two Brewferm yeast strains — the blanche strain and the lager strain — did indeed get switched. We'll update our online chart, which can be found at www.byo.com.



CO_2 Conundrum

I have now pored over (pardon the pun) the Advanced Brewing column in the January–February 2006 issue about 10 times and I seem to have missed the point. I followed everything up to and including the example for the pale ale. I get lost because I do not see the pressure that you are putting on the keg from the CO_2 tank for dispensing.

Christian Sloan
via email

The pressure on the keg (in other words, the gauge pressure) is 13 PSI — the amount of pressure required to carbonate the keg to the desired level. The keg is kept at that pressure and the amount of resistance in the dispensing equipment is built around that value. We hope this makes sense so you can quit poring and start pouring.

Finding Fermentation

I am writing in regards to Willie Bobo's letter to the editor (January-February 2006 issue). Sixteen hours after pitching his yeast there was no visible activity and he asked if he should pitch again. I have found the first sign of fermentation is not foam or bubbles, but a rise in temperature. Attaching a temperature strip to the side of the carboy will reveal when fermentation is beginning before any other visible sign.

Dave Calhoun
Yakima, Washington

The temperature of wort does indeed rise when fermentation starts as heat is released due to the metabolic activity of the yeast. And, this temperature change can be used as an indication that fermentation has started. Seeing little spots of foam on top of the wort and pressure building up behind the airlock is another sign. We've stared at our share of silent fermenters, wondering when (or if) fermentation would start. Although this is a time honored homebrewing ritual, we recommend always pitching enough yeast and aerating your wort well. This takes the worry out of waiting.

White What Now?

It was really neat seeing my recipe published (Aurora Ale, p. 10, January-February issue). I did see one misprint and one step by step that was a little confusing. The second grain was listed as white malt and should have read white wheat malt. In the step by step section it looks like you should put the lemon and rosemary in for the last 15 minutes of the boil when they should go in to steep 15 minutes after the boil.

Steve Ruch
Vancouver, Washington

Thanks for the clarification, Steve. Looks like a tasty beer.

Great Gobs of Gypsum

I was just sitting here at work reading the December 2005 issue of *BYO* and I saw that you guys listed a clone of the Red Hook ESB recipe. I was elated. I live in Seattle and love the fact that there are so many good microbrews up here. Red Hook ESB is one of my favorite store bought "consistent consumption" beers. Looking over the recipe, something struck me as quite odd. In the ingredients, I noted that the recipe called for 4 oz. of gypsum on a five-gallon batch. I've never had a recipe that called for more than 2 tsp. of gypsum for 5 gallons and I was just wondering if they really wanted you to add a full quarter pound of drywall or not?

Eric D'Ancicco
via email

RED HOOK BREWERY
SEATTLE • WOODINVILLE

You're right that 4 oz. (113 g) of gypsum is too much for a 5-gallon (19-L) batch — it should have been 0.4 oz. (11 g). (Actually, when we contacted Red Hook to confirm, they said 0.4–0.5 oz. (11–14 g) was the right range. Incidentally, kudos on reading BYO *at work. We're going to give that a try.*

Viennesee

I just read your article on Vienna style lagers. I notice you didn't mention Genesee Red Lager. While shopping for "good beer" at a specialty store in New Jersey three years ago I noticed and purchased a thirty pack of this stuff just because of the ridiculously low price.

Much to my surprise, they actually achieved a malt profile. I assume they minimized the adjuncts.

Two years ago this beer took first place in the Vienna Lager category at the Great American Beer Fest. Last year, I believe it came in third. I took some to my homebrew club meeting and we all agreed that while certainly not a yellow fizzy beer, it was somewhat thin for the style. Ever since, I have been wondering

RECIPE INDEX

BYO RECIPE STANDARDIZATION

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

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

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

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

how Genesee Red Lager did so well at the GABF. Do you know anything about this beer?

G. Morgan
via email

Story author and BYO *editor Chris Colby responds: "According to the GABF (Great American Beer Festival) website, Genesee Red Lager (High Falls Brewing Company) won a silver medal in 2005 and a gold medal in 2004 in the Vienna-Style Lager category. The High Falls Brewing website says that it's brewed with three types of roasted malt, which could mean just about anything, and has 4.9% alcohol by volume. (They also mention that it contains no fat or cholesterol.)*

"From my experience, beers labeled as Vienna lagers fall into two categories — lagers made with a noticeable amount of Vienna or Munich malt and Pilsner-style beers with enough crystal malt (or malt coloring agents) to turn them red. Schell's FireBrick, brewed with pale and Munich malts, is an example of the former — what I call the "little Octoberfest" model. Leinenkugel's Red is an example of the latter. (Leinie's Red, incidentally won a gold medal at the 2002 World Beer Cup and a silver medal in 1998 in their Vienna-style lager category.) Either kind can be tasty, but I prefer the former and my article primarily describes how to brew that version of a Vienna.

"My response to this point is just the scenic route to me admitting I've never tried this beer, but if I ever see a cheap 30-pack of Genny Red in my local beer aisle, I'll give it a try."

"Champagne" Cleaning Question

I would like to make some of the Berliner Weisse "Napoleon's Champagne" listed in the December 2005 issue, but I have a question regarding the *Lactobacillus* bacteria. Is it difficult to sanitize equipment after using lactobacillus? I know that *Brettanomyces* can be hard to get rid of.

Edward Kurk
via email

This question comes up a lot in reference to beers that are brewed with microorganisms other than brewers yeast. The answer is that any hard surface — glass, stainless steel or hard, unscratched plastic — can be cleaned and sanitized without any problems. It may, however, be harder to get rid of bacteria or wild yeasts from softer items, such as tubing or stoppers. If this worries you, keep a separate set for sour beers. In general, however, homebrewers who brew sour beers report no problems with contamination in their "normal" beers.

Wheat for a Wit

I have been reading and enjoying your magazine for a number of years now. However, I feel I must weigh in on the brewing of witbier as described in your "10 Hardest Styles" article (December 2005). I have been brewing witbiers for a number of years now with very good results, drawing gold regularly in competition. From what I've read elsewhere, the malt bill should contain up to 50% (+/- 10%) un-malted (torrefied) wheat, rather than malted wheat, with the rest being (probably Belgian) Pilsener malt and maybe a little oats. The un-malted wheat (with other light grain) is what gives you that hazy, straw-colored, puffy-headed classic wit look.

I agree with the article that one should go easy on the spice additions, but I would use a less estery yeast than Forbidden Fruit. I like White Labs WLP400 or Wyeast 3944. I know that this beer is a bit more trouble to make than say, a basic bitter, but it's a very richly rewarding, full-flavored refresher, and well worth the trouble. You can find one of my wit recipes (I experimentally swapped oats for rye), "Artemis Callipygia Witbier" on our club website: **http://www.maltosefalcons.com/recipes/20050703.php**

I raise a glass of hearty homebrew to the *BYO* staff. Congratulations on 10 years!

Cullen Davis
Grand Hydrometer
Maltose Falcons Homebrewing Society
Sherman Oaks, California

Thanks for the information, Cullen. We agree that using unmalted wheat will yield a more traditional witbier. As for yeast choice . . . you say tomato, we say Forbidden Fruit.

KRISTIN GRANT is a freelance journalist and beer enthusiast based in Baton Rouge, Louisiana. She is a regular contributor to *The Advocate*, the city's main newspaper, and regularly writes for a variety of national magazines. Kristin is an avid gardener and especially enjoys growing herbs and plants used for diversifying her brewing.

Kristin's current passions are high hop Pilsners and German-style Märzen brews. She graduated from the Johns Hopkins University in Baltimore, Maryland and recently won the top prize for fiction at the Ozark Creative Writers Conference and has been published in *Stories from the Blue Moon Cafe IV*; an anthology of southern writers.

On page 40, she combines her love of homebrewing and gardening by describing various herbs and spices to grow in a backyard "beer garden."

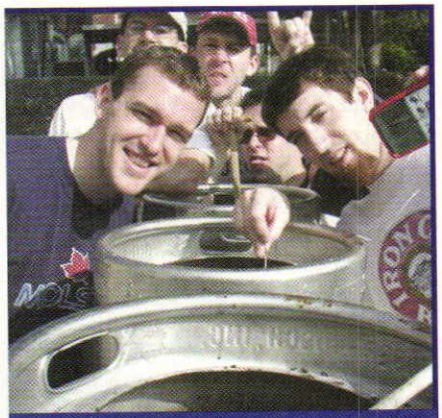
STEVE BADER owns and operates Bader Beer & Wine Supply in Vancouver, Washington. Steve started homebrewing in 1990, began teaching homebrewing classes from his home in 1991 and opened his homebrew shop in 1992. Starting with the September 2001 issue of *BYO*, he took over the job as the Replicator and took the column to new heights. The first beer he "Replicated" was Harpoon IPA and he has cloned 49 beers in his tenure, including North Coast's Old Rasputin, Ommegang's Hennepin and Tröegs Hopback Amber Ale. Unfortunately, Steve is moving on and soon he will no longer be writing the Replicator. He will, however, remain on our review board and is already working with our new Replicator to make the transition smooth. See page 11 for his homebrew recipe for Saint Arnold Summer Pils. Thanks for all the clones, Steve!

TOM MILLER began homebrewing in 1990. He has worked in the malthouse at Augustiner-Bräu in Munich, Germany and as a brewer at Snake River Brewing Company in Jackson Hole, Wyoming. While completing a Master's degree in German Languages and Literature at Washington University in St. Louis, he authored a linguistic study of the German word "Durst" (thirst) in Oktoberfest literature, entitled "Auf sanfter Brust gleitet das Wies'n Bier zum Tisch." The article was published in a German literary magazine in 1994. He later became a writer for the now defunct industry magazine *BrewPub*. In 2001 he debuted his column, "Tips From the Pros," for both *Brew Your Own* and our sister magazine *WineMaker*. In this issue he discusses body and mouthfeel with brewers from Brewer's Alley in Frederick, Maryland and Blind Tiger Brewery in Topeka, Kansas. Check it out on page 13!

homebrew CLUB

Antioch Sud Suckers • Nashville, Tennessee

It was a summer night in 2003. Six guys sat around a keg in a garage in South Nashville, Tennessee talking about beer. We were drinking pale ale as I recall. It had been recently kegged and was long on foam. After several pints, we decided that this group was more than just a couple of homebrewers in some guy's garage floating kegs and eating bologna. We were a group, an assembly . . . no — a club! But we could not be like other clubs. There could be nothing repetitive or mundane about our new congregation! Everyone would be a Vice President! There would be no dues, no benefits other than camaraderie and, as someone blew frothy head from the top of their glass, plenty of suds. In that very moment the Antioch Sud Suckers were born.



The Sudsuckers like to suck their suds, and even better, like to brew them together. Their first group brew was 60 gallons of Jack A.S.S. Stout!

Nashville's rebel homebrewing faction, the Sud Suckers emphasize fellowship over order, brewing over discussion and advancing our homebrewing skills through practice. A lot of practice. Most of us are relatively new to brewing (4 years or less), but we do have a couple of wise experts that have been brewing for quite a while. We try to keep the organized club functions to a minimum, so when we meet, there's a great deal to talk about and taste. We have four annual events, geared towards seasonal brewing; lagers in the winter, bocks in the spring, Belgians in the summer and porters and stouts in the fall. Afterall, who needs an event to brew ales! We also gather to celebrate the holiday season, spouses and kids in tow and do the unthinkable — have a cocktail not made with beer (the horror!).

Our first organized brew event was October 2003. We brewed 60 gallons of Imperial Stout that we aged for 8 months in a whiskey barrel obtained from the neighboring Jack Daniel's distillery. We aptly named it Jack A.S.S. Stout. An ambitious endeavor for this motley bunch, but the end product was a hearty stout with whiskey aromas and a woodsy-smoke taste.

Besides using Jack Daniel's barrels our members love to incorporate non-traditional ingredients like chocolate donuts, chili peppers, green apple Jolly Ranchers or Andes Mints. This experimentation often results in our favorite judging comment: "This beer interests me intellectually — but I wouldn't want to pursue it."

Our three years of club existence netted a second place finish in the MidSouth Homebrew Club of the Year competition and a doubling of the club membership. The Sud Suckers strive with vigor to be unlike any other homebrew club. We keep the rules to a minimum, the tap handles open and, with an increased focus on precision over consumption, 2006 should bring more ribbons, members and, certainly, suds! If you are in the Nashville area and are interested in homebrewing, please contact us through our Website at www.antiochsud-suckers.com.

reader RECIPE

JOE'S GARAGE ALE (Almond Ale)

OG 1.036 FG 1.010

Ingredients

1 lb. (0.45 kg) crystal malt (120 °L)
1 lb. (0.45 kg) chocolate malt
½ lb. (0.23 kg) biscuit malt
3 lbs. (1.4 kg) amber dry malt extract
1 oz. (28 g) Nugget hops (60 min)
1 oz. (28 g) Northern Brewer hops (30 min)
1 cup malto dextrin
Irish Moss
3 slightly outdated vials of White Labs WLP004 (Irish Ale Yeast)
Add 3 oz. (84 g) of almond extract at kegging

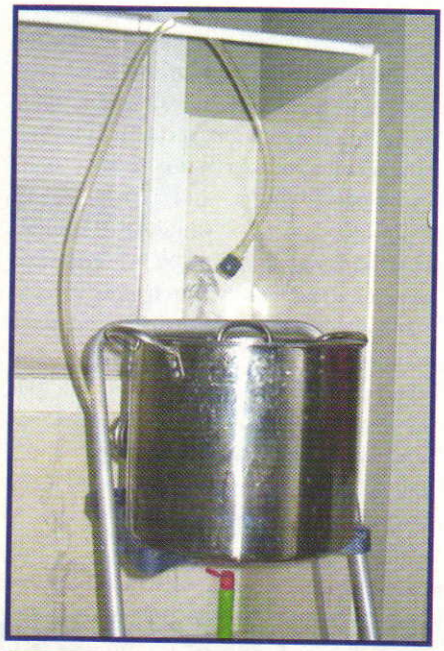
Named after a Frank Zappa album, this is a low gravity ale, with a strong bitterness. I steeped the grains for 45 minutes at 150 °F (66 °C). While they were steeping I brought my brew pot to a boil and threw in the malto dextrin, Nugget hops, and amber dry malt extract. Thomas Creek, our local homebrew supplier, will often sell slightly outdated vials of White Labs yeast at a price of three for one. I typically make a yeast starter just prior to brewing with one of the vials, and then I throw in two of the vials at the end of the brew session. I then toss the yeast starter in just before going to bed or first thing the next morning. It makes for a strong fermentation!

– Eric Rogers • Greenville, SC

brewer PROFILE

Eric Rogers • Greenville, South Carolina

I first started brewing about five years ago. I was living in a one-bedroom apartment that contained what my girlfriend (now my wife), referred to as a "one-butt" kitchen, because that's all that would fit in it. Nevertheless, we brewed several good batches in that little space.



When the power goes out, the brew kettle makes for a hot shower!

We now have a larger kitchen and I'm able to do full boils on the gas stove placing my seven and a half gallon brew pot across two burners. I use a third burner and a separate pot to steep specialty grains while my brew pot water comes to a boil. I mostly brew alone now but my wife is very supportive and has yet to complain about the smell, the dirty kitchen or the stain on the ceiling from a recently overactive barleywine fermentation.

During a recent four-day power outage I used my brew pot as a shower. I heated up the water on the gas stove then placed the pot on a stepladder beside the bathtub. I have a PVC cap that I drilled holes into, which I normally use on the end of my transfer hose for aeration, but it made a great shower head. For future reference, should anyone ever try this, 105 °F (41 °C) is the perfect temperature.

I bottled my beer for about four years, but after several bottle explosions, I finally converted an old refrigerator into a kegerator about a year ago. I'm a filmmaker and I had used my kitchen as the set for a film. We had brought in an old refrigerator that fit the production design better than the stainless steel refrigerator we normally have in the kitchen. On the last day of shooting, before the crew took off, I had them move the old refrigerator to the basement where it is now known as the Lizerator, being named after the main character in the film, Elizabeth. I have several tap handles I change from time to time.

The Lizerator holds two kegs and tap handles swap on rotation.

hop PROFILE

LIBERTY

LIBERTY is an American hop variety and is typically used for its aromatic contributions. The hop derived in 1983 as a female cultivar of Hallertau and a downy mildew resistant male. The hop is a half-sister to three other common American varieties: Ultra, Mt. Hood and Crystal. It is a low alpha acid variety with a rating between 3 and 5% AA. This hop is typically used in small quantity in lighter beers and is most popular in lagers, Pilsners and some Bocks. It is also used in American wheat beers and Kölsch styles. The hop aroma is mild but contributes a distinctive spicy characteristic that many brewers favor for certain of the above mentioned styles. The cones of this hop are of a stockier nature; short, dense and wide. Liberty is a hearty variety that is able to withstand downy mildew to a moderate degree.

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.

homebrew CALENDAR

March 4
The Drunk Monk Challenge
Aurora, Illinois

The Urban Knaves of Grain present The 8th Annual Drunk Monk Challenge. This is a qualifying event for the Masters Championship of Amateur Brewing (MCAB) and a leg of the Midwest Homebrewer of the Year. The deadline for entries is March 4 and the event will be held on March 11. Entries should be shipped to Walter Payton's Roundhouse America's Brewpub on 205 North Broadway in Aurora. Fees are $5 online or $7 for paper entries. For full info visit knaves.org/dmc.

March 15
Samuel Adams Holiday Homebrew Competition
Boston, Massachusetts

Samuel Adams and the Boston Beer Company are hosting a homebrew competition this year and the Grand Champion will win a trip to Boston to brew the winning beer with Jim Koch at the Samuel Adams Brewery. The deadline for entries is March 15 and all beers must be received at Beer and Wine Hobby at 155T New Boston Street in Woburn, Massachusetts. There is no fee for this competition. For full info and forms, visit www.samueladams.com/promotions.aspx.

March 31
2006 ALES Homebrew Open
Regina, Saskatchewan

The deadline for entries to the ALES Homebrew Competition is March 31. The Brewer's Dinner and Awards Ceremony will be held on April 8 at the Bushwakker Brewing Company in Regina. The fee is $5 per entry and all BJCP styles will be accepted. This competition is a qualifying event for the AHA's National Homebrew Competition. For more info and online registration visit www.alesclub.com.

BIG WINNING recipe

Best of Show at Palmetto State Brewers Open
Columbia, South Carolina
Ken Hilton • Greenfield, North Carolina

Special congratulations to Ken for being named the 2005 Carolina Brewer of the year!

Hefe-Hefe Hefeweizen
(6 gallons or 23 L, all-grain)
SG = 1.044 FG = 1.009 ABV = 4.7%

Ingredients:
6.5 lbs. (2.9 kg) malted wheat
4 lbs. (1.8 kg) Europils malt (Canadian version of Pilsner)
1.5 lbs. (0.7 kg) Vienna malt
¼ lb. (112 g) CaraMunich® 40/60
0.5 oz. (14 g) Tettnanger leaf 6.5% alpha for 60 minutes
0.25 oz. (7 g) Saaz leaf 2.5% alpha for 60 minutes
1 pk. Wyeast 3068 (Weihenstephan Weizen Yeast)

Step-by-step

Add 3 tsp. of chalk and 1 tsp. lactic acid to 10 gallons of very soft water for the mash and sparge. This was a single decoction mash. Infuse 3.6 gallons (13.7 L) water at 143 °F (62 °C) to do a protein rest at 120 °F (49 °C) for 30 minutes. Then remove 40% of the mash and raise to 150 °F (66 °C) and hold for 30 minutes. Raise the decoction to boiling and boil for 15 minutes. Add back to the mash and adjust the mash temp to 150 °F (66 °C) for 60 minutes. Add 3 gallons (11.4 L) boiling water and mash out at 168 °F (76 °C) for 30 minutes. Sparge with 170 °F (77 °C) water down to 1.000 OG hit (1.013 ambient). Ferment at 68 °F (20 °C). With this beer, I bottled half the batch after 1 week, and added 1 quart (~1 L) of sour cherries to the remaining 2 gallons (7.6 L). The cherry brew was pretty good, but not as good as the straight Hefeweizen. The sour, tart taste competes with the banana/clove esters of the Weihenstephan yeast. Enjoy!

replicator

by **Steve Bader**

Dear Mr Replicator,

I had the opportunity to try several beers from the Saint Arnold Brewing Company while I was in Houston, Texas. The Summer Pils is by far the best "summer" beer I have ever had. However, I live in York, Maine and despite my best efforts, I cannot get this beer. Could you please tell me how I could replicate this beer? Any help is greatly appreciated.

Mike Jancovic
York, Maine

Pilsners are wonderful to drink, but are a tough beer style to brew. Even small flaws are obvious due to the delicate nature of the beer. I talked to founder and Head Brewer Brock Wagner of Saint Arnold Brewing Company about this wonderful beer.

Summer Pils is a seasonal beer that Saint Arnold Brewing has tweaked over time. Brock says that Summer Pils has a clean, malt flavor with moderately aggressive hoppiness. Saint Arnold found that this is one of those beers that is better if you keep the alcohol content down a bit. Saint Arnold uses a very small amount of Munich malt to get a bit of color and some more maltiness. Brock also said he thought the key to making this beer is to use relatively soft water. Saint Arnold uses reverse osmosis water to remove the water minerals. For homebrewers making this beer Brock suggested that you boil and cool your brewing water in advance to reduce the calcium carbonate.

Brock also suggested that this beer be fermented on the lower end of the lager fermentation scale, as Saint Arnold found in their brewing trials that fermentation at 48 °F (9 °C) was best. And for all-grain brewers, Brock also suggested to get better fermentability out of the mash by using a thinner than normal mash and keeping the temperature on the lower side of the scale, around 152 °F (67° C).

For more information you can visit the Saint Arnold Brewing Company web site at www.saintarnold.com or by calling (713) 686-9494. Good luck and enjoy!

Saint Arnold Brewing Company Summer Pils

(5 Gallons/19 L, extract with grains)

OG = 1.048 FG = 1.008
IBU = 30 SRM = 5 ABV = 5.2%

Ingredients

3.3 lbs. (1.5 kg) Coopers Light unhopped liquid malt extract
2.3 lbs. (1.04 kg) Coopers Light unhopped dried malt extract
1.0 lb. (0.45 kg) German Pilsner malt
3.0 oz. (85 g) German Munich malt
1 tsp (5 mL) Irish moss (boil 60 min)
8.0 AAU Hallertauer hops (60 min) (2.0 oz./56 g of 4.0% alpha acid)
3.5 AAU Saaz hops (0 min) (1.0 oz./28 g of 3.5% alpha acid)
1.3 AAU Hallertauer hops (0 min) (0.33 oz./9 g of 4.0% alpha acid)
White Labs WLP830 (German Lager) or Wyeast 2206 (German Lager) yeast
0.75 cup (180 mL) corn sugar (for priming)

Step by Step

Place crushed malts in a nylon steeping bag and steep in 1.75 qt. (1.69 L) of water at 152 °F (67 °C) for 30 minutes. Remove grain bag from wort, rinse with 0.75 qt. (~0.75 l) of 170 °F (77 °C) water. Add water to make 3 gallons (11 L), add the malt syrup, dried malt extract, bittering hops and bring to a boil.

Add the Irish moss and boil for 60 minutes. Add the Saaz and the second addition of Hallertauer hops at the end of the boil and let them steep for 5 minutes.

Now add the wort to 2 gallons (9 L) of cool water in a sanitary fermenter, and top off with cool water to 5.5 gallons (20 L) Cool the wort to 75 °F (24 °C), aerate the beer heavily and pitch your yeast.

For fermenting lager yeast, you want the beer to cool over the next few hours to 68 °F (20 °C), and hold at this temperature until the beer has begun fermenting, normally about 24 hours. Then cool the beer to 48 °F (9 °C) and hold there for the remainder of the fermentation, probably about 2 more weeks, since yeast ferments slower at lower temperatures. When the beer has dropped to your ending gravity, then bottle or keg your beer and enjoy!

All-grain option:

This is a single step infusion mash. Your grain bill will be 9.5 lbs. (4.3 kg) of German Pilsner malt and 3 ounces (9 g) of German Munich malt. Mash the two grains together at 152 °F (67 °C) for 60 minutes.

Brock suggests a slightly thinner than normal mash to produce a higher degree of fermentability. Collect approximately 7 gallons (32 L) wort to boil for 90 minutes to yield 5.5 gallons (25 L).

Lower the amount of the Hallertauer hops in the first addition of the boil to 1.75 ounces (50 g) to account for higher extraction ratio of a full boil.

Brock suggests a "first wort hopping" addition for these hops, which means you add the hops to the wort to the kettle as you collect it — when the heating wort is around 170 °F (77 °C) — rather than waiting for the wort to come up to a boil. The fermentation and lagering procedures for your beer are the same as in the extract recipe.

An Intro to Kettle Adjuncts

Adding a little pep to your step-by-steps

by Garrett Heaney

In its most simple form, beer is made with four ingredients: malt, hops, yeast and water. Some brewers use only these four ingredients, while others tend to sprawl out over the spectrum and introduce any number of alternative ingredients. When it comes to replacing or augmenting malt, these alternative ingredients are known as adjuncts and they are added for different purposes. A simple way to distinguish adjuncts is to separate them into mash adjuncts and kettle adjuncts. Mash adjuncts are grains like oats or corn that require mashing to extract the sugars that benefit brewing.

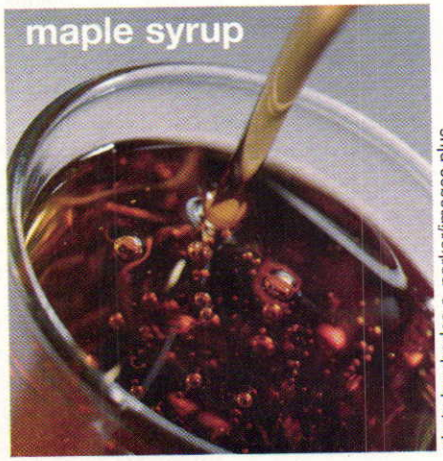


photo by charles a. parker/images plus

Inside the kettle adjunct category there are a number of ingredients that are added for different reasons. All of which, however, have soluble sugars that do not require mashing. Ingredients like this can simply be added directly to the wort during boiling and can be used with extract brewing. Here are the most common kettle adjuncts:

HONEY: Honey is a highly fermentable ingredient with relatively high sugar content. In fact, it is used on its own in a medieval beverage known as mead. In general, honey is a good adjunct to add to the kettle in order to raise the alcohol and maintain a balanced body. Some beers that benefit from honey are nut brown ales, stouts and several Belgian ales.

MAPLE: Maple is added in a number of forms as an adjunct. At its simplest form, it is maple sap, that comes directly out of the tree. Sap has been substituted on its own for brewing liquor, to give a very nice flavor and texture to the final beer. While sap has only 2.5% sugar content, a more common form of maple comes in syrup, with about 66% sugar. Maple has a distinct flavor that adds a detectable sweetness to many brews.

MOLASSES: Molasses is a dark syrup that derives directly from everyday cane sugar (sugar beet molasses has an unpleasant taste). When raw sugar is processed, molasses can be harvested as a dark and thick syrup. It gives a distinct flavor to certain beers, and is popular in a number of stouts and porters. Being as dark as it is, it also benefits the color profile of beers where "darker is better."

BROWN SUGAR: Brown sugar is a "happy medium" between processed cane sugar and molasses. During processing, brown sugar is not completely rinsed of the molasses and retains about 3-5% of it. This gives it a touch of the flavor of molasses, but it remains in granular form. Brown sugars are common in wee heavy styles, stouts and holiday brews.

BELGIAN CANDI SUGAR: Authentic Belgian candi sugar is crystallized beet sugar. It is made from distilling sugar water and extracting the pure sucrose. It can thin out higher gravity beers and add a caramel flavor note. It is available in light, amber and dark colors.

The "oses":

These kettle adjuncts are all various forms of fermentable sugars that are simply added during the boil to increase alcohol strength while having little effect on a beer's body, color or flavor.

GLUCOSE OR DEXTROSE: This is one of the most common forms of carbohydrate in the natural world and a key product of photosynthesis. It is available in powder and syrup forms (including the very popular "corn syrup").

FRUCTOSE: This is a simple sugar (monosaccharide) that is also very common in the natural and brewing worlds. It is found in honey and most fruits and berries. Brewers can add it in the form of powder or sugar or fruit itself.

SUCROSE: Sucrose is the most common sugar known to man: table sugar. If you take a closer look, you'll find that it is actually a "disaccharide" made up of both glucose and fructose. Again, plain old sugar can be used in almost any brew and leaves little flavor after the yeast converts it to alcohol.

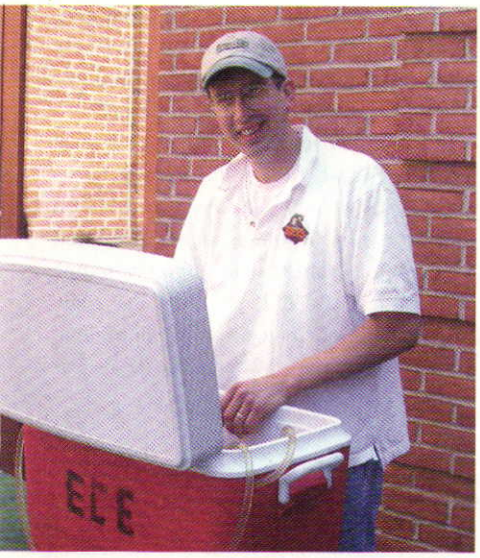
Note: When adding adjuncts to the boil, it is important to stop the heat of the boil so that these ingredients don't scorch on the bottom before they dissolve. It is important to note that with the addition adjuncts to the kettle, you are increasing the gravity of your wort. This, in turn, will decrease your hop utilization and may effect the final "hoppiness" of your brew. To avoid this, try to add the adjuncts as close to the end of the boil as possible — once your hops have had the opportunity to infuse normally. Many brewers throw in adjuncts for the last 15 minutes of a boil. This is a safe bet, because you want to ensure that your wort is sterile when the boil is complete. Good luck!

Maximizing Mouthfeel

Controlling the body of your brew

by Thomas J. Miller

A famous chef once said "we eat with our eyes first." What does this mean for brewing? Simply that every sense plays a role in our enjoyment of beer. We see the color, we taste the taste . . . and we feel the way beer eases across our palate and the sensations left behind. This mouthfeel experience can make the difference between a mediocre beer and a great beer. It is a lesson worthy of learning from the pros, and putting their tips to good use.



Tom Flores graduated from UC-Davis with a Masters of Science in Food Science and Technology, with an emphasis in brewing in 1994. He has been the Head Brewer at Brewer's Alley in Frederick, Maryland since 1997.

Texture is a major component of beer flavor that is often overlooked. Taste and aroma seem to get all the attention, but appropriate texture in beer is just as important. A couple of synonyms for texture that are more commonly used are body and mouthfeel; I use them all interchangeably.

In conversation with fellow brewers regarding beer texture, the aim is often to increase body and avoid the perception of "thin" mouthfeel. I understand this focus, but with respect to mouthfeel, more is not always better. The level of texture should always be evaluated in terms relative to what is appropriate for a beer's overall flavor composition. Maybe the focus of avoiding "thinness" is due to the fact that it is more of a challenge to increase mouthfeel than it is to diminish it.

Whatever your intentions are for the mouthfeel of your beer, the key to manipulating beer texture is an understanding of the physical property of viscosity. The viscosity of a solution is determined not only by how much "stuff" is dissolved into it, but also by the nature of this "stuff."

In specific technical language, this translates to: "Viscosity is determined by the concentration of a solute, as well as the molecular weight of that solute." You can end up with two beers of the same intrinsic viscosity — one which has a high concentration of low-molecular weight solutes (i.e., various sugars like maltose, glucose, etc.) and the other with only a little bit of some very high molecular weight material (i.e. betaglucan, arabinoxylan, etc.).

In the end, the raw material which will have the greatest impact on the texture perceived in beer is the grain you are using. There are some other factors which can affect how you sense viscosity on your palate, but which do not have a big impact on the intrinsic viscosity. For example, glycerol production by yeast during fermentation can lend a certain "slickness" to the texture of a beer.

So manipulation of viscosity is at the heart of controlling body and mouthfeel. You may be looking for some guidance on how you achieve this control. Since beer has so many things dissolved in it that could potentially affect viscosity, I'm sorry to say that there is no single method of approach. However, the most effective way to start adjusting viscosity in either direction is to focus on the high molecular weight material. To accomplish this, most brewers try to control the amount of beta-glucan and dextrinous material (produced from the degradation of starch during the mash). The effect of beta-glucan is well known and generally agreed upon within the brewing community, but that of dextrinous material is subject to some dispute. I guess you could say that it's hard to draw the line between where starch can no longer be called starch and should be more properly referred to as dextrin. I believe that it is possible to have dextrinous material in wort at the end of a mash that is not near the molecular weight of starch, but is of sufficiently high-molecular weight to influence wort viscosity.

All this adds up to the take home message: Higher mash temperatures (low fermentability/high dextrin content) generally yield a fuller bodied beer in the end, and lower mash temperatures (high fermentability/low dextrin content) generally yield a drier and thinner beer. This approach is fairly well known and easily exploited.

The great thing about homebrewing versus commercial beer production is the lack of headaches for a 5 or 10-gallon (19 or 38-L) system. Beta-glucan is generally viewed by professional brewers as a problematic material to be avoided, and for good reason. Too much beta-glucan (especially high-molecular weight beta-glucan) can lead to stuck runoffs, plugged filters and gelatinous sediment in finished beer. But a subtle hand in introducing a small amount of beta-glucan can actually have a positive effect on body, as well as head retention. Common sources of increased beta-glucan in wort include: rye, unmalted barley and oats. If you use oats, it is important to use pre-gelatinized oats in the mash, unless you are going to cook them separately before adding them to the mash. Good luck!

Brewer: John Dean started homebrewing in the spring of 1990 and landed his first pro brewing job at Barley's Brewhouse in Topeka, Kansas in 1996. He has been the Brewmaster for the Blind Tiger Brewery in Topeka since 1999.

When I think of boosting body and mouthfeel on a particular beer, I start with the yeast. This may sound like we are starting at the wrong end of the brew day, but it is the yeast's ability to ferment that will largely determine the body and mouthfeel left behind in that brew. This ability is measured by attenuation. Yeasts available at homebrew shops will have this value printed on the package.

American ale strains tend to be strong attenuators and hang around the 73–80% range. English strains get as low as 63–70%, while some Scottish strains drop to 60% attenuation. Now we go back to the beginning of the brew day, the malt bill. Dextrin is the key to making your American ale yeast behave like it is English. Dextrin is made up of polysaccharides from starch that will lend body and mouthfeel to any beer. It is sold in a powdered form that you can add right to the boil. There are also very pale caramel malts, such as Carapils and Carafoam®, that are specially produced and can be used to boost the dextrin content of wort.

You can use up to 20% Carapils and Carafoam®, but I find 8–10% gives me the desired effect. There are other malts available to help build body. Munich malt is a great body builder and can be used in large quantities. Don't be afraid to replace some two-row base malt with Munich. With some brands of Munich malt you can use up to 100% in your malt bill! I brew several beers in the 80 to 100% ranges. Crystal malts can add sweetness and body but with a much bigger impact on flavor and color.

The way we manipulate what happens in the mash tun can help us in our endeavor too. Our goal for building body and mouthfeel is a thick mash. A thin mash increases the proportion of maltose, which will lead to greater attenuation (and a thinner body). Next we want that mash to land in the 158–162 °F (70–72 °C) range. A saccharification rest at this temperature will produce wort rich in dextrin. You want to keep mash pH in the 5.3 to 5.5 range. Your last runnings should not fall below SG 1.008 or you could extract tannins, which are astringent and can add to mouthfeel.

As far as hops are concerned, it is often the case that really hoppy beers require more malt backbone to prevent the beer from becoming unbalanced and perceived as thin-bodied. If you're happy with your grain bill, you can also alter your choice of hops to boost mouthfeel. Going with some low cohumulone varieties is always a good choice.

A Tannin Tangent

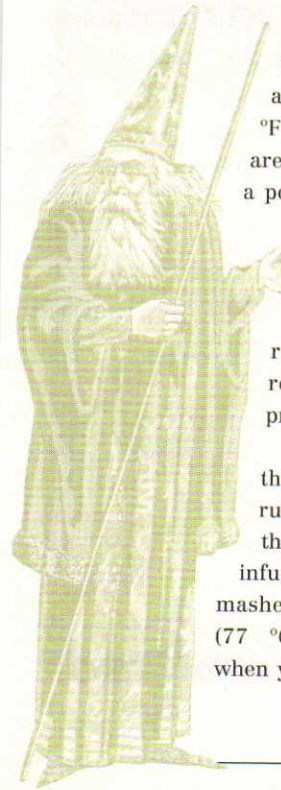
Chilling sanitation and the wonders of the whirlpool

Talk about decoction

I have a question that's been stumping me for a while. I'm an all-grain brewer and would like to try decoction mashing. All-grain brewers are always told to include a mash-out rest and to keep the mash temperature below 170 °F (77 °C) for risk of leaching tannins into the wort. So, how is it that a decoction mash requires part of the grist to be removed from the mash and boiled? What about the tannins?

Darrin Walraven
Greensboro, North Carolina

This is a very good question that inevitably arises when knowledgeable all-grain brewers begin thinking about doing a decoction mash. The conventional rule is to mash-out at around 170 °F (77 °C) and not to exceed this temperature during wort collection for the reason you mention. In a traditional triple decoction mash, the mash begins at around 104 °F (40 °C) and a portion of the thick mash is removed, boiled and returned to increase the temperature to about 122 °F (50 °C). This cycle is repeated to heat the mash to 140 °F (60 °C) and then up to 158 °F (70 °C). So there are three times where a portion of the mash (always the thick mash) is removed, boiled and returned to the resting mash to provide heat.



My view on the conventional rule about keeping the temperature of infusion and step mashes below 170 °F (77 °C) makes sense when you consider what happens to the mash during wort separation. As the wort gravity drops, the pH of the wort flowing from a mash bed increases, and with the increase in pH, the solubility of polyphenols increase. With this, you run the risk of getting a grainy flavor if you have high pH and low gravity runnings combined with high temperature.

A decoction mash is different. Thick portions of mash are removed and boiled. The wort in mash is very concentrated, usually about 18–22 °Plato. This means that the concentration of sugar is high. It also implies that the wort protein content is high as well since there have been no steps taken to remove protein from the wort, for example wort boiling and trub separation. During the mash boil in a decoction mash, protein from the malt reacts with tannins and precipitate. The pH is also "normal" (~5.2) at this point in time and the solubility of tannins is still relatively low compared to that seen in the last runnings from the lauter tun. I admit that the following statement is an educated guess but I would venture to bet that the reaction between protein and polyphenols is significant and explains why decocted beers are not overly astringent.

I was in attendance at a National Homebrew Conference in Baltimore 11 years ago and Dr. Klaus Zastrow, a well-known retired Brewmaster from Anheuser-Busch, was speaking about the history of lagers. After his talk I asked Dr. Zastrow the same question you asked me and he gave me a slightly different answer. He actually began by disagreeing with the premise that decocted lagers are no more astringent than other lagers (which was my premise).

I wish I spoke German, at least enough to hack by in brewing terms, because Dr. Zastrow had a specific word to describe the astringency of decocted beers and explained that this certain flavor attribute was one of the desirable hallmarks of decocted lagers. He did not imply the flavor was unpleasant but explained in English that this attribute gives the beer a certain briskness. Brisk is a tea term and is the opposite of flat or soft and I interpreted his statement to mean that decocted beers had more, uh how do you say, *cojones*. I hope my brief answer helps you in your quest and that this has given you the confidence to brew up a batch of that Pils with *cojones* you've read so much about!

I like my wort chilly chill

I brew using a copper counter-flow chiller (Chillzilla) and discovered that it fits inside my pressure cooker. To sanitize, actually sterilize it, I will run it through at 10–15 PSI for about 15 minutes. Can this be harmful to my brew or me?

Jim Skolka
Salisbury, Maryland

. . . these discoveries soon become part of my standard way of doing things and makes the alchemy of brewing a tad different from one brewer to another.

I love these questions that begin with "I was monkeying around with my gear and discovered that . . ." Ahh, discovery! Finding that new tool, new technique or realizing that you can do something with your existing rig that you thought impossible without spending more money on your setup. In my personal brewing experience these discoveries soon become part of my standard way of doing things and makes the alchemy of brewing a tad different from one brewer to another.

Pressure cookers are wonderful discoveries, especially if you name it something else. I call my pressure cooker an autoclave. Autoclave sounds less like some pot robbed from granny's kitchen used to make pot roast or can green beans from the garden. I use my

autoclave to sterilize wort in little Erlenmeyer flasks and media bottles to grow yeast. The autoclave is also great for sterilizing media to make Petri dishes containing various microbiological media. And of course, when one considers that surgeons sterilize scalpels, forceps, hemostats, suture and all sorts of other surgical implements in autoclaves they become an obvious tool for use in a brewery.

Sanitize and sterilize are not interchangeable words. Sterilize in its simplest form means to completely destroy all living matter.

Since I am digressing worse than usual, I want to clarify the term sterilize. When most equipment in a brewery or food processing facility is cleaned, it is then sanitized with some sort of chemical or heat treatment. Sanitize is based on the Latin root *sanitas* and in food safety circles "sanitary" means that bacteria, viruses and other things that are health concerns have been removed or destroyed by cleaning and sanitizing of equipment to a point where human safety is not compromised. Sanitize and sterilize are not interchangeable words. Sterilize in its simplest form means to completely destroy all living matter. The standard dunk in bleach, peroxyacetic acid, iodophor or whatever your sanitizer of choice is does not sterilize equipment.

Autoclaves can sterilize if the steam pressure (temperature) and duration of the process is sufficient. Usually when equipment is sterilized the process is targeted to destroy a specific group of bugs and the term "commercially sterile" is used since absolute sterility is not practical. There are some heat resistant spores that are very difficult to destroy, for example *Clostridium botulinum* spores, that can kill people if canned foods are not properly processed. All canned foods are processed so that these spores are reduced by 12 log cycles. This means if you begin with 1 trillion spores you end up with 1 — not sterile but a pretty impressive reduction. This also means that if you begin with 1 spore per can the odds of having a can with one spore are 1 in a trillion. Beer does not support the growth of pathogens, but there are certainly heat resistant bacteria that can make for some awful tasting beer and heat exchangers are a good place for these little buggers to hide.

Cleaning beer and wort lines is also very important. At our brewery, the line is cleaned after every brew and heat sanitized by recirculating 203 °F (95 °C) water through the line for no less than 20 minutes. We do the same thing with our beer filter and measure the water temperature at the outlet of the filter and maintain a minimum temperature of 176 °F (80 °C) for 20 minutes before we cool the filter down with cold water that

was previously boiled. Heat is a wonderful method of killing bacteria because bacteria cannot hide from heat provided that the heat is actually uniformly distributed through the equipment being sanitized or sterilized.

When equipment is exposed to very hot water or steam, as in an autoclave, it is important to verify that all parts can tolerate high temperatures. Heat-treating materials not rated for extremely high temperatures can result in failure and if the piece of equipment being treated is to contain something potentially dangerous, like hot wort, a failure can cause serious injury. We had a steamer in the food science department at UC-Davis and someone implemented a procedure where bottles were placed in the steamer after washing and prior to use. After a number of cycles, this fatigued the glass and we started having bottles explode during counterpressure filling. Unfortunately I was operating the filler when this first occurred and was left in shell shock after blowing up several bottles. Luckily, I was wearing a face shield!

I checked out the Chillzilla on the web and it comes from the manufacturer with no plastic parts and the unit can certainly be placed in a pressure cooker without harming the chiller or causing flavor problems in your beer. This unit does require the owner to supply a plastic hose on the wort inlet and outlet fitting and the manufacturer suggests using a "thermoplastic" hose. I would suggest using braided PVC hose for this and verifying that the hose is not damaged by the heat treatment you have in mind.

You should note that hoses are rated at specific pressures and temperatures. These two numbers mean that a hose can hold 100 psi of pressure at 120 °F (49 °C), for example. The rating does not mean that the hose melts above 120 °F (49 °C), but means that it may burst if pressurized above 100 psi at the same temperature. When heat sterilizing in an autoclave you really don't care about the pressure rating because you are not using the hose to hold liquid pressure, but you do want to ensure that the hose is not damaged. Simply remove the hose and autoclave the chiller if you cannot determine the hose's temperature rating. When I autoclave things I use 15 psi for 20 minutes and most home pressure cookers have a weight designed to provide 15 psi of steam pressure. The time and temperature used in an autoclave depends on what bugs you are targeting and you can get data on the kill rate of various bacteria at different temperature if you so desire.

When it's time to whirlpool

I've been doing all-grain brewing for about a year now and noticed considerable more break material in the kettle than when I was brewing with extracts. I cool with an immersion chiller and siphon directly from the kettle to the fermenter, just as I had before, stopping the siphon before drawing any break material. My all-grain batch size has been coming in typically 0.5–1 gallon (1.9–3.8 L) shy of my target volume. Then I realized, that I'm leaving that "missing wort" in the kettle mixed with the break! My question is,

what's the best way to obtain the most wort from the kettle without a lot of break?

Chris Hillman
Winnipeg, Manitoba

This is really a straight-forward and easily addressed problem if you simply add a few more minutes and one additional step to your brew day — namely whirlpooling. And I'm not suggesting that you run out to the spa for a dip in a hot tub! The whirlpool method is used in nearly all commercial breweries these days to separate trub and often times pellet hops from wort in an effort to minimize wort loss. Typical wort losses in a whirlpool are less than 5% or less than 1 quart (~1 L) in a 5-gallon (19-L) batch.

Hot wort is usually whirlpooled by pumping wort out of the kettle and into a whirlpool vessel tangentially near the bottom third of the vessel. Some kettles are designed so that the kettle also serves as the whirlpool vessel (a pump and tangential inlet are installed for this purpose and the pump is later used for pumping to the wort chiller). This causes the wort to spin while trub and hop pellets collect in the center of the whirlpool. Most brewers wait for the wort to stop spinning before removing the wort from the whirlpool, either from a valve installed on the perimeter of the tank or by simply racking the wort with a racking cane.

In your case you are using an immersion chiller and these things disturb the wort currents that make the whirlpool method effective. There is nothing wrong with chilling the wort and then spinning it simply by stirring the wort with a spoon, allowing the rotation to stop and then racking to your fermenter. Since cool wort won't kill bacteria or wild yeast, you need to be careful with the cool wort in an effort to minimize the risk of contamination. The spoon used to stir should be sanitized before use and the kettle should be covered while you wait for the wort to stop spinning.

This is an easy method and you will know if you are stirring fast enough by the way the trub settles in the center of the kettle. Commercial brewers shoot for an inlet velocity to the whirlpool of about 5 feet per second to get the desired result. If a trub pile does not form in the center of the kettle, try stirring a little faster to get the wort moving and smoothly remove the spoon while stirring so that it does not impede movement. Good luck!

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!

Maibock

A beer for the lusty month of May

by Horst D. Dornbusch

"Tra la! It's May, the lusty month of May!
That lovely month when ev'ryone goes blissfully astray
Tra la! It's here, that shocking time of year!
When tons of wicked little thoughts merrily appear.

It's May! It's May, that gorgeous holiday
When ev'ry maiden prays that her lad will be a cad!
It's mad! It's gay, a libelous display
Those dreary vows that ev'ryone takes, ev'ryone breaks
Ev'ryone makes divine mistakes
The lusty month of May!" — Lady Guinevere

Thus sings the sassy Lady Guinevere in Lerner's and Loewe's famous ditty from the musical Camelot, the 1960 Broadway hit. Indeed, May can be a wicked month in the Continental climate of Bavaria, where Maibock (literally May-bock) was invented. Bavaria is Germany's southern-most state, with the Alps as a backdrop.

The month of May in this region is the brief season of spring, between the last thaw and the first bloom. In Bavaria, winters are long and severe, and summers are long and hot. Springtime passes by in just a flash, with the frozen dreariness of winter — a time for heavy sipping brews — not quite a fading memory, but the tantalizing promise of summer already in the air.

The Bavarians call the time for bockbiers *Starkbierzeit* (strong beer season), which lasts for about six months. The first bockbiers after the new grain and hops harvest come out towards the end of November, when the weather often takes a quick turn for the worse. Bockbiers start at around 6% alcohol. By comparison, "normal" blond lagers in Bavaria — and just about anywhere else — tend to have an alcohol by volume level of about 4.5–5.2%. Bockbiers get progressively stronger during the season, escalating to a wine-like peak of 9% ABV or more (in Doppelbock and Eisbock) during Lent. Bocks then begin declining again to 6% towards the end of *Starkbierzeit* in May, with Maibock being the last of the bock styles.

Bockbiers also change their color during "Starkbier" season. As a general rule, they start out deep amber in the fall, turn progressively darker as the weather gets colder and then become lighter again. Maibock is the palest of the Bavarian bockbiers. Therefore, it is also often called Helles or Heller Bock (light bock).

What beer could be more fitting for that transitional time of year than a Maibock? It is still too chilly to just laze about outside in a beer garden, but it is already too bright to continue to hide indoors.

For that restless time of year, *when ev'ryone goes blissfully astray*, the Bavarians have created their Maibock, a beer hall brew that is still belly-warming but already gives the drinker *a libelous display* of an easier time to come. Maibock is as schizophrenic a brew as spring is a schizophrenic season in southern Germany. It combines — in a unique blend — the strength of a powerful winter brew with the bright color and refreshing hoppiness of a summer session beer. Also known as Frühlingsbock (spring time bock), Maibock is a happy marriage, in both grain bill composition and flavor, between a bockbier and a Helles. Thus it

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Maibock by the numbers

OG	1.060–1.070
FG	usually about 1.014)
SRM	usually 4.5–6
IBU	20–35
ABV	6–7%

RECIPE

The Lusty Bock of May
(5 gallons/19 L, all-grain)
OG = 1.064 FG = 1.016
IBU = 25 SRM = 8 ABV = 6.2%

Ingredients

6 lbs. (3.4 kg) Pils malt (~ 1.5 °L)
3.25 lbs. (1.47 kg) light caramel malt (~ 1.5 °L)
1.75 lbs. (0.9 kg) light Munich malt (~ 8 °L)
6.75 AA Hallertauer Mittelfrüh hops (1.7 oz./48 g at 4% alpha acid)
1 oz. (28 g) Hersbrucker (flavor/aroma)
1 package Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager), or White Labs WLP920 (Old Bavarian Lager) yeast
1 cup corn sugar or dried malt extract (for priming)

Step by Step (infusion mash)

Dough in at about 135 °F (57 °C) and let the mash rest for 30 minutes. Then infuse the mash with near-boiling water, while stirring to avoid hot spots, to reach a mash temperature of about 145 °F (63 °C) for a 20-minute rest. Repeat the infusion to raise the mash temperature to about 160 °F (71 °C) for another 20-minute rest. Start sparging with near-boiling water until the mash temperature is at 172 °F (78 °C). Then reduce the sparge temperature to the mash-out temperature. Stop the sparge when the kettle gravity is at about 1.050 (12 °P). Boil for 90 minutes. Evaporation losses should raise the density of the wort to the target original gravity of 1.064 (16 °P). Add the bittering hops about 20 minutes and the aroma hops about

recipe continued on page 20

recipe continued from page 19

70 minutes into the boil.

After shut-down let the wort rest about 15 to 20 minutes so the trub can settle. Then heat-exchange the wort to a fermentation temperature of roughly 50 °F (10 °C). Next, aerate the cool wort and pitch yeast. Allow about two weeks for primary fermentation. Rack the brew when the gravity has dropped to about 1.028 (7 °P).

Allow another week or two for secondary fermentation, until the gravity is terminal (about 1.014 or 3.5 °P). Raise fermented brew's temperature to room temperature for a two-day diacetyl rest. Then pull the temperature down incrementally by about 2 °F (1 °C) per day until it is as cold as your equipment or circumstances allow (slightly below freezing is best) and lager the beer for about 4 weeks. After a final racking, add the conditioning agent and package. Store cool for at least another four weeks to let the brew fully mature.

Decoction instructions

If you wish to try a decoction Maibock, skip the first paragraph of the infusion mash instructions. Instead produce your wort as follows: Mix the milled grain with approximately 4 gallons (roughly 15 L) of water at 145 °F (63 °C). This should result in a mash-in temperature of 135 °F (57 °C).

Let the mash rest for 30 minutes. Ladle about 1.3 gallons (5 L) of the mash into a pot and heat it (while stirring occasionally to avoid scorching) to 160 °F (71 °C). Let the decoction rest at this temperature for 15 minutes. Then raise temperature to bring the mash to a boil. Cook the decoction for 15 minutes. Return the boiled portion of the mash to the main mash and mix thoroughly. This should raise the temperature of the main mash to about 145 °F (63 °C). Let the entire mash rest for another 20 minutes. Repeat the decoction, only this time with 2 gallons (7.5 L) of mash. This should raise the main mash temperature to about 160 °F (71 °C). Again, let the mash rest for 20 minutes. Repeat the decoction for a third time, with about 1.5 gallons (5.7 L) of the main mash. This should raise the main mash temperature ready for lautering at 172 °F (78 °C). Sparge with 172 °F (78 °C) water until the kettle gravity is about 1.050 (12 °P) for a 90-minute boil. Evaporation losses should raise the density of the wort to the target original gravity of 1.064 (16 °P). After shutdown, continue as outlined in the second paragraph of the instructions for infusion mashing above.

The Lusty Bock of May (5 gallons/19 L, extract plus grain)

OG = 1.064 FG = 1.016
IBU = 25 SRM = 9 ABV = 6.2%

Ingredients

6.45 lbs (2.9 kg) Pils liquid malt extract (such as Weyermann Bavarian Pils)
3.25 lbs. (1.5 kg) light caramel malt (~ 1.5 °L)
1.75 lbs. (~ 0.8 kg) light Munich malt (~ 8 °L)
6.75 AA Hallertauer Mittelfrüh hops (1.7 oz/48 g at 4% alpha acid)
1 oz. (28 g) Hersbrucker (flavor/aroma)
1 package Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager) or White Labs WLP920 (Old Bavarian Lager)
1 cup corn sugar or dry malt extract for priming

Step by Step

Mill the specialty malt coarsely and divide it equally into three muslin bags. Place these in at least two gallons of cold water and raise the temperature slowly, for about half an hour, until it reaches 170–190 °F (77–88 °C). At this point bubbles should start to pearl up in the liquid, but the pot must not boil! Lift the bags out of the steeping liquid and rinse them with several cups of cold water. Do not squeeze them. Discard the spent grain. Turn off the heat, and stir in the canned extract. Fill the kettle and bring the wort to a boil. Add the bittering hops and continue with the rest of the instructions for the all-grain recipe.

The Lusty Bock of May (5 gallons/19 L, extract only)

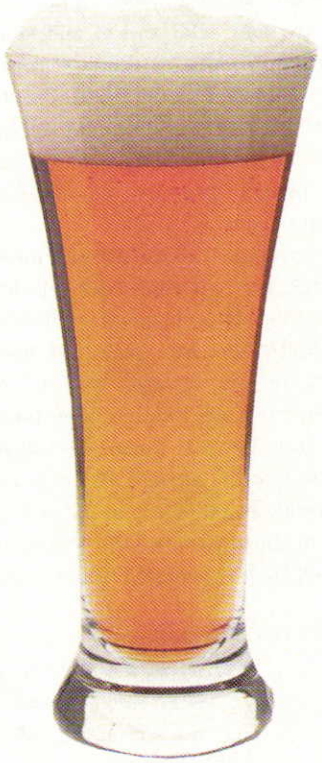
OG = 1.064 FG = 1.016
IBU = 25 SRM = 9 ABV = 6.2%

Ingredients

9.66 lbs. (4.4 kg) Weyermann Bavarian Maibock liquid malt extract
6.75 AA Hallertauer Mittelfrüh (1.7 oz or ~50 g at 4% alpha acid)
1 oz. (28 g) Hersbrucker (flavor/aroma)
1 package Wyeast 2206 (Bavarian Lager), Wyeast 2308 (Munich Lager), White Labs WLP838 (Southern German Lager), or White Labs WLP920 (Old Bavarian Lager)
1 cup corn sugar or dry malt extract for priming

Step by Step

Mix the malts with your hot brewing liquor in the kettle. Bring the wort to a boil and add the Hallertauer Mittelfrüh bittering hops. Continue with the hop schedule, adding the Hersbrucker flavor/aroma hops, then continue with the instructions for the all-grain recipe.



continued from page 19

is just right for *that gorgeous holiday* that is May.

Maibock profile

Though Maibock is a transitional beer, brew-technically it is still a true bock. This means the brew needs plenty of aging. If you want to drink your Maibock during the lusty month of May, therefore, as you are supposed to, you must brew it no later than March.

The minimum OG for a Maibock is 1.060 (15 °P), but most Maibocks are around 1.064 (16 °P) and tend to finish at approximately 1.014 (3.5 °P) for approximately 6.8% ABV. Because the Maibock is already a precursor to the paler and hoppier brews of summer, its hop bitterness and hop flavor are slightly more pronounced than those of the bockbiers served during the depth of winter. Noble Bavarian hop varieties, such as Hallertauer or Hersbrucker, are obligatory for this brew.

Maibock, like all bocks, has a substantial body. Malty sweetness predominates from start to finish, in both flavor and aroma. Unlike the darker bockbier versions, however, there must be no toasted chocolate malt character. The base for a Maibock is standard Bavarian Pils malt. For mouthfeel, you can use pale caramel malt as well as Vienna or Munich malts. The last two also give the Maibock its color.

In the recipe on page 19, I have selected a grain bill of roughly 55% Pils malt (~ 1.5 °L) roughly 30% light caramel malt (~ 1.5 °L) and roughly 15% light Munich malt of (~ 8 °L). This grain bill produces a Maibock with a beer color of about of 5.6 SRM.

Though most commercial Maibocks are within a narrow range of this color value, some breweries prefer to keep their Maibocks almost as dark as their fall or winter bocks. For a slightly darker Maibock, therefore, you can compose a grain bill of about 80% Vienna malt and about 10% each Carafoam® and Carared®. This grain bill produces a beer color in the 9-SRM range.

For yeast, any Bavarian lager yeast will do. Because a Maibock is at the bottom edge of the high-gravity category, be sure to pitch only viable yeast. It is best to make a starter. Alternatively, if you want to play it safe, you can pitch two packs rather than one.

& Beer, Billy Goats & German Grammar

Maibock is often referred to on the label or a pub menu as Helles or Heller Bock as opposed to the darkish mid-winter bockbier, which is also called Dunkles or Dunkler Bock. The reason for the capital letter "B" in "Bock" is that all nouns in German are capitalized, even in the middle of a sentence.

The reason for the two endings of "s" and "r" in the adjective "hell" (light) is that, in the German language, nouns have grammatical genders. The word "Bock" is not only the name for a beer, whose gender is neuter (das Bier), it is also the name for a ram or Billy goat, whose gender is masculine (der Bock).

Those who prefer to label their strong Bavarian lager after a Billy goat, therefore, call their brew a Heller Bock; those who believe that their brew has nothing to do with a four-legged critter call it a Helles Bock (bier).

Decoction vs. infusion

In Bavaria, all bockbiers, including the Maibock, are still brewed by the time-honored, laborious and energy-intensive decoction method, even though modern grains no longer make decoction a necessity. Supporters of the decoction method argue that the beer's maltiness increases if it is decoction instead of infusion-mashed.

I subjectively believe that the quality of the grain is more important for maltiness than the mashing method. You cannot coax maltiness out of cheap, poorly malted grain even if you boil the hell out of it. Conversely, superior malt will always make a malty brew even if the wort derives only from infusion mashing. In my experience, decoction has one advantage: I usually get greater extract efficiency from a decoction mash than from an infusion mash, especially when the grain bill is as heavy as it is for a bock.

Apart from such practical considerations, however, perhaps the best argument for decoction is the intangible factor of tradition, that is, the ritual of doing things the way they have always been done, before modernity. I know that tradition is the principal reason why many commercial brew masters in Bavaria still decoct all their bocks.

For all-grain homebrewers, therefore, I have included two sets of mashing instructions, a standard one for infusion and one for decoction. If you've got the time and inclination, by all means try your hand at decoction.

Extract Maibock tips

Theoretically, you need approximately 8.9 pounds (~4 kilograms) of liquid malt extract (LME) as a substitute for the 11 pounds (~ 5 kilograms) of total grist in the all-grain recipe. The best choice by far for all-extract brewers is a liquid malt extract (LME) specially formulated to make a Maibock version that is at the darkish end of the color spectrum: Some Bavarian Maibock LMEs make a brew of approximately 9 SRM.

Luckily some products come in a 4-kilogram (~ 8.8-pound) jerry can, which, in practice, is close enough to our theoretical LME requirements. If this Maibock LME is not available where you shop, you can replace it with a combination of 7.4 pounds (~ 3.4 kg) of Pils LME (such as a Bavarian Pils) and 1.4 pounds (~ 0.6 kg) of amber lager LME (such as a Munich amber).

Extract-plus-grain brewers, too, can conveniently use one entire jerry can of Bavarian Pils LME when substituting the Pils grist for the all-grain recipe. Note that the amount of LME specified in the extract-plus-grain recipe is calculated on the assumption that there is no contribution to gravity from the steeped grain. Check the gravity at the end of the boil, therefore, and liquor the wort down with cold water if necessary. On the other hand, if your OG is slightly higher than specified, don't worry. A Maibock may go as high as 7% in the alcohol-by-volume department without violating its stylistic guidelines.

Horst Dornbusch writes Style Profile in each issue of BYO.

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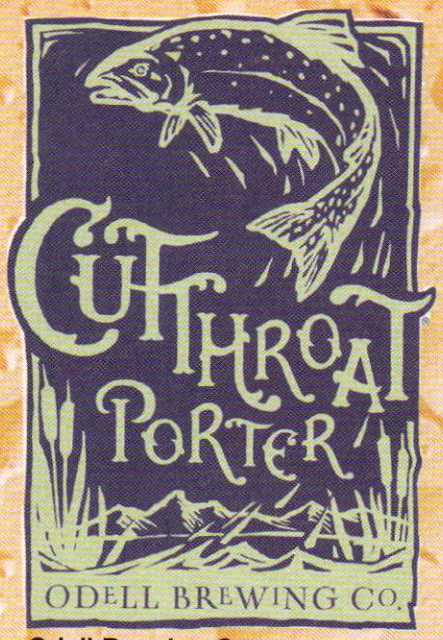
TROUT ANGLERS' CLONES

complied by **Garrett Heaney**

Five trout-themed clones from across the United States. Happy fishin'!

Two great things about spring, for many readers and writers of *BYO* are 1) beer and 2) fishing. When these two entities merge, the sun, moon and stars couldn't line up any more perfectly. Wise breweries out there have coupled the love of beer with the tradition of trout fishing. We threw out a line to a number of such breweries and managed to reel in 5 BIG clones straight from the brewers! Trout River Brewing Company released their Rainbow Red Ale, Steelhead Brewing Comany parted with their Wee Heavy Scotch Ale, Dark Horse Brewing Company sent us their Thirst Trout Porter, Fish Brewing Company shared their Fish Tale Trout Stout and Odell Brewing Company cast us their Cutthroat Porter. Trout fishing seasons are opening across the country and *BYO* wants to help you celebrate. What better way than to brew a fresh beer to come home to . . . or better yet, to throw in the tackle box.



Odell Brewing Co.
Fort Collins, Colorado

Cutthroat Porter

(5 gallon/19 L, all-grain)
OG = 1.052 FG = 1.017
IBU = 43 SRM = 36 ABV = 4.5%

Ingredients

9.0 lbs. (4.1 kg) 2-row pale ale malt
8.0 oz. (224 g) caramalt
6.0 oz. (168 g) crystal malt (40 °L)
4.0 oz. (112 g) amber or brown malt
4.0 oz. (112 g) Munich malt
8.0 oz. (224 g) chocolate malt
2.0 oz. (56 g) roasted barley
0.07 oz. (2 g) gypsum
0.04 oz. (1 g) calcium carbonate
1 tsp. Irish moss
11.25 AAU Fuggles hops (60 mins)
(2.5 oz. /71 g at 4.5% alpha acids)
0.5 oz. (14 g) Kent Goldings hops (1 min)
0.25 oz. (7 g) Kent Goldings hops (1 min)
0.25 oz. (7 g) Northern Brewer hops (0 min)
1 pkg. of your favorite ale yeast (not an estery strain)
6 oz. (168 g) corn sugar (for priming)

Step by Step

Mill all the grain and mash with the gypsum and calcium carbonate to achieve a 155 °F (68 °C) mash temperature. You will need 3.4 gallons (13 L) of strike water at around 166 °F (74 °C) to do this. Let the mash rest for 40 minutes. Recirculate until the drawn off wort is fairly clear. Sparge with 170 °F (77 °C) water. Bring wort to a boil, starting at a level of 5.8 gallons (22 L). Boil to reach 5.5 gallons (typically about 60 mins), making the following additions: Add the Fuggles at the beginning of the boil. Add the Irish moss with 20 minutes to go. Add ½ oz Kent Goldings with 1 minute to go. Add ¼ oz. Kent Goldings and ¼ oz. Northern Brewer just before chill down. Chill the wort down and ferment at the appropriate temperature for your favorite ale yeast. Once fermentation is complete, chill the beer to as close to 36 °F (2 °C) as you can and age for 10–14 days. Bottle or keg and enjoy!

Cutthroat Porter

(5 gallon/19 L, extract w/ grains)
OG = 1.052 FG = 1.017
IBUs = 43 SRM = 36 ABV = 4.5%

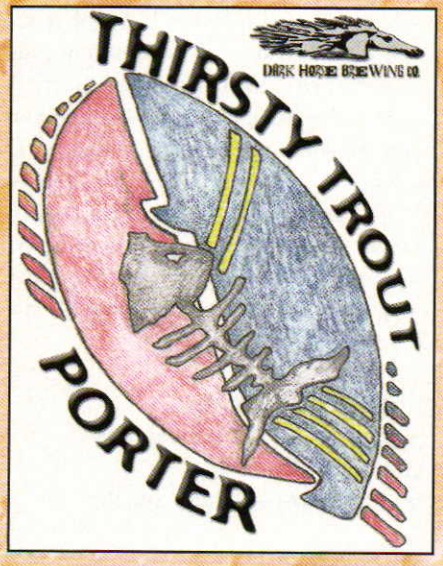
Ingredients

2 lb. 6 oz. (1.1 kg) Muntons Light dried malt extract
3.3 lbs. (1.5 kg) Muntons Light liquid malt extract (late addition)
8.0 oz. (224 g) caramalt
6.0 oz. (168 g) crystal malt (40 °L)
4.0 oz. (112 g) amber or brown malt
4.0 oz. (112 g) Munich malt
8.0 oz. (224 g) chocolate malt
2.0 oz. (56 g) roasted barley
0.07 oz. (2 g) gypsum
0.04 oz. (1 g) calcium carbonate
1 tsp. Irish moss (20 mins)
11.25 AAU Fuggles hops (60 mins)
(2.5 oz. /71 g at 4.5% alpha acids)
0.5 oz. (14 g) Kent Goldings hops (1 min)
0.25 oz. (7 g) Kent Goldings hops (1 min)
0.25 oz. (7 g) Northern Brewer hops (0 min)
1 pkg. of your favorite ale yeast (not an estery strain)
6 oz. (168 g) corn sugar (for priming)

Step by Step

Place crushed grains in a nylon steeping bag and steep at 155 °F (68 °C) in 3.0 qts. (2.8 L) of water for 45 minutes. Rinse grains with 1.5 qts. (1.4 L) of water at 170 °F (77 °C). Add water (to save time, preferably boiling water) to "grain tea" to make 3 gallons (11 L), stir in dried malt extract and bring to a boil. Boil for 60 minutes, adding hops and Irish moss at times indicated in the ingredient list. Stir in liquid malt extract with 15 minutes remaining in boil. Keep a small pot of boiling water handy and do not let the wort volume dip below 2.5 gallons (9.5 L) during the boil. Cool wort, siphon to fermenter, top up to 5 gallons (19 L), aerate and pitch yeast. Ferment at 68–72 °F (20–22 °C).

—Doug Odell, Owner



Dark Horse Brewing Co.
Marshall, Michigan

Thirsty Trout Porter

(5 gallons/19 L, all-grain)
SG = 1.064 FG = 1.016
IBU = 27 SRM = 54 ABV = 6.2%

Ingredients

8.25 lbs. (3.74 kg) 2-row pale malt
2.3 lbs. (1.04 kg) Bonlander Munich malt
1.25 lbs. (0.56 kg) crystal malt (40 °L)
1.25 lbs. (0.56 kg) crystal malt (80 °L)
0.70 lbs. (0.32 kg) chocolate malt
0.07 lbs. (0.03 kg) black malt
3.9 AAU Columbus hop (90 mins)
(0.25 oz./7 g of 15.6% alpha acids)
3 AAU Cascade hop (30 mins)
(0.5 oz./14 g of 6% alpha acids)
0.83 oz. (24 g) Cascade hops (0 mins)
1 pkg. Nottingham Ale Yeast
0.75 cups corn sugar (for priming)

Step by Step

Start by milling your grain, hydrate with 3.2 gallons (12.2 L) water at around 163 °F (73 °F) to hit a mash temperature of 152 °F (67 °C). Let the mash rest for 15 to 30 minutes. (Take an iodine test if the thought of a shorter mash causes you concern.) Recirculate wort over grain for about 5 minutes until the wort clears. Run wort into kettle and sparge with

168–172 °F (76–78 °C) water until you reach volume on kettle. Bring wort to boil and commence hop schedule: First hop addition at start of boil (90 min), second hop addition at 30 minutes left in boil and the third hop addition at end of boil. (Whirlpool, if possible, for 5 minutes). Rest for 5 minutes, then knock out into fermentation vessel. Cool to 68–70 °F (~21 °C) and pitch yeast. Ferment at approximately 68 °F (20 °C) until brew reaches 3.8–4.2 °Plato (~ SG 1.015–1.017). Rack off yeast and condition for 5 days. Add priming sugar or wort. Rack into bottles and let age at 40 °F (~4 °C) or cooler for two weeks. Pop a top and enjoy!

Thirsty Trout Porter

(5 gallons/19 L, extract w/grains)
SG = 1.064 FG = 1.016
IBU = 27 SRM = 54 ABV = 6.2%

Ingredients

1.0 lb. (0.45 kg) Briess Light dried malt extract
4.66 lbs. (2.11 kg) Briess Light liquid malt extract (late addition)
2.3 lbs. (1.04 kg) Bonlander Munich malt
1.25 lbs. (0.56 kg) crystal malt (40 °L)
1.25 lbs. (0.56 kg) crystal malt (80 °L)
0.70 lbs. (0.32 kg) chocolate malt
0.07 lbs. (0.03 kg) black malt
3.9 AAU Columbus hop (90 mins) (0.25 oz./7 g of 15.6% alpha acids)
3 AAU Cascade hop (30 mins) (0.5 oz./14 g of 6% alpha acids)
0.83 oz. (24 g) Cascade hops (0 mins)
1 pkg. Nottingham Ale Yeast
0.75 cups corn sugar (for priming)

Step by Step

Place crushed grains in a large nylon steeping bag. (There are 5.6 pounds/2.5 kg of grains to steep.) Steep at 152 °F (67 °C) in 2.1 gallons (8.0 L) of water for 60 minutes. (Poke and prod bag periodically with brewing spoon to ensure grains and liquid mix.) Lift bag out and place in a large colander over brewpot. Slowly rinse grains with 1.0 gallon (3.8 L) of water at 170 °F (77 °C). Add dried malt extract to "grain tea" and bring to a boil. Add Columbus hops and begin the 90-minute boil. Keep a small pot of boiling water handy and don't let the boil volume dip below around 2.25 gallons (8.5 L). Add Cascade hops at times indicated in the ingredient list. Turn off heat and add liquid malt extract with 20 minutes left in boil. Resume heating until end of boil period. Cool wort and siphon to fermenter. Top up to 5 gallons (19 L), aerate wort and pitch yeast. Ferment at 68 °F (20 °C).

— Aaron Morse, Head Brewer

Fish Brewing Company
Olympia, Washington

Fish Tale Trout Stout

(5 gallon/19 L, all-grain)
OG = 1.059 FG = 1.016
IBU = 40 SRM = 55 ABV = 5.5%

Ingredients

8.5 lbs. (3.8 kg) 2-row pale malt
1.0 lb. (0.45 kg) Carapils malt
1.0 lb. (0.45 kg) Munich malt
0.5 lb. (0.23 kg) crystal malt (15 °L)
0.5 lb. (0.23 kg) crystal malt (40 °L)
0.5 lb. (0.23 kg) black malt
1.0 lb. (0.45 kg) roasted malt (220 °L)
0.1 oz. (2.8 g) gypsum in mash
1 tsp. Irish moss (15 mins)
8.4 AAU Chinook hops (60 mins) (0.7 oz./19.6 g at 12 %AA)
1.1 AAU Cascade hops (60 mins) (0.2 oz./5.6 g at 5.5 % AA)
1.1 AAU Cascade pellet hops (10 mins) (0.2 oz./5.6 g at 5.5 % AA)
1.1 AAU Cascade pellet hops (0 mins) (0.2 oz./5.6 g at 5.5% AA)
Wyeast 1332 (Northwest Ale) yeast
0.75 cups corn sugar (for priming)

Step by Step

Heat 4 gallons (15 L) of strike water to 166 °F (74 °C). Mash grains at 155 °F (68 °C). Let rest for 30 minutes, recirculate until clear, then sparge with 170 °F (77 °C) water. Start 90-minute boil. When wort starts to boil, commence hop schedule: 0.7 oz. (19.6 g) Chinook hops at 60 minutes, 0.2 oz. (5.6 g) Cascade at 60 minutes, 0.2 oz. (5.6 g) Cascade at 10 minutes, 0.2 oz. (5.6 g) Cascade at end of boil. Cool wort to 68 °F (20 °C), ferment until final gravity reached (1.016). Prime with ¾ cup corn sugar and bottle.

Fish Tale Trout Stout

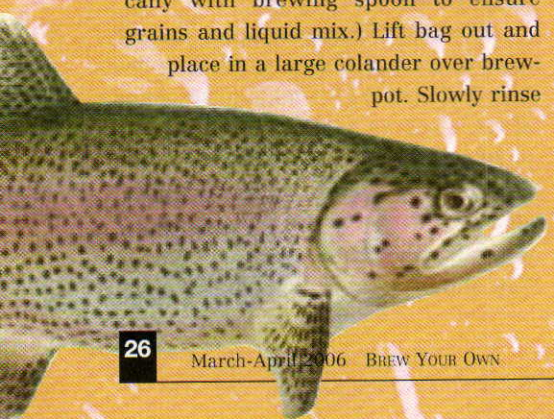
(5 gallon/19 L, extract w/ grains)
OG = 1.059 FG = 1.016
IBU = 40 SRM = 55 ABV = 5.6%

Ingredients

1.25 lb. (0.57 kg) Coopers dried malt extract
4.5 lbs. (2.0 kg) Coopers Light liquid malt extract (late addition)
1.0 lb. (0.45 kg) Carapils malt
1.0 lb. (0.45 kg) Munich malt
0.5 lb. (0.23 kg) crystal malt (15 °L)
0.5 lb. (0.23 kg) crystal malt (40 °L)
0.5 lb. (0.23 kg) black malt
1.0 lb. (0.45 kg) roasted malt (220 °L)
0.1 oz. (2.8 g) gypsum in mash
1 tsp. Irish moss (15 mins)
8.4 AAU Chinook hops (60 mins) (0.7 oz./19.6 g at 12 %AA)
1.1 AAU Cascade hops (60 mins) (0.2 oz./5.6 g at 5.5 % AA)
1.1 AAU Cascade pellet hops (10 mins) (0.2 oz./5.6 g at 5.5 % AA)
1.1 AAU Cascade pellet hops (0 mins) (0.2 oz./5.6 g at 5.5% AA)
Wyeast 1332 (Northwest Ale) yeast
0.75 cups corn sugar (for priming)

Step by Step

Put crushed grains in a nylon steeping bag. Steep grains at 155 °F (68 °C) in 1.7 gallons (6.4 L) of water for 45 minutes. Rinse grains with 0.75 gallons (2.8 L) of water at 170 °F (77 °C). Add ~0.8 gallons (~3 L) of boiling water to make 3 gallons (11 L), add dried malt extract and bring wort to a boil. Add



Chinook hops and boil for 60 minutes. Add Cascade hops at times indicated in ingredient list. At 15 minutes remaining in the boil, stir in liquid malt extract and add Irish moss. Cool wort and siphon to fermenter. Top up to 5 gallons (19 L), aerate and pitch yeast. Ferment at 68 °F (20 °C). Prime with corn sugar and bottle.

— Jenn Gridley, Head Brewer

Steelhead Brewing Company Burlingame, California

Wee Heavy Scotch Ale

(5 gallon/19 L, all-grain)
OG = 1.105 FG = 1.030
IBU = 25 SRM = 28 ABV = 9.6%

Ingredients

20.5 lbs. (9.3 kg) Great Western pale malt
10.9 oz. (0.31 kg) Belgian Special B malt
9.33 oz. (0.26 kg) Belgian biscuit malt
2.2 oz. (62 g) Briess chocolate malt
7 AAU Nugget hops (60 mins)
(0.53 oz./15 g of 13% alpha acids)
3 AAU Mt Hood hops (20 mins)
(0.5 oz./14 g of 6% alpha acids)
English or Scottish ale yeast
(4 qt./~4 L starter)
0.75 cups corn sugar (for priming)

Step by Step

Heat 6.8 gallons (26 L) of strike water to 164 °F (73 °C) and mash grains at 153 °F (67 °C) for 60 minutes. Collect about 11 gallons (42 L) of wort. (Specific gravity of pre-boil wort will be around 1.047.) Boil for 3 hours (or longer) to reduce volume to 5 gallons (19 L), adding hops at times indicated in ingredient list. Ferment at 60 °F (16 °C).

Wee Heavy Scotch Ale

(5 gallon/19 L, extract w/ grains)
OG = 1.105 FG = 1.030
IBU = 25 SRM = 28 ABV = 9.6%

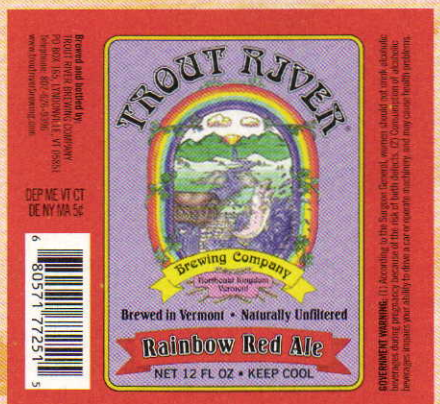
Ingredients

5.0 lbs. (2.27 kg) Muntons Light dried malt extract
8.13 lbs. (3.69 kg) Northwestern Gold liquid malt extract (late addition)
10.9 oz. (0.31 kg) Belgian Special B malt
9.33 oz. (0.26 kg) Belgian biscuit malt
2.2 oz. (62 g) Briess chocolate malt
7 AAU Nugget hops (60 mins)
(0.53 oz./15 g of 13% alpha acids)
3 AAU Mt Hood hops (20 mins)
(0.5 oz./14 g of 6% alpha acids)
English or Scottish ale yeast
(4 qt./~4 L starter)
0.75 cups corn sugar (for priming)

Step by Step

Place crushed grains in a nylon steeping bag. Steep at 153 °F (67 °C) for 45 minutes in 0.5 gallons (2 L) of water. Rinse grains with 0.25 gallons (0.95 L) of water at 170 °F (77 °C). Add water and dried malt extract to make 2.5 gallons (9.5 L) of wort. Bring wort to a boil, add Nugget hops and begin the 60-minute boil. Add Mt. Hood hops and liquid malt extract with 20 minutes left in boil. Cool wort to 60 °F (16 °C) and transfer to fermenter. Aerate thoroughly and pitch yeast. If fermentation doesn't srtart within 12 hours, aerate every 6 hours until it does. Ferment at 60 °F (16 °C).

— Emil Caluori, Head Brewer



Trout River Brewing Company Lyndonville, Vermont

Rainbow Red Ale

(5 gallon/19 L, all-grain)
OG = 1.047 FG = 1.012
IBU = 57 SRM = 23 ABV = 4.5%

Ingredients

8.25 lbs. (3.74 kg) 2-row pale malt
1.0 lb. (0.45 kg) medium crystal malt
0.5 lb. (0.23 kg) dark crystal malt
2 oz. (56 g) roasted barley
8 AAU Northern Brewer hops (60 mins)
(1.0 oz./28 g of 8% alpha acids)
1 oz. Cascade hops (45 mins)
(1.0 oz./28 g of 5% alpha acids)
1 oz. Cascade for hops (15 mins)
(1.0 oz./28 g of 5% alpha acids)
Wyeast 1084 (Irish Ale) yeast
0.75 cups corn sugar (for priming)

Step by Step

Heat 3.1 gallons (12 L) water to 160 °F (71 °C) and mash at 149 °F (65 °C) for 20 minutes. Add one gallon (3.8 L) of boiling water and begin heating the mash, stirring gently to prevent sticking. Heat 4 gallons (15 L) of water to 170 °F (77 °C). When mash temperature reaches 160–170 °F (71–77 °C), transfer mash to lauter-tun and sparge with 4 gallons (15 L) of 170 °F (77 °C) water.

Collect 5.0–5.5 gallons (19–21 L) of wort. Boil with the following hops additions: 1 oz. (28 g) Northern Brewer for 60 minutes, 1 oz. (28 g) Cascade for 45 minutes and 1 oz. (28 g) Cascade for 15 minutes. Cool wort, aerate and pitch Wyeast 1084 (Irish Ale Yeast). Ferment at 68 °F (20 °C).

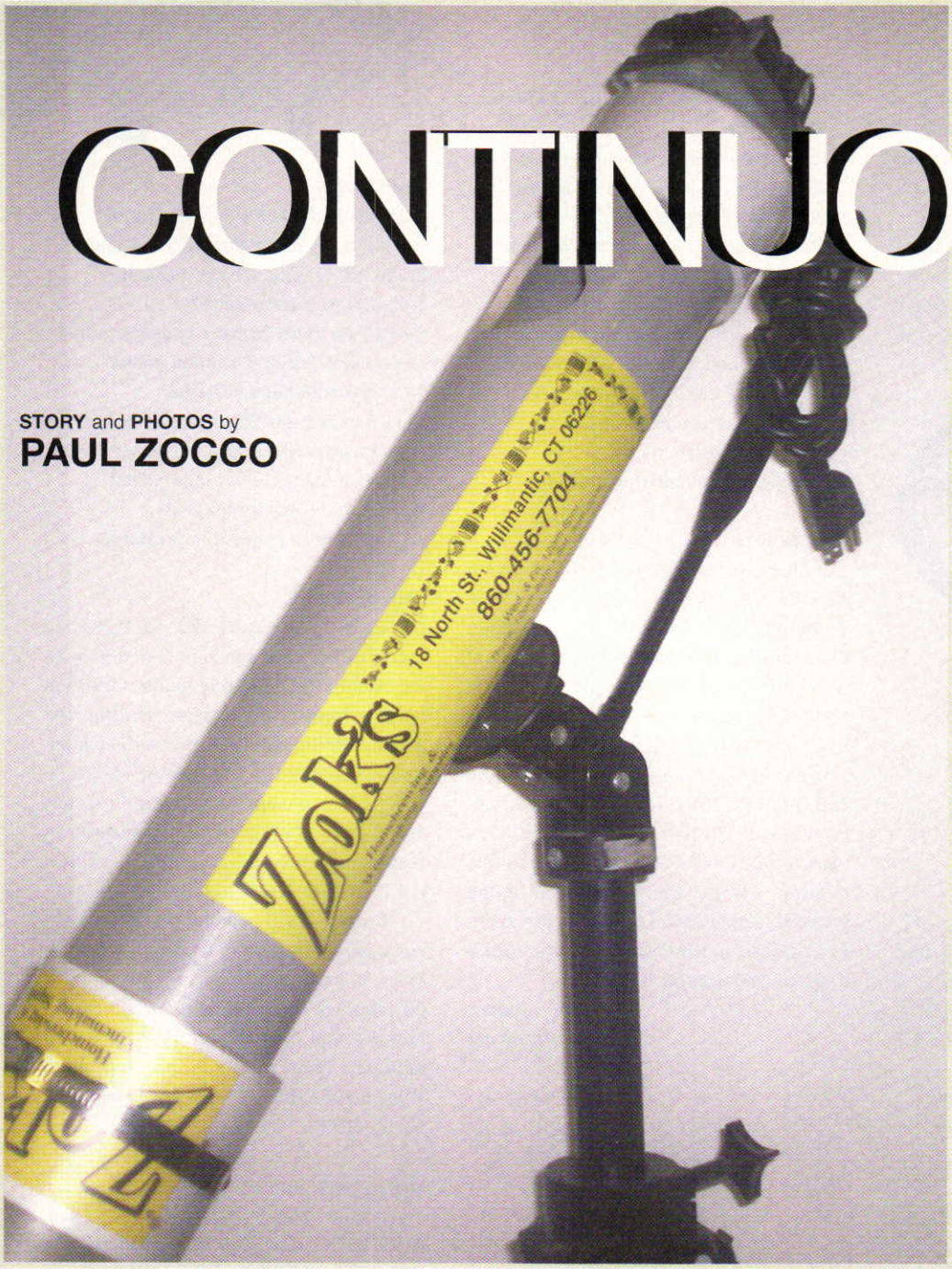
Extract with grains option:

Replace pale malt with 2.0 lbs. (0.91 kg) of Coopers dried malt extract and 3.3 lbs. (1.5 kg) of Coopers Light liquid malt extract. Place crushed grains in a nylon steeping bag and steep in 3.25 qts. (3.1 L) of water at 149 °F (65 °C) for 20 minutes. Rinse bag with 1.5 qts. (1.4 L) of 170 °F (77 °C). Add water and dried malt extract to make 3 gallons (11 L) of wort and bring to a boil. Boil for 60 minutes. Add hops at times indicated in the ingredient list. Add liquid malt extract with 15 minutes remaining in boil. Cool wort, siphon to fermenter and top up to 5 gallons (19 L). Aerate wort and pitch yeast. Ferment at 68 °F (20 °C).

— Dan and Laura Gates, Owners

CONTINUOUS WORT HOPPER

STORY and PHOTOS by
PAUL ZOCCO



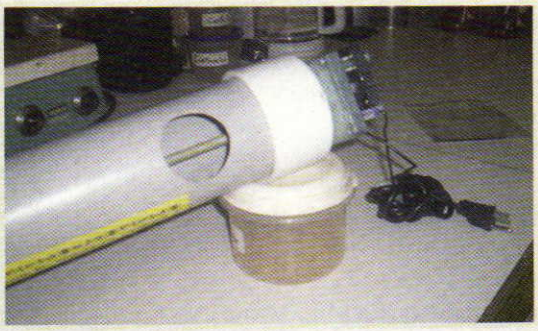
A few years ago, Sam Calagione of Dogfish Head started producing some unusual IPAs, barleywines and other over-the-top beers. Conventional brewing practice dictates the addition of hops at specific times during the boil. In contrast, Dogfish Head has designed a series of beers that are continuously hopped throughout the entire boiling process. Their 60 Minute IPA, 90 Minute IPA and 120 Minute IPAs have hops added throughout their 60, 90 and 120 minute boils, respectively.

Being an avid homebrewer, I wanted to brew beers like these guys were making . . . big, hoppy beers full of too much of everything, especially hops. Being somewhat of a gadget type person, I also wanted to build and use a continuous wort hopper, similar to the one at Dogfish Head.

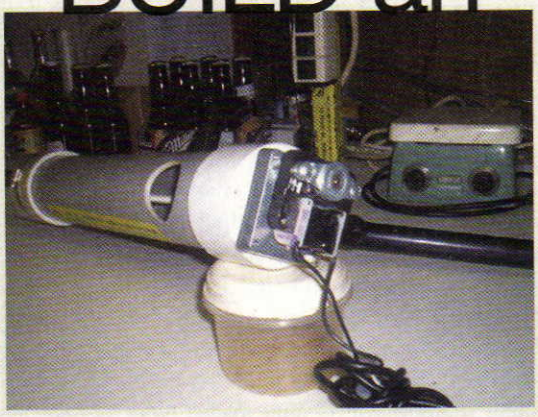
I wanted a device that would drop a steady stream of hop pellets into my kettle throughout the entire boil. My plan was to come up with something like Dogfish Head's hop feeder, which they call Sir Hops-a-Lot. Of course, mine would be a lot smaller, made from easily obtained components and everyday tools. The result of my quest was my "homebrewed" continuous wort hopper, which I named the Zopinator.

The planning phase involved a lot of deliberation and a few failed designs. I toyed with the idea of using a small

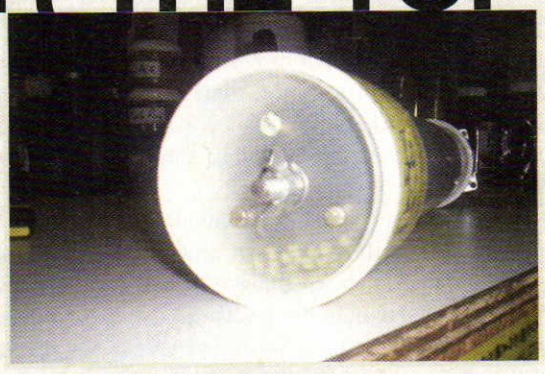
BUILD an OVER-THE-TOP HOPPER



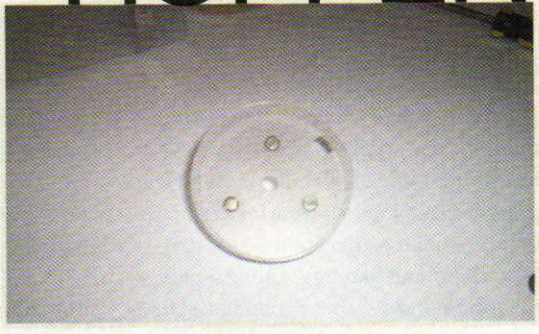
Upper: The hops are loaded into the hopper via this hole.



Lower: A look at the motor that drives the hopper.



Upper: The business end of the hopper. Hops drop from the hole on the left.



Lower: An isolated view of the disk.

motor driven auger, but decided against it. Instead, I opted to use a one RPM motor as a drive for a spinning, perforated disk inside a tubular reservoir.

One Part Design . . .

I found a one RPM motor at Grainger, a national equipment supply company, for around $35.00 (U.S.). It is equipped with a ⅜" steel drive shaft. The motor must turn an 18" (46 cm) length of ⅜" threaded rod that will operate a rotating port (valve). To attach the motor drive to the port, I made up a simple coupling by drilling a ⅜" hole through a piece of steel round stock (1" long, ¾" in diameter). I drilled small holes (2 opposed on each end) and threaded them with a ¼" X 20-thread tap. A couple of ¼" Allen screws on each end lock onto the motor shaft on the motor end, and also connect to the drive shaft on the other end of the coupling. Inserted into the drive end would be a length (16–18"/41–46 cm, depending on the length of your PVC pipe) of ⅜" threaded steel rod. The threaded shaft turns a small rotating "valve" that allows hops to drop through.

The main housing for the Zopinator is a 2' (61 cm) length of 4" diameter PVC pipe. The 1 RPM motor easily mounts to a conventional PVC end cap. The length of the pipe is not a critical dimension, but 2' (61 cm) keeps the motor a safe distance from the steam exiting during the boiling cycle.

So, with the motor mounted on one end and a threaded shaft attached via your homemade coupling, you now have a drive that operates a valve on the other end. This is where the design got a little tricky.

I attached a common PVC coupling to the pipe on the opposite end of the motor. I then cut a 1/16" thick disc of plastic to the exact inside diameter of the coupling. I wanted a pretty tight fit so it could revolve inside the coupling so hop pellets wouldn't "leak out," but not so tight that it would be restrictive. The inside of a PVC coupling has a small step in it that could act as a surface the plastic valve could be in contact with. After a little filing and sanding, the plastic disc fit nicely inside the coupling. I then drilled a ⅜" hole in the center of the disk and attached it to the ⅜" threaded drive rod so that it had a locking nut and a washer on both sides of the plastic valve, effectively locking it in place.

Next, I drilled a ⅜" hole about halfway up the PVC and attached the entire assembly to a camera tripod. Any support you choose must stand a foot or so (at least 30 cm) above your boil kettle so the hops can drop in. A 45° angle down toward the brew kettle seemed to be enough to allow the hops to drop fairly consistently.

. . . One Part Trial and Error

The hop pellets I sell at my homebrew shop have a similar diameter, but are various lengths. This was an early concern of mine. I wondered if the hops would bunch up as they packed down and would not drop through the hole as planned. However, with the Zopinator on a roughly 45° angle, the hops did drop out pretty consistently. Occasionally, however, the hops would pack up above the hole and not drop. To solve this problem, I drilled four small holes in the valve about 1" (2.5 cm) from the center mounting hole. To these, I attached four small bolts. These turn along with the rotating plastic valve, effectively keeping the hops from bunching up. After drilling and cutting increasingly larger openings in the thin plastic disk, I came up with an orifice size that was suitable. Finally, I drilled a 1" (2.5 cm) hole about an inch (2.5 cm) or so below the motor location as a place to insert the hop pellets.

Test Check One Two

On testing day, I loaded the Zopinator with pellet hops, set a timer and placed a small scale below the hopper. I observed that the pellets dropped a few at a time, a little time would pass and then a few more would drop. It seemed inconsistent. However, over time, the non-linear drop rate evens out and things worked smoothly. When

60 Minute IPA clone (Dogfish Head)

(5 gallons/19 L, all-grain)
OG = 1.064 FG = 1.019
IBU = 60 SRM = 6 ABV = 5.8%

Ingredients

12 lb. 15 oz. (5.86 kg) 2-row pale malt
6.4 oz. (0.18 kg) Thomas Fawcett amber malt
11.2 AAU Warrior hops (60-35 mins) (0.70 oz./20 g of 16% alpha acids)
3.6 AAU Simcoe hops (35-25 mins) (0.28 oz./7.9 g of 13% alpha acids)
5.6 AAU Palisade hops (25-0 mins) (0.70 oz./20 g of 8% alpha acids)
1 tsp. Irish moss (15 mins)
0.70 oz. (20 g) Palisade hops (whirlpool, 0 mins)
0.59 oz. (17 g) Amarillo hops (dry hops)
0.59 oz. (17 g) Simcoe hops (dry hops)
0.59 oz. (17 g) Glacier hops (dry hops)
Wyeast 1187 (Ringwood Ale) or other English ale yeast (1.5 qt./~1.5 L starter @ SG 1.030)
7/8 cup corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C) for 60 minutes. Boil wort for 60 minutes. Begin hopping wort with a continuous stream of Warrior hops at a rate of 0.28 oz. (7.9 g) per 10 minutes. Warrior should run out with 35 minutes left in boil. (Target IBU for Warrior additions = 39 IBUs.) Refill hopper with Simcoe hops and resume hopping until 25 minute remaining mark. (Target IBU for Simcoe additions = 10.5 IBUs.) Refill hopper with Palisade hops for remaining part of boil. (Target IBU for Palisade additions = 10.5 IBUs.) Add Irish moss with 15 minutes remaining. Add whirlpool hops after boil and begin cooling. Aerate cooled wort and pitch yeast. Ferment initially at 71 °F (22 °C), but let temperature rise to 74 °F (23 °C) towards the end of fermentation. Warm condition for 3 days (to remove diacetyl), then cool beer and add dry hops, allowing 2 weeks contact time.

Extract option:

Steep 1.5 lbs. (0.68 kg) of 2-row pale malt and 6.4 oz. (0.18 kg) of Thomas Fawcett amber malt at 152 °F (67 °C) in 2.25 qts. (2.1 L) of water. (This is technically a partial mash, so follow temperature and volume guidelines closely.) After 45 minutes, rinse grains with 1 qt. (~1 L) of 170 °F (77 °C) water. Add water to "grain tea" make 4 gallons (15 L). (To save time, heat ~3.5 gallons (13 L) of water during "steep.") Stir in 4.0 lbs. (1.8 kg) Muntons Light dried malt extract and bring to a boil. During the boil, do not let wort volume drop below 3.5 gallons (13 L). Add boiling water if wort volume dips near this mark. Follow the hopping instructions given in the all-grain recipes. With 15 minutes left in the boil, turn off the heat and stir in 2.0 lbs. 14 oz. (1.3 kg) of Muntons Light liquid malt extract and Irish moss. Resume heating once extract is dissolved. After chilled wort is transferred to fermenter, add water to make 5 gallons (19 L). See the all-grain instructions for remaining details.

Thanks to Bryan Selders and Sam Calagione of Dogfish Head for the information used in compiling this clone.

measured in 10 minute increments, the hop rate remained constant.

Crunching the Numbers

Theoretically, to calculate total IBUs for a continuous hop addition, you would have to calculate an IBU value for each hop pellet (or group of hop pellets) that fell in the wort then add these values together. To make the calculations a little less daunting, I grouped the hop additions into the amount of hops dropped in a 10-minute period — about 1.1 ounces (31 g).

For a continuous addition throughout a 60-minute boil, using hops with 5% alpha acids, I calculated 94 IBUs. (Your calculations may vary, depending on the assumptions you make and — of course — the drop rate of your hopper.)

To achieve less hop bitterness, you could use lower alpha hops, run the hopper for a shorter amount of time or boil a larger amount of wort. (A 10-gallon/38 L batch, made with the above procedures, would yield 47 IBUs.)

To achieve more bitterness, you could add higher alpha hops or run the hopper longer (say, for 90 minutes instead of 60). You could also "spike" the wort with added hops at specific times.

The original purpose of the Zopinator was to aid in making unusual hoppy beers. I wanted their hop profiles a little bit different than the regular run of the mill ales. I find that in BJCP beer competitions, judges seem to like a little change from the regular, and award high points to unusual examples (that are still within style guidelines).

In truth, the real reason I designed and built the Zopinator was to do the same as Sam of Dogfish fame did . . . that is, to brew some real off centered beers with some profound hop flavors and aromas that would show off what we homebrewers (and adventurous commercial brewers) live for — individuality. Now, whenever I design a beer recipe, I put my "signature" on it with the Zopinator.

Paul T. Zocco is the owner of Zok's Homebrewing Supplies, Willimantic, Connecticut. The terms "Sir Hops-a-Lot" and "continual hopping" are trademarks of Dogfish Head.

photo courtesy of bavarian brewers federation

Oh, SAY CAN YOU "C"?

American pale ale is a favorite style of most homebrewers, and likely one of the reasons that they started homebrewing.

by **Chris Colby**

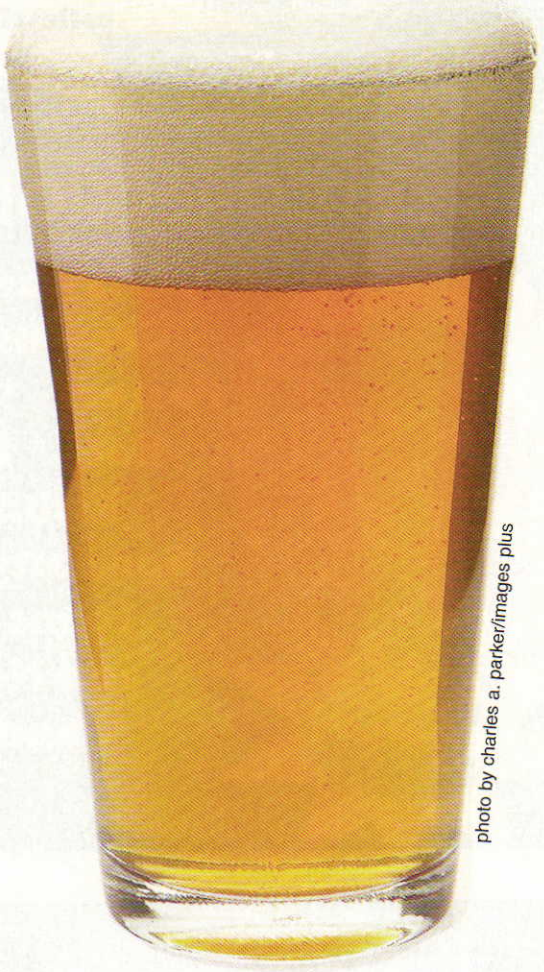


photo by charles a. parker/images plus

A guide to brewing

AMERICAN PALE ALES

packed with lots of citrusy "c" hops

American pale ale has also morphed into a number of related beer styles, including American red or amber ale, American India pale ale (IPA) and double or imperial IPA. All these styles feature a pale or amber base, with a prominent hop presence, usually with a citrusy, "American" hop character.

An American pale ale is one of the most straightforward styles of beer to brew. As with any style, however, attention to detail can make your beer stand out in a crowd. Using fresh ingredients — especially fresh, aromatic hops — is a starting point, but where do you go from there?

It's (Not Really) The Water

Preparing your water is one of the first things you do on brewday, but fine-tuning the mineral content is one of the last things you need to worry about. Unless you have very soft water or water that is high in carbonates, you can likely make a great American pale ale with what you have.

The best kind of water for brewing American pale ales is fairly low in carbonates, ideally under 50 parts per million (ppm). It should, however, be fairly high in calcium — from gypsum (calcium sulfate) or calcium chloride additions. Calcium levels anywhere in the 100–250 ppm range are fine.

Extract brewers should realize that malt extract has minerals dissolved in it. Any pleasant-tasting water should be good enough to brew an extract-based American pale ale. The best kinds of water for extract brewing are soft water, distilled water or reverse osmosis (RO) water with a little gypsum added to accentuate the hop presence — about 1 teaspoon per 5 gallons (19 L) should do the trick.

All-grain brewers can add gypsum if they have very soft water. Use 2–4

teaspoons of gypsum for the roughly 10 gallons (38 L) of brewing liquor you'll need to make a 5-gallon (19-L) batch. For brewers with high-carbonate water, dilute it with distilled water and add back some gypsum or calcium chloride.

Let the flavor of the beer be your guide to calcium additions. If you know you have soft water and your hop profile is too soft or "rounded," add a little more calcium next time. Conversely, if the hop character is harsh and grating, ensure that your carbonate levels are low and back off on excessive calcium additions. You have a "fat middle" to work with, so working out your mineral targets to the nearest ppm is not needed.

As always, no matter what type of brewer you are, carbon filtering your water or treating it overnight with Campden tablets is recommended. One Campden tablet is enough to treat 20 gallons (76 L). This will rid your water of chlorine compounds that can lead to off flavors in your beer.

Pale and Crystal Malts

The backbone of most American pale ales is domestic 2-row pale malt and 5–10% medium crystal malt. A variety of other malts may also be added to increase the malt complexity. Extract brewers should choose a light malt extract base.

Any good domestic 2-row pale malt will work well as the base malt and homebrewers have many choices available to them. English pale ale malts or German Pilsner malts can also be used, or mixed with domestic pale malt to subtly vary the base malt character.

Medium crystal malts — with color ratings between 30 and 60 degrees Lovibond (°L) — are usually the most abundant specialty malt in an American pale ale. Many times they are the only specialty malt. The amount and type of crystal malt you use will influence the color, flavor and mouthfeel of your beer. Lighter crystal malts have a sweet, caramel flavor to them. Darker crystal malts take on additional caramelized flavors. At around 60 °L and above, crystal malts begin imparting a raisiny character and the darkest versions (above 90 °L) additionally show hints of roast. The more crystal malt you add also increases the perceived sweetness and body of the beer,

AMERICAN PALE Ale Recipes

Patrick Henry Pale Ale (5 gallons/19 L, all-grain)

OG = 1.054 FG = 1.014
IBU = 57 SRM = 11 ABV = 5.2%

Ingredients

10.66 lbs. (4.84 kg) domestic 2-row pale malt
0.50 lbs. (0.22 kg) crystal malt (40 °L)
2.0 oz. (57 g) crystal malt (60 °L)
1/8 oz. (3.5 g) chocolate malt
1 tsp. Irish moss (15 mins)
7.4 AAU Chinook hops (60 mins) (0.61 oz./17 g of 12% alpha acids)
3.6 AAU Simcoe hops (60 mins) (0.28 oz./7.8 g of 13% alpha acids)
8.75 AAU Centennial hops (15 mins) (7/8 oz./25 g of 10% alpha acids)
5/8 oz (17 g) Cascade hops (0 min)
1/4 oz. (7 g) Amarillo hops (0 min)
5/8 oz (17 g) Cascade hops (dry hop)
1/4 oz. (7 g) Amarillo hops (dry hop)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Safale US-56 (1.5 qt./~1.5 L yeast starter @ SG 1.030, fermented for 2–3 days at room temperature)
7/8 cup corn sugar (for priming)

Step by Step

Heat 3.5 gallons (13 L) of water to 164 °F (73 °C). Stir in crushed grains and mash at 153 °F (67 °C) for 60 minutes. Add boiling water to raise mash temperature to 168 °F (76 °C) and hold for 5 minutes. Recirculate wort for 20 minutes at a rate of approximately 0.5 gallons (1.9 L) per 5 minutes. Run off wort and begin sparging when liquid level is approximately 1 in. (2.5 cm) above grain bed. Sparge water should be hot enough to keep upper part of grain bed at 170 °F (77 °C). Collect 6 gallons (23 L) of wort over ~90 minutes (about 1 gallon (3.8 L) every 15 minutes), add 0.25 gallons (0.94 L) of water and boil wort for 75 mins. Add hops and Irish moss at times indicated. Cool wort to 70 °F (21 °C) and let sit, covered, for 30 minutes. (This will let the trub and hop debris settle. If you use a counter-flow chiller, direct the chilled wort to a settling bucket, then rack to fermenter 30 minutes later.) Rack to fermenter, aerate well and pitch sediment from yeast starter (or rehydrated dried yeast). Let ferment at 70 °F (21 °C) for 7 days. Rack to secondary, add dry hops and let condition for 7 days. Bottle or keg. Initially, the hop character will be fairly aggressive, but it will smooth out to a reasonable level in a couple weeks if the beer is stored near 40 °F (4.4 °C).

Liberty Bell Red Ale (5 gallons/19 L, extract w/ grains)

OG = 1.047 FG = 1.012
IBU = 42 SRM = 10 ABV = 4.6%

Ingredients

1.66 lbs. (0.75 kg) Briess Light dried malt extract
3.3 lbs. (1.5 kg) Coopers Liqht liquid malt extract (late addition)
1.0 lb. (0.45 kg) Munich malt (10 °L)
0.66 lbs. (0.30 kg) crystal malt (30 °L)
0.66 lbs. (0.30 kg) crystal malt (40 °L)
1 tsp. Irish moss (15 mins)
7.5 AAU Magnum hops (60 mins) (0.53 oz./15 g of 14% alpha acids)
2.5 AAU Centennial hops (60 mins) (0.25 oz./7 g of 10% alpha acids)
1.25 AAU Liberty hops (15 mins) (0.25 oz./7 g of 5% alpha acids)
1.25 AAU Willamette hops (15 mins) (0.25 oz./7 g of 5% alpha acids)
0.25 oz. (7 g) Cascade hops (0 mins)
0.25 oz. (7 g) Willamette hops (0 mins)
0.50 oz. (14 g) Willamette dry hops
Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast (1.5 qt./~1.5 L yeast starter @ SG 1.030, fermented for 2–3 days at room temperature)
1 cup corn sugar (for priming)

Step by Step

In your brewpot, heat 3.5 quarts (3.3 L) of water to 163 °F (73 °C). Place crushed grains in a nylon steeping bag and submerge in hot water. Steep grains at around 152 °F (67 °C) for 45 minutes. If the temperature drops below 150 °F (66 °C), heat to 155 °F (68 °C.) Lift grain bag out and place it in a colander or large strainer over brewpot. Rinse grains slowly with 1.5 qts. (1.4 L) of water at 170 °F (77 °C). Add dried malt extract and water to make 3 gallons (11 L) of wort and bring to a boil. (To save time, have 2.5 gallons (9.5 L) of water boiling at end of steep.) Add bittering hops and boil wort for 60 minutes. Keep a small pot of boiling water on hand and do not let the liquid volume in brewpot dip below 2.5 gallons (9.5 L). Add hops and Irish moss at times indicated in the ingredients list. Add liquid malt extract with 15 minutes left in boil. (Turn off the burner and stir in extract thoroughly before reapplying heat. Keep the boil clock running.) Cool wort in sink or with immersion chiller. Once the side of the brewpot is cool to the touch, let the wort settle — undisturbed — for 30 minutes. Siphon wort to fermenter, leaving as much "gunk" behind as is feasible. Top up to 5 gallons (19 L), aerate wort and pitch yeast sediment from yeast starter. Ferment at 68 °F (20 °C). After 7 days, rack to secondary and add dry hops. After 7 days, bottle or keg. (**Note:** This recipe is not a clone of Anchor Liberty.)

as the malts contribute unfermentable sugars to your wort. Generally, you will want to add between 0.5–1.0 lbs. (0.23–0.45 kg) of crystal malt per 5 gallons (19 L) and aim for a color rating in your beer of 5–16 SRM. Using two or more different crystal malts in your grist will add a hint of complexity to your caramel character.

Optional Malts

You can brew a fine American pale ale with 2-row and one type of crystal malt, but many homebrewers like to add other malts to add some complexity.

Munich malt is often included to add a bit of maltiness to IPAs and some homebrewers also use it for this purpose in American pale ales. Between 10 and 20% will give a noticeable, but not overwhelming, amount of Munich malt character. For a lighter touch, you could also try Vienna malt.

For a biscuity character, a small amount of biscuit malt (or Briess Victory malt) can be added. Biscuit notes are more commonly found in English-style ales, so don't go overboard with this — half a pound (0.23 kg) is as high as I would go for 5 gallons (19 L) of American pale ale.

Tiny amounts of dark grains — such as chocolate, Carafa® or roasted malts, or roasted (unmalted) barley — can be used to darken the beer slightly and change the hue from reddish to more copper-like. Use up to 0.75 oz. (21 g) of any malt rated around 300 °L and you'll get a little copper in your beer without adding any perceptible roastiness.

Some homebrewers add wheat malt for head retention and CaraPils malt for body as a matter of routine to every recipe they formulate. However, if your brewing procedures are sound, you should not need to add them for these purposes. If you have problems with body or foam, you should address the issue head on, not try to work around the problem with a recipe fix.

When formulating your grain bill, keep in mind that complexity can be a good thing — but so can simplicity. Look at each ingredient and ask yourself, is this addition making my beer better, or just more cluttered? Also keep in mind that the hop character is an important aspect of an American pale ale, for some the most important aspect. Your malt profile should complement the hops, not upstage them.

I asked several commercial brewers for their thoughts on malt complexity and got a diverse set of replies.

Richard Norgrove of Bear Republic Brewing Co. said, "If you are going to hop aggressively, you will need the malt to support this. Your brew will stand out if you use complex malt bills. Everyone can brew a hop bomb, but what will make you remember it?"

In contrast, Vinnie Cilurzo said, "I'm a firm believer in a simple grain bill, not just for APA and IPA, but for most beers. My philosophy at Russian River Brewing Company is to keep the malt bill simple to allow for more complex hop characteristics to shine through. Something as simple as 95% pale ale malt or 2-row malt, 2.5% CaraPils malt and 2.5% crystal 40 °L malt is perfect for me."

Lee Chase, from Stone Brewing, agreed, saying, "Keep it simple! Generally, even one or two properly selected malts can give you some great complexity. Sometimes three's a crowd."

Among commercial beers, examples from each philosophy can be found — sometimes from the same brewery. Nick Floyd of Three Floyd's Brewing Co. said, "Malt bills on an American pale ale can run the gamut. We use a complex malt bill (10 different malts) for our pale ale and a really simple malt bill (3 different malts) for our Imperial IPA."

When making the decision on a malt bill for your own American pale ale, the best advice is just to brew a beer like ones that you enjoy.

Hops Hops Hops

The thing that sets American pale ales apart from most other beers is the hops. American pales generally have fairly high bittering levels, but they also show lots of hop flavor and aroma from late kettle additions or dry hopping.

You can use brewing software to calculate the estimated IBUs in your beer, but keep in mind this is just an estimate. Taste your beer and adjust the amount of bittering hops as needed.

Peter Zien, of AleSmith Brewing Company says, "The key figure is the bittering unit to gravity unit (BU:GU) ratio. It's been my experience that a ratio of 1.0 is a good starting point for a hoppy American pale ale."

Since you will be adding a relatively large amount of hops late in the boil, and hops absorb wort, most brewers use high-alpha hops (over 8% alpha acids) for their bittering.

Late addition hops are sometimes divided into flavor hops (added with around 15 minutes left in the boil) and aroma hops (added near the end of the boil). To get the proper level of hop flavor in a American pale ale, you should add 0.5–1.0 oz. (14–28 g) per 5 gallons (19 L) of flavor hops to your wort. You should likewise add another 0.5–1.0 oz. (14–28 g) of aroma hops, more if you don't dry hop. Dry hop additions in the 0.75–1.5 oz. (21–43 g) range will give you a nice level of dry hop aroma. Increase all these levels by 0.25–0.50 oz. (7–14 g) for IPAs and at least that much again for double IPAs.

When dry hopping, whole hops are easier to use than pellets, which can form a sludge at the bottom of your keg or secondary fermenter. Always use green, fresh-smelling dry hops or your hop aroma will suffer. Contact time can be as short as 3 days to as long as the keg lasts, but longer contact times may impart a grassy edge to the beer.

As with bittering hops, use your taste buds to determine if you're getting the level of flavor and aroma from late kettle additions and dry hopping as you'd like. Also, keep in mind that there are other ways to introduce hop flavor and aromas into hoppy American-style ales. These include hopbacks, that filter hot wort through a bed of hops on the way to the chiller, and Randalls, a hop filter that resides between your keg and your glass.

The "C" Hops

It's not just the level of hopping that sets American pale ales apart, the hop character also plays a big role. Although you can use just about any variety of bittering hop for an American pale ale, you should add enough citrusy, American-style hops for flavor and aroma to set it apart from English pale ales or bitters.

Most classic American pale ales employ one or more of the "C" hops — Cascade, Centennial, Chinook or

The EXTENDED Family

American pale ales are part of an extended family of beers. Although they are all variations on a central theme, each has its own keys to successful brewing.

Red or Amber Ales

The characteristics of American red ales and American pale ales overlap quite a bit. For many breweries, the decision to label a beer as a pale ale or as a red or amber ale is more of a marketing decision that anything else. On average, reds and ambers — as their name implies — show a bit more malt color than pale ales. To get a real red color in beer, as opposed to a more coppery hue, use 1–1.5 lbs. (0.45–0.68 kg) of crystal malts in the 30–40 °L range. Weyermann also makes two malts, CaraRed® and CaraAmber®, that work well for this. You can also use Munich or biscuit malt in a red or amber ale at the same levels as in a pale ale.

Reds or ambers sometimes have the hops scaled back to showcase their malt profile, but don't wuss out and drop them too far back. If you do, you could end up with a caramel-sweet beer without enough bitterness for balance.

American IPA

Anchor Liberty (from Anchor Brewing) was the first American ale to feature a pile of Cascade hops. It is still regarded as a classic example of an American IPA. Brewing an American IPA really only involves kicking everything in an American pale ale up a notch. Bump the specific gravity up over 1.060 and add more hops to match. Peter Zien of AleSmith Brewing Company recommends upping the BU:GU ratio to around 1.25. With the added malt, you may be boiling longer to reduce your wort volume. This can give you more time to add hops.

Double or Imperial IPAs

Double or imperial IPAs are American pale ales pushed to the extreme. These beers — including Pliny the Elder (Russian River), 90 Minute IPA (Dogfish Head), Dreadnaught (Three Floyds), Ruination (Stone), Racer X (Bear Republic) and Imperial IPA (Rogue) — are hop monsters.

One technique used in brewing double or imperial IPAs is multiple hop additions added in the middle of the boil. Traditionally, brewers added hops near the beginning of the boil to supply bitterness to their beer. If hop flavor and aroma was desired, they added hops towards the end of the boil. Hops were not added during the middle of the boil because this was thought to be a waste of hops. Less bitterness was obtained due to a shortened boil time and yet the hop's flavor and aroma were mostly boiled off.

Today however, brewers are more likely to make hop additions at several times during the boil, including additions in the middle of the boil. In the 60-, 90- and 120-Minute series IPAs from Dogfish Head, hops are added continuously throughout the boil. Proponents of this style of hopping claim that you get a hop character not obtainable by hopping in the usual manner. However as with the ideas regarding malt complexity and cohumulone content, opinions vary.

Vinnie Cilurzo says, "Where a brewer adds hops in the boil is a part of the artistic side of brewing. There is no correct answer; it has to be determined by experience. The beauty of homebrewing is the fact that a brewer can do whatever he wants to suite his or her palate. At Russian River we produce two pale ales, two IPAs and two double IPAs; in all cases we use mid-boil additions. I find that there is a hop flavor that is contributed from a mid-boil addition that layers the flavors of the hops while you are tasting the brew. I find by not adding a mid-boil hop addition you don't have as much hop character layered through the mouth feel of the brew."

Richard Norgrove of Bear Republic Brewing Co. agreed, likening leaving out mid-boil hops to "making a multiple layer cake but forgetting the filling in the middle layers."

Lee Chase of Stone Brewing wasn't so sure, saying, "Much of this argument is going to be dependent on the engineering of the brewhouse, the operators comfort level on the brewhouse, etc. I personally like the repeatability of adding hops at the start of the boil for bittering, and at the whirlpool for flavor and aroma. That being said, I honestly believe that you can't over-hop an IPA."

In many of these beers, hops are added to — or beyond — the point of alpha acid saturation. There is a limit to how much alpha acids you can boil out of hops. However, adding hops beyond this point may still contribute more flavor and aroma, even if the IBUs will no longer increase.

Just Say NO to CO(humulone)?

There's a popular view in homebrewing that hops high in cohumulone are "harsh" and should be avoided. (Cohumulone is one of the forms of alpha acids in hops, along with humulone and adhumulone.) Many brewers claim that these hops should be replaced with low cohumulone hops, which provide a more rounded and pleasing bitterness.

Other homebrewers argue that "harsh" is as much of a value judgment as it is a flavor description. After all, your average fizzy yellow lager drinker thinks that any perceptible hop character is harsh. A more value-neutral way of describing high cohumulone hops might be "full of character" or perhaps even "aggressive." A big, hoppy beer should have a bit of "bite" to it, to keep it from being too bland, these brewers would argue. Cooking is replete with "harsh" flavors, from the burn of hot chile peppers to the acidic sting of vinegar. However, these things — in measured amounts — bring food to life. Should we really round off all the edges from our beers? As with the question of malt complexity, brewers were divided.

Peter Zien said, "AleSmith believes in smooth bittering, with the majority of a given hop bill being added later in the boil to emphasize flavor and aroma. We employ hops with medium to low cohumulone levels, which impart a smoother bittering profile in my opinion."

Jim Kuhr, of FX Matt Brewing (Saranac) echoed the sentiment. "Stick with low cohumulone hops, if possible. In our opinion, beers with 'aggressive edges' may be nice to try on occasion, but they are not something most people come back to enjoy time and again."

Nick Floyd of Three Floyd's Brewing Co., however, saw uses for both high and low cohumulone hop varieties. "If you want a toned-down session pale ale, use hops with a low cohumulone for bitterness that quickly fades. If you want to make a monsterous hop statement, use a high cohumulone hop variety."

Lee Chase also thought high cohumulone hops had a place in some beers. "At Stone Brewing, we use both. Some beers just need that stick-to-your-tongue character, and in others it would get in the way of another flavor or texture. Know what you are going for, and select the hop that works for you."

Vinnie Cilurzo at Russian River said, "There is a balance to be achieved between a high and low cohumulone hop in a pale ale or IPA. In my opinion, too much low cohumulone hop and you'll get too clean of a beer. I like to blend low and high co-humulone hops to get an end beer that has a hop bite while still staying clean. My favorite bittering hops are Magnum and Warrior blended with some Columbus."

Finally, Brock Wagner, of Saint Arnold Brewing Company, had an interesting take on the question, saying "I believe water chemistry and the timing of hop additions has a greater effect on the harshness of the bitter than the cohumulone does. Early hop additions and water low in calcium carbonate promote a softer hop bitter."

Cascade: Boring or Classic?

I also asked the brewers what they thought about Cascade hops, perhaps *the* classic American hop variety. With the introduction of many new hop varieties, some hombrewers feel that Cascade is boring and that it will be supplanted by these newcomers. Other homebrewers feel that this classic, high cohumulone hop will always have a place in American pale ales. There was still love for Cascade hops, even among brewers using newer varieties. Richard Norgrove of Bear Republic put in a good word, saying, "Wait 'til you get some of the '05 Cascades . . . Wow! Don't abandon them yet."

Columbus — among their late addition or dry hops. The brewers I interviewed were also excited about new hop varieties, with Amarillo getting the most mentions. Simcoe, Warrior and Palisade were each also mentioned by more than one brewer. Of course, many old favorites — such as Nugget, Galena, Willamette, Mt. Hood and Liberty — are still widely used. As with the malt bill, American pale ales can feature simple or complex hop schedules.

One of the best things a homebrewer can do is to try various hop varieties, discover what each brings to his beer and then base his hop schedule on that knowledge. Vinnie Cilurzo says, "To test new varieties, we make a beer called Hop 2 It. In every batch, the malt bill stays the same and the quantity of hops added in the dry hop and the end and middle of the boil always stay the same. The only thing we change is the hop variety and quantity of hops adding at the beginning of the boil, adjusting for bittering units. This allows us to really see the true aroma and flavor of a particular variety. We have been making Hop 2 It for years now and it is one of the most valuable tools we have at Russian River to analyze a hop."

Clean Ale Yeast

Most American pale ales are fermented with a clean ale yeast. The most famous of these is the so-called "Chico" strain, which is believed to have come from Ballantine and is used by Sierra Nevada in their classic pale ale. Homebrewers know this strain as Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or the new dried version, Safale US-56.

Other suitable yeast strains include Wyeast 1272 (American Ale II), White Labs WLP051 (California Ale V) or any English ale yeast in which the ester levels can be kept minimal by pitching rate or fermentation temperature.

A 1–2 quart (~1–2 L) yeast starter, with starting specific gravity 1.030–1.040 is recommended to ensure that an adequate number of healthy yeast cells are pitched. Strongly aerating the culture and perhaps adding a small amount of yeast nutrients will give the best results. As with any beer, running a good fermentation is one of the most important variables

in determining the beer's quality. The actual brewing of pale ales is very straightforward.

Brew That Thing!

American pale ales can be made with a single infusion mash in the 150–154 °F (66–68 °C) range. For this style, more complex mashes are just a waste of time.

All-grain brewers should boil their wort for 60–90 minutes. Most brewers wait until the final 60 minutes before they start hopping, but others may boil hops for 90 minutes (or, in a few cases, longer).

Extract brewers should only boil their wort for 60 minutes. They should also add around half of their malt extract late in the boil. These steps will help to minimize wort darkening. To ensure an adequate amount of bitterness in their beer, extract brewers should boil as large a volume of wort as they can manage as the maximum IBUs attainable depends on the volume of wort boiled. (See the December 2005 issue of *BYO* for more on this technique.)

Upon cooling the wort, there will be a lot of hop material floating around. Allowing this to settle and compact a bit before transferring your wort to the fermenter will allow you to yield slightly more wort and may also minimize vegetal flavors in the beer.

Aerate the wort well and hold fermentation temperatures as constant as possible. Carbonate the beer more than you would an English pale ale, but less than for an American Pilsner. You want the carbonation to bubble up the hop aroma and perhaps add a little carbonic "bite," but you don't want the beer to be too gassy. Between ⅞ and 1 cup of corn sugar is about right for priming 5 gallons (19 L). In a keg, you can shoot for a specific volume of CO_2, but let your taste buds have the final say as to how much pressure to keep on your beer.

Although the basics of brewing an American pale ale are simple, perfecting one involves a lot of variables. Take good notes every time you brew one and you'll soon home in on your target. And always remember — if in doubt, add more hops.

Chris Colby would like to thank all the brewers quoted in this article for their time and their help.

photos courtesy of bavarian brewers federation

PLANT a BACKYARD beer GARDEN

by Kristin Grant

the freshest ingredients are those you grow yourself

SPRING IS HERE and for many homebrewers, it's time to plant a beer garden. You won't find *lederhosen* or German oompah bands in this type of beer garden. What you will find are fresh ingredients to spice up your homebrew. Brewers throughout history have added herbs and spices to beer. "For thousands of years people made perfectly wonderful beer out of whatever was available," says Randy Mosher, author of "Radical Brewing" (2004, Brewers Publications).

The obvious choices for a brewer's garden are hops (*Humulus lupulus*) and barley (*Hordeum spp.*). For instructions on growing hops, see the March-April 2005 issue of *BYO*. And, if you're up to the challenge of malting the barley you grow, see the May-June 2002 issue of *BYO*. In this article, I'll focus on herbs and spices that are relatively easy to grow and use.

For the Belgian-style Brewer

Coriander (*Coriandrum sativum*) is one of the two common spices found in a Belgian witbier, the other being orange peel. Some saisons are also spiced with coriander (although the "spice"

illustrations by don martin

Ginger Baker's Cream Ale

(5 gallons/19 L, extract w/grains)
OG = 1.044 FG = 1.009
IBU = 15 SRM = 6 ABV = 4.5%

Ingredients

18 oz. (0.51 kg) Vienna malt (4 °L)
9.0 oz. (0.26 kg) 6-row pale malt
5.0 oz. (0.14 kg) 2-row pale malt
10 oz. (0.28 kg) Briess Light dried malt extract
1.0 lb. (0.45 kg) corn sugar
3.3 lbs. (1.5 kg) Coopers Light liquid malt extract (late addition)
2.0 oz. (57 g) grated fresh ginger root (15 mins)
0.5–2.0 oz. (14–57 g) thinly-sliced fresh ginger root (to taste in secondary)
1 tsp. Irish moss (15 mins)
4 AAU Mt. Hood hops (60 mins) (0.9 oz./26 g of 5.5% alpha acids)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Safale US-56 yeast (1.5 qt./~1.5 L starter)
1 cup corn sugar (for priming)

Step by Step

Steep grains at 152 °F (67 °C) in 0.75 gallons (2.8 L) of water for 45 minutes. Rinse grains with 0.5 gallon (1.9 L) of 170 °F (77 °C) water. Add dried malt extract, corn sugar and water to make 2.5 gallons (9.5 L). Bring to a boil, add hops and boil for 60 minutes. Add liquid malt extract, grated ginger and Irish moss with 15 minutes left. Cool wort, transfer to fermenter and top up to 5 gallons (19 L). Aerate wort, pitch yeast and ferment at 68 °F (20 °C). Add sliced ginger to taste in secondary.

Lemongrass Helles

by Dan and Joelle Dewberry
(5 gallons/19 L, all-grain)
OG = 1.045 FG = 1.011
IBU = 16 SRM = 4 ABV = 4.3%

Ingredients

8 lbs. 10 oz. (3.9 kg) German Pils malt
0.25 lbs. (0.11 kg) CaraPils malt
0.25 lbs. (0.11 kg) light Munich malt (10 °L)
8 lemongrass stalks
4.3 AAU Hallertau hops (60 mins) (1.1 oz./30 g of 4.1% alpha acids)
0.5 oz. (14 g) Hallertau hops (15 mins)
Wyeast 2308 (Munich lager) yeast

Step by Step

Mash at 153 °F (67 °C). Boil for 60 minutes. Ferment at 52 °F (11 °C) and perform a diacetyl rest at 60 °F (16 °C) for 2 days. Lager at 35 °F (1.6 °C). Chop up lemongrass stalks into 1/4" (0.63 cm) pieces, leaving dark green tops behind. Boil 1.0 qt. (0.95 L) of water for 5 minutes, then pour hot water over lemongrass pieces until pieces just submerged. Steep, with lid on, for 60 minutes. Strain lemongrass tea and add tea to beer to taste.

in many saisons is a function of the yeast). Coriander is the fruit of the coriander or cilantro plant and has a sweet, peppery, orange-like scent and flavor. Colloquially, most people refer to these fruits as seeds.

Coriander/cilantro, which grows to approximately 24 inches high, thrives in bright sunlight and can be grown anywhere in the US or southern Canada. Both seeds and seedlings are readily available at most nurseries. There are different kinds of coriander, all with different flavors. Indian coriander is the type most homebrewers plant. Coriander can be planted in your garden or in containers after the threat of frost has passed. The plant matures within 60–75 days and — if you keep resowing seeds — you can harvest coriander throughout the entire growing season.

Harvested fruits can be dried in the sun or in a food dehydrator. They should then be stored in a cool, dry place. The "seeds" can be lightly roasted, to bring out their flavor, or used as is. Coriander (unroasted) is used in witbiers and saisons at a rate of up to 1 oz. (28 g) per 5 gallons (19 L), although it will be strongly spicy at the top end of this range. For a less spicy beer, use 0.25–0.5 oz. (7-14 g) per 5 gallons (19 L). The fruits can be added near the end of the boil — for the final 10-15 minutes — added after the boil and steeped 15 minutes before cooling or added in secondary.

Growing Gruit

In the medieval period, before the widespread use of hops, some beers were spiced with gruit. Gruit is a mixture of spices, usually containing sweet gale, yarrow and wild rosemary. Supplementary spices — such as juniper berries, ginger, rosemary, nutmeg, cinnamon, aniseed, mugwort, heather, woodruff or lavender — may also have been used.

Two of the common spices in historical gruit — wild rosemary (*Rhododendron tomentosum*, formerly *Ledum palustre*) and mugwort (*Artemisia vulgaris*) — are now known to be toxic. In addition, both yarrow and sweet gale are not recommended for pregnant women. (Of course, pregnant women shouldn't be drinking strong, medieval-style beers, so this shouldn't be a practical concern.)

Some of the other spices in gruit are difficult to grow in North America, but can be found at your average supermarket or a well-stocked homebrew shop. The remaining ingredients can be grown with little difficulty in most places in the US. These include the big two — sweet gale and yarrow — plus ginger, rosemary, woodruff and lavender. Some of these plants can be grown in containers, if you don't have a garden, and some of the herbs have potential uses in other beers besides gruitbiers.

Sweet gale (*Myrica gale*) is a bushy shrub that should be planted at one end of your garden since the plant can reach a height of 4–6 feet (1.2–1.8 m). "Also known as bog myrtle, it has a millennia-old connection with beer, and unlike some other ancient beer herbs, actually has an enjoyable aroma," says Mosher. "The leaves and seed heads are used — I have to say the seed heads are far superior to the leaves in my experience."

Sweet gale is sold at nurseries and thrives in Northern states. Because of the cooler climate needed, brewers in southern states should ensure the plant is at least partially shaded and well watered. The strong aroma stands up well to a

complex ale. If you use fresh leaves off your sweet gale shrub, up to 3.0 oz. (85 g) can be used for dry "hopping." Up to 1.5 oz. (43 g) of dried leaves can be boiled. Using sweet gale in your brewing process adds an astringent flavor to the final product, so prepare to pucker when sipping this bitter beer.

Yarrow (*Achillea millefolim*) is a fern-like herb that spreads like wildfire in the garden, but taking the time to tend the unruly plant pays off in a crisp, bitter flavor for your homebrew. Yarrow flourishes in bright sunlight, and even if you forget to water it for an extended period, the plant will very likely continue to grow (and spread!).

Yarrow grows to 3 feet (0.91 m) high, and all parts of the plant, including the small white, pink or red flowers, the leaves and the stem can be used in the brewing process to add bitterness and a pungent odor. In fact, yarrow is so bitter that the taste is unpleasant when the herb is eaten directly. But as we know, what's "too bitter" raw is often perfect for

brewing. Yarrow was commonly used in the brewing process before hops became the bittering agent of choice. Use up to 1 oz. (28 g) fresh leaves or half as much dried material late in the boil.

Ginger (*Zingiber officinale*) is an exotic, pungent root and a centuries-old staple of flavorful beer. British brewers used ginger as early as the 1700s! Ginger is easy to obtain and grow. Once hot weather arrives, at least 75 °F (24 °C), go to your nearest grocery store and purchase some ginger root. Place the root in warm water for one night, then plant the soaked root in your garden just below the soil's surface. Grassy stems will sprout up, and both the stems and roots may be used in your homebrew.

In a lighter beer, the addition of ginger could add an exotic, Asian flavor. Darker beers made with ginger could be crafted as gingerbread holiday brews, along with spices from the grocery store such as nutmeg and cinnamon.

If you live in a cooler climate (that drops below 50 °F/10 °C during the winter), you will need to move your ginger plant indoors during the winter, then replant outside once temperatures are greater than 50 °F (10 °C). Placing your cultivated plant outdoors during this cooler period will spur the plant to produce more tubers in the upcoming spring. You can continue to propagate the ginger plant indefinitely — providing an endless supply of ginger for years to come.

Woodruff (*Asperula odorata*) is a low-growing plant that produces small, white flowers and is often used in the production of pot-pourri. "Although it has

no aroma when fresh, when it's dried it has a subtle cinnamon/vanilla sort of aroma," says Mosher.

The pungent leaves of the woodruff plant are used in the brewing process. You can dry "hop" with fresh leaves and dried leaves can be used, at a rate of 0.25 oz. (7 g) per 5 gallons (19 L) in the boil. Using woodruff results in a lime-green tint to the beer. To create a traditional woodruff-flavored Berliner Weisse, the woodruff is added to a simple sugar syrup and the syrup is added to the finished beer right into the glass.

Seeds are readily available, and nurseries generally sell woodruff seedlings during the spring and summer months. The plant grows well in partial shade with plenty of water. To prevent woodruff, which is often used as a ground cover, from spreading throughout your entire garden, place each clipping into soil that has been packed into an empty coffee can; then bury the container so that the top edge of the can is two inches above the soil surface.

The strong piney aroma of **rosemary** (*Rosmarinus officinalis*) can stand up to just about any beer foundation, dark or light. The unique flavor of rosemary, created by its essential oils such as pinene and eucalyptol (if that's any indicator of the flavor!), causes the plant to be a favorite ingredient in the culinary world. The oils are contained in the stem and leaves, so those parts of the rosemary plant should be used when creating a "woodsy" beer.

Many ancient rituals such as weddings included rosemary in some form because throughout history, rosemary symbolized fidelity between lovers. With this in mind, you could craft a rosemary brew as a gift for your special someone

along with a note explaining the beer's symbolic qualities.

Rosemary is readily available at nurseries and thrives in bright sunlight. The plant should be brought indoors during the winter if you live in a cold climate (below freezing). Use up to 2 oz. (56 g) of fresh leaves late in the boil or as dry "hops" in secondary or keg.

The distinctive scent of **lavender** (*Lavandula angustifolia*), a woodsy, rosemary-like aroma with sweet and flowery undertones, is concentrated in the essential oils stored in the plant's stem. These pungent stems can add both flavor and fragrance to your homebrew, especially witbiers. The head of the plant, which features light purple-to-silver colored

flowers when in bloom, can also be used in the brewing process.

Lavender does not typically exceed 3 feet (0.91 m) in height, and prefers bright sunlight. Although categorized as a perennial, some types of lavender will grow for only two to three years.

The pungent nature of the essential oils in lavender can add loads of flavor to beer — to the point that the lavender-influence can overtake the basic underlying beer. Use up to 0.75 oz. (21 g) of leaves late in the boil or for dry "hopping." As an added bonus, fresh lavender sprigs can be used as a colorful garnish.

Make Mine Minty

When considering popular beer flavors, **mint** (*Mentha spp.*) does not likely jump to mind. But it does in Japan, where the herb is used to flavor beers offered at trendy bars and restaurants.

With more than 500 varieties of mint, you must first decide which type you'd like to use. Four distinctive types are peppermint, which features a crisp, cool taste like a candy cane; spearmint, which has a minty taste tempered with a mild, almost licorice-like flavor; apple mint, which offers a sweeter version of the standard peppermint flavor with overtones of fruit; and chocolate mint combines a traditional peppermint flavor with, you guessed it, chocolate. Of these types, apple mint is the least likely to overtake your garden.

Speaking of the tempting taste-combination of mint and chocolate, any type of mint can be paired with chocolate — either chocolate malt or actual chocolate, in the form of cacao nibs or cocoa powder — in beer.

Mint is grown most easily from seedlings, which are readily available at nurseries nationwide. This herb is so easily grown that your main concern will be restraining the plant rather than helping it to grow. Like Woodruff, you could plant the seedlings in containers such as empty coffee cans.

The minty flavor of any mint plant is concentrated in the leaves. Fresh leaves can be used for dry "hopping," or up to 1.0 oz. (28 g) per 5 gallons (19 L) dried leaves can be added to the boil.

An Oriental Touch

The name **lemon grass** (*Cymbopogon citratus*) says it all when it comes to describing this lemon flavored-and-scented herb. Lemongrass adds zest to Asian dishes such as seafood soups and chicken recipes. The lemony scent is pungent and oozes from both the grass blades and the bulb. The grass blades can be sliced to release more flavor, and the bulbs can be bruised or minced.

This herb is available both at nurseries and Asian markets. Since the plant grows from a bulb, the easiest way to add this exotic herb to your garden is to purchase a small plant and sink it into the soil. Otherwise, you can clip a bulb off an existing plant, cover the bulb in "rooting hormone" (a powder available at nurseries), then plant the bulb in moist sand in a pot. Bring lemon grass plants indoors if threat of frost exists. Fresh stalks of lemongrass can be dry "hopped" at rates of up to 3.0 oz. (85 g) per 5 gallons (19 L).

So this spring, when you've got a stop at your local homebrew shop planned, consider dropping by a garden center on the way home and get your beer garden going.

Kristin Grant wrote about growing hops in the March-April 2005 issue.

Calibrate Your Brewery

Make sure your brewing tools read right

Story by Chris Colby

In last month's column, we used two physical properties of water — its freezing and boiling point — to help us calibrate our thermometers. In this installment of Techniques, we'll use another physical property of water — its density — to help us calibrate some other pieces of brewery equipment.

A slight diversion

Incidentally, in last issue's column, you may have wondered why we took both altitude and barometric pressure into account when we measured the boiling point of water. The boiling point of water varies depending on the amount of air pressure on the surface of the water. Air pressure (barometric pressure) decreases with altitude, of course, but some of you may have wondered why we didn't just apply the adjustment for barometric pressure and forget about altitude. This would be the correct approach except for one thing; local weather services express all barometric pressure readings as if they were taken at sea level. Therefore, when you measure the boiling point of water at your house, you need to "decorrect" for the fact that your barometric pressure reading is corrected for altitude by the weather service.

The density of water

Density is the weight of an object divided by the volume it occupies. Water has a density of one kilogram (kg) per liter (L) at 4 °C. In other words, if you had exactly 1 L of water at 4 °C and placed it on a (properly calibrated) scale, it would weigh exactly 1 kg. Expressed in English units, the density of water is roughly 8 lbs. 5.5 oz. per gallon. (In this column, I'll mostly be using metric units and will only give conversions to English units if that knowledge is useful.)

At 4 °C, water is at its maximum density. If you heat it above this temperature, it expands slightly. Oddly enough, when you cool it below this temperature, it also expands.

When we use our hydrometers, we are measuring the density of extract in our wort or beer. ("Extract" here means dissolved solids, not malt extract — although malt extract may account for some of the total of your extract.) Homebrewers tend to express this in terms of specific gravity, which is the density of a liquid relative to pure water. Liquids that are equally as dense as water have a specific gravity of 1.

Homebrewers usually express specific gravity to three decimal places. Using that convention, the specific gravity of a liquid that was as dense as water would be 1.000. Because specific gravity is the density of a liquid relative to that of water, specific gravity has no units. In other words, the specific gravity of pure water is 1.000, not 1.000 followed by a weight and volume (such as kg/L or lbs./gallon).

Since homebrewers almost always express specific gravity to three decimal places, many simply express their gravity in "gravity points" — the value of the last three decimals. For example, ale with an original specific gravity of 1.060 can be described as having 60 "gravity points."

A single-point calibration

If your hydrometer is properly calibrated, it should read 1.000 when floating in pure water. Because the density of water changes with temperature, hydrometers are meant to be used at a specific temperature (either 60 °F/16 °C or 68 °F/20 °C). This temperature is almost always printed on the slip of paper inside the hydrometer. Tables that take temperature into account can be found in most beginning homebrew books.

So, to check if your hydrometer accurately measures the specific gravity of water, simply float it in pure water (distilled or reverse osmosis water) at the correct temperature. Spin the hydrometer to dislodge any bubbles that may be clinging to it and bring the test jar up to eye level.

You will see that, in the middle of the test jar, the water will be level. However, it will climb up the sides of the test jar, making the liquid surface look like a "U" or smiley face. The curved surface of a liquid in a container is called a meniscus. When reading your hydrometer, take your reading from the lowest point of the meniscus — the point where the liquid level intersects with the hydrometer scale gives you your reading.

If you're lucky, your hydrometer reads 1.000 at the specified temperature. If it reads either higher (1.001 or more) or lower (0.9999 or less), simply add or subtract the amount of error from your readings in wort or beer. For example, let's say your hydrometer reads 0.998 in pure water at 60 °C (its calibration temperature). 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.

A two-point calibration

Checking the reading of your hydrometer in pure water is a single point calibration, and this is all most homebrewers will ever do for their hydrometers. However, what if the hydrometer read correctly at 1 but the scale printed on the paper sleeve inside the hydrometer was compressed or elongated compared to what it should be?

To check to see if your hydrometer reads correctly in the range you use it in, you need to do a two-point calibration. And, in order to do a two-point conversion, you need to be introduced to Plato — not the Greek philosopher, but a measure of extract weight frequently used by professional brewers.

Degrees Plato (°Plato) is the percentage of sucrose (table sugar), by weight,

dissolved in a water solution. For example, if you had 10 g of sucrose dissolved in 90 g of water, you would have a 10 °Plato solution — i.e. 10 g of sugar in a solution that weighs 100 g overall is 10% sugar (w/w).

There is a quick and dirty way to convert between degrees Plato and specific gravity — just multiply the value in degrees Plato by four to get the value in "gravity points." Conversely, you can divide the number of "gravity points" by four to yield the value in degrees Plato. For example, the 10 °Plato solution mentioned before would have a specific gravity of 40 "gravity points — 1.040.

This "times 4" rule is only an approximation however, as specific gravity and degrees Plato do not have a linear relationship. A 10 °Plato wort really does have a specific gravity of 1.040. However, as you get farther away from 10 °Plato, this approximation gets less accurate. Most brewing texts have a table that converts between degrees Plato and specific gravity. In his book, "New Brewing Lager Beer" (1996, Brewers Publications), Greg Noonan gives a regression equation that allows us to calculate extract weight in Plato from specific gravity readings. The equation is:

$$P_{(°Plato)} = 135.997(SG)^3 - 630.272(SG)^2 + 1111.14(SG) - 616.868$$

where P is extract weight in °Plato and SG is specific gravity.

The second point

If you have a (calibrated) scale, you can make a sugar solution with a density equivalent to the average density of your wort. You can use this to check if your hydrometer reads correctly in that range.

For example, let's say you brew mostly pale ales and porters and your target original gravity is SG 1.048. A specific gravity of 1.048 is equivalent to 12 ° Plato. (Actually 12 °Plato is 1.04838, but the difference here is only 0.38 "gravity points.")

If you dissolve 12 g of sucrose in 88 g of water, you will have a 12 °Plato or SG 1.048 solution. (Actually, to have enough liquid to be able to float a standard-sized homebrew hydrometer, you will need to use 24 g of sucrose and 176 g of water.)

When you make this sugar solution, you must use sucrose (table sugar), not corn sugar. Why? Because most corn sugar has water associated with it. The most common kind of corn sugar sold at homebrewing stores is dextrose (D-glucose) monohydrate. What this means is that water is complexed with the sugar and makes up part of its weight. In contrast, sucrose is just plain sucrose.

You can probably guess the next step — float your hydrometer in your test solution. Remember to apply your correction from your pure water reading. In our previous example, our hydrometer read two points low at 1.000, so we will have to correct for this by subtracting 2 from our specific gravity reading.

If your hydrometer's scale is correct, your (corrected) specific gravity reading should be 1.048 (or 12 °Plato). If your second reading is correct, you only need

to apply your initial correction for how far off your hydrometer was in pure water, if at all. If your hydrometer is off at this second point, you will have to apply a point-slope correction to all your hydrometer readings. The easiest way to do this is to make a graph. For our example, let's say our hydrometer read 1.047 in the 12 °Plato (SG 1.048) solution. Corrected, this means it read SG 1.045 (11.2 °Plato) when it should have read 1.048 (12.0 °Plato).

Graphic gravity adjustment

Begin by labeling the x axis (the horizontal one) from 1.000 to some specific gravity value at the high end of your normal range. For example, if the biggest beer you plan to brew is an SG 1.080 Scottish wee heavy, make the scale on the x axis go from 1.000 to, say, 1.090. On the y axis (the vertical one), label your scale from the reading of your hydrometer in pure water to the same upper value as before. Following our previous example, we would label the y axis starting at 0.998 and extend it to 1.090. Now, with a ruler, draw a straight line between the two points indicated by your pure water test and the sucrose solution test. This line is called the calibration curve.

In our example, our first point is (1.000, 0.998) — in pure water, in which the value should have yielded a reading of 1.000, our hydrometer read 0.998. Our second point is (1.048, 1.045) because in a solution with a specific gravity of 1.048, our (corrected) reading was 1.045.

To get corrected readings from your hydrometer, take a hydrometer reading and do not add or subtract anything. Find the value from your hydrometer on the y axis and trace a horizontal line over to the calibration curve. Now, drop a vertical line down to the x axis — the value at which the line intersects the x axis is your corrected specific gravity.

So there, wasn't that easy? The correct answer here is, "No, that was a huge pain in the gluteal region. Why would you go through all that every time you use your hydrometer?" The answer to that is, I don't. Personally, I wouldn't go to these lengths unless my hydrometer was way off. And if it was that far off, I'd just buy a new hydrometer. However, performing the second point check on your hydrometer is a useful way to ensure the accuracy of your readings.

Volume

One reason homebrewers measure specific gravity is so they can estimate their extract efficiency — how much extract they get from their grains and adjuncts. Homebrewers often express this in points per pounds per gallon. In other words, how many gravity points they yielded from weight of their ingredients divided by the volume of wort they obtained. (For more on calculating this, see the November 2000 issue of *BYO*.) In order to accurately estimate this, however, you need to be able to accurately measure the volume of your wort. Likewise, it pays to calibrate all of your brewing vessels so you can read the volume of liquid in them anytime during the brew day.

The basic idea for calibrating brewing vessels is simple — add a known volume of water to the vessel and make a mark at that level. For example, you could pour a gallon of water into your carboy and place a piece of tape on the outside that corresponds to that level. Repeat this process four more times to mark the 2-, 3-, 4- and 5-gallon marks. The only catch to the above plan is — how do we measure exactly one gallon?

Standard kitchen measuring cups are not very accurate. (Neither are the hash marks printed on the outside of your brewing bucket.) What you need is something that measures volume accurately. Scientists use volumetric glassware for this. Unfortunately, good volumetric glassware is very expensive. For homebrewing, we need something that is reasonable accurate, but much cheaper. Fortunately, just such a thing is sold at many homebrewing shops — a graduated cylinder. Chemists use graduated cylinders when they need a measure of volume more accurate than that stamped on the sides of beakers and flasks, but not so accurate that they need to drag out their expensive (and fragile) volumetric flasks.

For homebrewers, a 250-mL graduated cylinder will work well (and can double as a hydrometer test jar). A decent graduated cylinder will say how accurate it is. Mine says 250 mL +/- 2 mL at 20 °C. So, it's accurate to about 1% — which should be good enough for most homebrewing applications.

Calibrating a 5-gallon (19-L) carboy by pouring in 250 mL at a time would be very tedious. You'd need to do this almost 75 times to get to the 18,927-mL (18.9-L/5-gallon) mark. To help in calibrating larger vessels, I like to make an intermediate calibrated vessel. A one gallon (3.8 L) milk or water jug works well for this. Pour 250 mL in it almost 16 times, and you can measure out 3.79 L or 3,790 mL (1.00 gallon). Mark the 1-gallon mark on the jug and then use it to calibrate your larger vessels.

To calibrate brewing buckets, you can use a permanent marker to write on the outside of the bucket. For carboys, labeled pieces of tape can be placed at every gallon (or half-gallon) mark. For water tanks or other vessels with sight glasses, volume marks can be painted on the sight glass. For any vessel that is not see-through, you can make a dip stick.

Scales and balances

With a reasonably accurate 250 mL graduated cylinder, you can easily make 1 L of water — 4 X 250 mL = 1 L. Recall that 1 L of water at 4 °C (refrigerator temperature) weighs exactly 1 kg. With this information, you should be able to calibrate any scales or balances in your brewery.

Once you've calibrated the equipment in your brewery, you will know that your readings of temperature, specific gravity, volume and weight are accurate. This knowledge can help you to consistently brew high-quality beers.

Chris Colby calibrates his stomach one pint at a time.

Cast Tap Handle

Getting your tap pulls into shape

Story and photos by Thom Cannell

In the January–February 2004 issue of *BYO* we constructed some very nice tap handles built of preformed wooden spindles. A few of you were kind enough to send photos of your improvements on our suggestions. To say those results impressed us would be a massive understatement — Congratulations! Yet there remained the ultimate custom tap handle. You've seen those outrageously decorative sculptures of mermaids, geese, pirates and all manner of fanciful testimonials to brewers' eccentricity. We, as homebrewers could do no less . . . but how?

I'm a car nut and automotive journalist. Viewing a craft show on casting replacement tail lamps for old cars it dawned on me: Casting is casting, molding is molding and what comes out of the mold could be a tap handle as easily as a tail light lens.

Some molding companies sell casting kits for recreating plastic or metal parts. These everything-in-one-box kits include everything one would need to mold and cast at least one tap handle. Plus, the one I used came with an instructional video to teach novices how to construct a mold, pour the silicone molding compound and cast a new part.

The wonderful thing about silicone molding is that once the mold is made, multiple parts can be produced. Thus, if you make a really cool tap handle, you could give it to others as gifts or promote your brew! I decided to call my pal Mark Stucky who is a professional molder by trade. Together we made my first mold and casting, a graphic based on the *BYO* logo.

While some molders build a molding box from foam-core board and coat it with molding release, Mark convinced me to use an oil-based clay. That's what you'll see in the photos. To begin, you need the object to be copied. In other words, you have to create or possess a 3-D model of your desired tap handle. The kit provides a specific type of molding clay (Play-Doh does NOT work) that doesn't stick to silicone. You must use clay that does not adhere to silicone.

Though your creation will be your own, and you may choose to recreate a favorite miniature sculpture, we'll show you, step-by-step, how we created our original design.

If you're copying an existing 3-D object (like an antique tap handle) the process is much simpler. Place the object into a box made of foam-core board, one that is very well taped together. You will create two molds for this object, a left and right or front and back. Orient the object correctly — you can use bits of clay or wire to hold the object — and follow our steps from pouring onwards.

The first step is to purchase the materials for molding and casting. The kit that we used (available from Eastwood Company at www.eastwoodcompany.com) was a good all-in-one starting point. If you can find a similar one, you can use it and then buy other resin (plastic) colors

(top): Roll out the molding clay to approximately half the desired depth of the finished handle.

(middle): After drawing a paper pattern of the shape of your handle, lay it over a second layer of clay and use a pointed tool to puncture the shape into it.

(bottom): once you have the outline of the mold layed out, use any number of cutting tools to neatly carve out your design.

(top): Place the letters or graphics of your mold onto the flat clay surface that you first rolled out.
(bottom): You will then need to set up a box around your 3-D model into which you will pour the silicone.

or silicone molding compounds when you have more experience.

Materials in hand, you have to create your tap handle, whether copying an existing 3-dimensional object or designing a new one. Not being the world's best sculptor, I chose to stick with taking 2-D graphics into the third dimension. I modified the *Brew Your Own* logo, changing the orientation of the W (of the word *Brew*) to fit a narrow tap handle form, and drew it on paper.

Step by Step

1. Create your 3-D object in clay, or use an existing object.
2. Roll out molding clay to about half the total thickness you want in a tap handle (approximately ⅜" or 10 mm in our case). Smooth the clay and be sure there are no imperfections — any scratch or nick will show clearly in the finished object.
3. Cut out a tap handle shape, squat, oval or a narrow rectangle — the choice is absolutely yours. When finished, set this back aside for further finishing.
4. Adhere your paper pattern to another sheet of smooth clay. Use a needle or prick punch to transfer letter or other graphic shapes to the clay. Be sure to put a punch at each corner or sharp change of direction.
5. Once you've outlined your shapes, remove the pattern and cut out the letters or objects. I used table knives, a scribe, small bits of sheet metal and some dental instruments to cut out the logo. Each tool fits certain curves better than others. Make your cuts uniform, with a similar bevel or perpendicular edge. It looks better when every form is similar — if that's appropriate.
6. Once the letters are cut, smooth the top and side faces meticulously. Silicone casting is accurate enough to reproduce skin texture, so any flaw — groove, nick or scratch — will be on display in your final casting.
7. Adhere the letters or graphics to the flat form. Press firmly and use a fine tool to blend the bottom of the shapes into the flat. I used a dental tool that resembles a

tiny canoe paddle. You could add a slight bevel to the back of the flat and you can improve on it with a sander or file when the casting is complete.

8. This completes the 3-D object that will become your tap handle. Examine it again — absolutely everything that you see will be reproduced. When you're satisfied that it meets expectations set it aside.

Step by Step: molding kit

1. You need a box into which you will pour silicone molding compound in order to surround the 3-D model. While my instructional video suggested a Foam-Core box, Mark's experience was in building clay boxes . . . when in Rome.

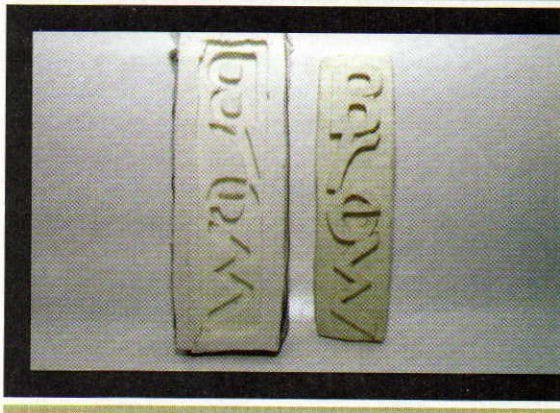
2. If you make a clay enclosure instead of a box, be absolutely sure the clay sticks to its substrate. Even pinholes will leak silicone.

3. Following directions, mix the silicone. Some kinds have a short "open" time from mixing the silicone with an accelerant, others a long time. Viscosity will affect how easily bubbles migrate to the surface. Once the mold is poured, heating will speed up the cure, but slightly shrink the mold. If you are manufacturing products, mold fidelity is more important than speed. If you're impatient, you can cure your silicone mold in the oven, following directions of course.

4. When pouring the molding compound, start in one corner and let it flow into every crevice. While instructions suggest painting molding compound onto the surface of your object (very complex molds might benefit), Mark says in his 10 years of experience it has never been necessary. Pour slowly to limit bubbles forming or being included in the mold, particularly near the desired surface.

5. Cure the mold overnight, or longer. The rubber mold can then be pulled off the original and is ready for casting. Be careful when removing the mold, especially where the thickness is minimal. I tore mine at one corner.

6. Another suggestion from Mark is to surround your mold with plaster of Paris



(top): Pour the silicone over your clay and let it cure over night. Here you can see the dried mold.
(bottom): You can then pour in the casting resin and let it cure. On the right is the casted, unpainted mold.

to support the edges. This doesn't make parting the object from the mold impossible, just a bit more challenging.

Step by Step casting

1. Casting resins are catalyzed liquids. Adding part A to part B in correct proportions results in a solid plastic. Different resins have different mix proportions and "open" times when you may pour. Misjudge open time and you'll have a frozen waterfall of solid resin. Resins also come in different colors including transparent and translucent. Imagine how our BREW tap handle would look if clear and filled with fresh hop flowers! Fortunately the resin can also be painted quite easily.

2. Before mixing resins you must prepare the attachment ferule and bolt for your tap handle. The bolt attaches the ferule to the tap handle; the ferule mates your tap handle to the tap. Many homebrew stores offer ferules, as do on-line merchants.

3. To attach the ferule to the tap handle I strongly suggest you use an attachment bolt at least 2" (50 mm) long — the longer is better. If you embed this steel rod into your tap handle, opposed to drilling and tapping the cast resin itself, your tap handle will be much stronger. If your design requires post casting bolt insertion, try to insert 2" minimum and secure with epoxy glue. Remember, tap handles normally crack at the base. A long rod welded to the attachment bolt will create an extremely sturdy tap handle, but you wouldn't want it to show through a clear or translucent tap handle.

Once you have thoroughly mixed and poured your resin according to directions — I'd suggest starting a timer set 30 minutes or less than your open time — set the filled mold on a surface and wait. You may need to add wedges or bits of clay to make sure the mold is perfectly level.

4. It may take an hour or as little as 10 minutes for the resin to cure. The resins contained in my kit set solid in less than three minutes from mixing and generated significant heat. When cured, remove the object from the mold and clean up any imperfections. Smooth the back and evenly round the edges (if it suits your design) and buff out any nasty scratches with 300-600 wet-or-dry sandpaper. You might add texture with a rotary cutting tool or other sharp object. You can now paint and decorate the surface to your liking with epoxy-based paints. Your imagination is the limit!

Thom Cannell writes "Projects" in each issue of BYO.

BUYING GUIDE

Casting kit
(the one we used cost $69.99)
Plaster of Paris
Foam core board
Petroleum jelly
Small paint brush
Popsicle sticks or tongue depressors
Disposable measuring cups or paper cups
Optional: casting video
(the one we used cost $39.99)

Take Me to Your Lager

Brewing great lager beer is well within your grasp

by Bill Pierce

The last half of the 19th Century brought a revolution in brewing, when technical and scientific advances — including refrigeration and isolation of pure yeast strains — propelled lager beer far beyond its traditional birthplace in central Europe and allowed it to be brewed virtually anywhere. It has now reached the point where more than 90% of the beers brewed worldwide are lagers.

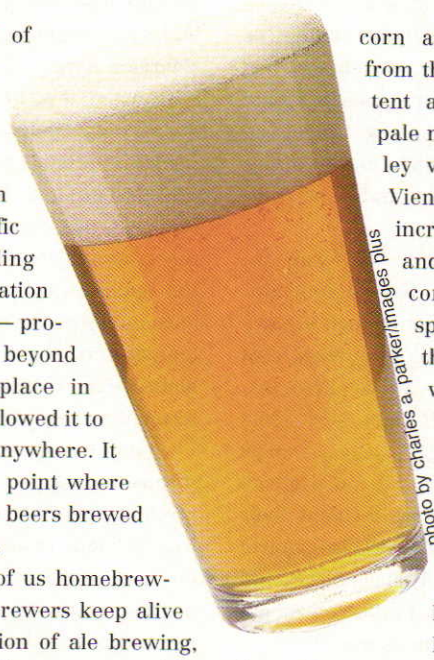


photo by charles a. parker/images plus

Of course, most of us homebrewers and many craft brewers keep alive the even older tradition of ale brewing, which has had a small resurgence of its own in the past 20 years. Even so, there are times when we want to brew lagers, especially the more full-flavored styles that often are harder to find commercially or are prohibitively expensive.

Early avoidance

Beginning homebrewers are often cautioned to start with ales, which are usually less demanding in terms of equipment and technique. Specifically, the requirement of maintaining fermentation temperatures around 45–55 °F (7–13 °C) — lower than typical room temperature, but higher than refrigerator temperatures — keeps many homebrewers from taking the plunge.

The early cautioning can, however, lead to the notion that lagers are so difficult to brew that only the most advanced brewers should attempt them. In reality, this is far from the truth. If you like the clean quality of lager styles, there is no reason not to begin brewing them.

It's the malt, Walt

The base malt for pale European lagers is often Pilsner malt, while American lagers using adjuncts such as corn and rice may benefit from the higher protein content and enzyme levels in pale malt from six-row barley varieties. Munich and Vienna malts contribute increased malty aromas and flavors, while the contribution of other specialty malts is much the same as in ales. A wide range of European and American malts that are malted with lager brewing in mind are available to homebrewers in North America.

Extract brewers also have choices specific to lager brewing. Some malt extracts available are manufactured from malts better suited to ale brewing. However, extracts from German maltsters Weyermann and Bierkeller are available in the US. In addition, the US maltster Briess makes a Pilsen extract and homebrew retailer Beer, Beer and More Beer offers a malt extract made from German malt (Durst Pilsner).

Adjuncts used in many American Pilsners and generic international lagers require mashing. Extract brewers can use rice syrup and corn syrup that are widely available, so these adjuncts can be added in the brewpot.

Another option is to perform a partial mash, augmenting the mashed grains with additional light malt extract added to the boil in order to achieve the target original specific gravity. When an extract brewer is adapting an all-grain recipe that calls for Vienna or Munich malt, partial mashing is an excellent option that will allow the flavors of the grain to prosper.

Lager mashes

Mashing does not need to be appreciably different for lagers than for ales, apart from the fact that non-flaked adjuncts such as corn or rice may require a separate cereal mash to gelatinize the starches prior to being added to the main mash of base and specialty malts. The saccharification temperature of the mash largely controls the degree of attenuation and the resulting body of the beer. Choose a higher temperature rest (156–158 °F/69–70 °C) for sweeter, fuller-bodied beers, or a lower temperature (148–150 °F/64–65 °C) for drier, less full beer styles.

Traditionalists favor decoction mashing, in which the thickest portion of the mash is boiled and returned to the rest of the mash in order to maximize malty flavors. However, there is universal agreement that decoction mashing is not strictly required with modern malts and most brewers achieve excellent results with single or multi-step infusion mashing routines. (For a detailed explanation of the process, see my article, "Decoction Mashing," in the July-August 2004 issue of *BYO*.)

A few lager styles, such as Czech Pilsner, feature noticeable hop character. Most lagers, however, use hops more in a supporting role, either balancing malty flavors for German styles or the light body and restrained flavors of American lagers. Consult the style guidelines for the qualities appropriate for your beer. Hop varieties used are often noble European types or their American derivatives, but it's worth experimenting to see what may suit your tastes.

Not the least is the yeast

The most important factor in lager brewing is the yeast. Lager strains have evolved to become adapted to lower fermentation temperatures, typically 45–55 °F (7–13 °C), which results in slower activity and more neutral flavor profiles with fewer fruity esters. There are some differences in attenuation and flavor among lager strains (some finish more dry and crisp, while others are a little more sweet and malty) but they tend to

be more similar to each other than the wide diversity of ale strains.

With liquid lager yeast, making a starter is all but mandatory. The claims of a yeast package being truly "pitchable" may apply to ale strains with very fresh yeast and low to moderate original specific gravity (1.050 or below), but pitching rates for lagers are far more critical. A very general rule of thumb for brewing lagers is to double everything involving the yeast when compared to ale brewing. This applies to both the quantity of yeast required and the time required to ferment the beer to completion. If you have not made a yeast starter before, instructions are available on the web sites of the major yeast suppliers, as well as in the article, "Making a Yeast Starter," in the January-February 2006 issue of *BYO*.

For 5 gallons (19 L) of a moderate gravity lager, a starter size of 3 quarts (2.8 L) is about the minimum. Larger volumes are recommended for larger batch sizes and bigger beers. This may mean stepping up the original starter a second time with fresh wort.

Ferment the starter at room temperature; the purpose of a starter is to propagate yeast rather than produce beer. Allow 2–3 days for each step of the starter to work. If you are concerned about the flavor of the starter being different from that of the wort into which it is pitched, wait an extra day or so for the yeast to flocculate and settle out. Then pour off much of the liquid and pitch mostly the yeast sediment that remains.

Two companies (Fermentis and Brewferm) have recently introduced dried lager yeast strains. For many homebrewers, the verdict is still out on dried lager yeast, but some homebrewers report good results with these new strains.

Lager yeast benefits greatly from wort aeration. Consider investing in an oxygenation or aeration system. (For further information see the Advanced Brewing column in the December 2005 issue). At the very least, pour the chilled wort back and forth several times between sanitized buckets from a height of 3 feet (~1 m) or more in order to increase the level of dissolved oxygen. Additional aeration can be provided after pitching the yeast, up to the point where there is noticeable fermentation activity.

Cool, daddy-o!

Wort chilling is also more important in lager brewing. The wort should be chilled to a temperature of 60 °F (15 °C) or below. If you use an immersion or counterflow wort chiller, the temperature of the chilling water becomes a factor. Those who have relatively warm tap water may have to employ an ice-water bath pre-chiller for the water or post-chiller for the wort.

Obviously, controlling the fermentation temperature is also important. Unless you are fortunate enough to have a location with a stable temperature of 45–55 °F (7–13 °C), this will require a fermentation chamber of some sort. Most homebrewers of lagers use a spare refrigerator or freezer with an external temperature controller to ferment their beer, which allows quite precise control (within 2 °F/1 °C). Used refrigerators and freezers are easy to find; the controllers are available from homebrew shops or electrical and heating/air conditioning wholesalers.

Some lager yeast strains produce sulfur compounds — particularly hydrogen sulfide (H_2S) — during fermentation, resulting in somewhat unpleasant odors that are disturbing to the unsuspecting. Don't be too concerned about these, although you may wish to inform others with whom you share your living space. With time and proper conditioning, these will dissipate and disappear entirely from the finished beer.

Recall the rule of thumb about the lager time frame being double of that for ales. If your ales typically finish fermenting in 7–10 days, 2–3 weeks is a good estimate for a lager. But, as with all fermentations, let the hydrometer or refractometer be the deciding factor rather than the calendar. In general, consider fermentation nearly finished when the reading is within a point or two of the target final specific gravity.

Give it a rest

Another source of confusion for inexperienced lager brewers is the so-called diacetyl rest. Some lager yeast strains are known for their production of diacetyl (2,3 butanedione), a chemical compound often described as being like butter or butterscotch. Diacetyl has a very low flavor and aroma threshold, about 200 parts per billion (ppb) for most people. In very small amounts it can contribute a buttery smoothness, but it quickly gets out of hand. In most lager styles diacetyl is considered a flaw.

Fortunately, brewer's yeast is capable of reabsorbing the diacetyl and reducing it to a related compound (2,3 butanediol) that has a far lower flavor threshold. However, this requires warmer temperatures, around 60–70 °F (16–21 °C, than the optimum conditions for clean lager fermentation. The solution is to raise the temperature for a brief period (24–72 hours) after the yeast has nearly finished fermenting the beer.

For homebrewers this typically means letting the fermenter warm to room temperature for a couple of days. Not all lager strains produce significant amounts of diacetyl, but unless you have previous experience with the yeast you are using, it is best to perform the rest anyway, as it does no harm. Conduct the rest in the primary fermenter in order to maximize the yeast population and quickly reduce the diacetyl.

Lagering

Once fermentation and the diacetyl rest have been completed, it is time to rack to a secondary fermenter and lager the beer. The term "lagering" refers to the extended secondary aging the beer undergoes at cold temperatures (hovering above freezing).

Removed from the primary yeast sediment and allowed to chill and age, the beer should clear and sulfury and other various extraneous aromas and flavors dissipate until it achieves that clean character for which lagers are known. As the saying goes, time heals many wounds. A number of the haze problems sometimes associated with ales are conspicuously absent from most lagers, mainly due to the time spent lagering.

Some brewing texts recommend slowly reducing the temperature by no more than 5 °F (3 °C) per day until the temperature is at the desired setting for lagering. However, many homebrewers

ignore this advice and achieve excellent results. There is agreement that in order to achieve the maximum effect the lagering needs to be done cold, with the temperature no more than 40 °F (5 °C). Many commercial breweries lager at nearly freezing temperatures, in the 32–34 °F (0–1 °C) range.

How long to lager is a matter of some discussion. Light American lagers are typically held near freezing for 10–20 days, while some strong German doppelbocks are lagered as long as six months. For medium to high-gravity beers, Greg Noonan — brewpub owner and author of "New Brewing Lager Beer" (1996, Brewers Publications) — recommends 7–12 days per each 2 °Plato of original gravity. (One degree Plato is roughly equal to 4 specific gravity "points."). For lower gravity lagers the time is reduced to 3–7 days. According to those guidelines, a 1.064 O.G. German bock should be lagered for 112–192 days, while a 1.040 American lager would be lagered 15–35 days.

Waking Rip van Winkle

After its long, cold slumber, the beer should be clear, clean and ready for bottling or kegging. At this point it can be racked from the secondary fermenter or lagering vessel to a serving keg or bottling bucket. It's best to keep the beer relatively cold while doing so to minimize foaming.

Homebrewers may wonder if there is still enough healthy yeast remaining to carbonate the beer. In terms of numbers, the answer is usually yes. Even seemingly crystal clear unfiltered beer contains a considerable amount of yeast. However, it may not be as healthy as desired, especially in higher gravity beers. Those who wish to hedge their bets may want to pitch additional yeast at bottling. I recommend this if the original gravity is 1.070 or higher.

The bottling yeast does not have to be a lager strain. The purpose of the additional yeast is merely to ferment the priming sugar and produce carbonation. A good neutral ale strain will do a fine job and dried yeast is very convenient for this purpose.

If the beer is naturally carbonated, allow the bottles or kegs to warm to room temperature for at least three weeks. Sample the beer to ensure the carbonation is at or near the desired level. High gravity lagers benefit from additional conditioning in the bottle, but others can be served as soon as they are carbonated. Refrigeration of lagers is recommended but not required for long-term storage; at a minimum avoid warm temperatures and wide fluctuations in order to promote stability and to retard staling.

Take the leap into lagering?

Once you clear the main hurdle — finding a spot to maintain lager fermentation temperatures — brewing a lager is not significantly harder to brew than an ale. At that point, the leap to lagering is more of a hop.

Bill Pierce is BYO*'s Advanced Brewing columnist.*

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Last Call

Letter Home

A soldier in Iraq misses the comforts of brewing

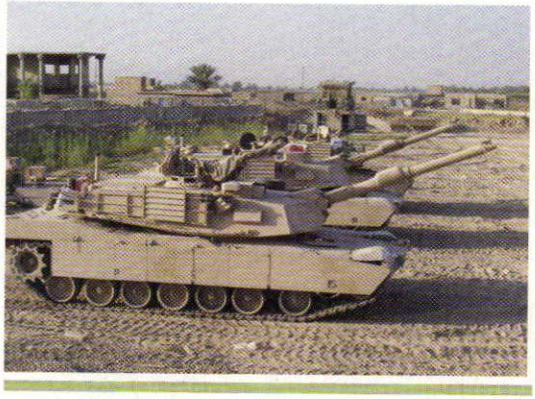
Story and photos by Sergeant William Andrews, 3rd Infantry Division • Lutifiyah, Iraq

The old adage, "You don't know what you've got 'til it's gone," rings in my head continuously as I pore over the myriad of pages from brewing magazines, product catalogs and homebrew clubs on the Internet. The clacking sound of the plastic airlock

of my fermenter, at first nearly inaudible, grows into a thunderous stomp in my head as my concoction grows to life. The pungent smell of malt and hops that permeate the house on brew day seem to me like the fond memories of fresh-cut grass people recall when asked of childhood. And as these distant mental images and olfactory delights wash over me now, there are some of you out there who let your opportunities squander away. Your brew pots, bottles and kegs lay empty — dry as the Iraqi landscape that I now sit in day after brewless day.

But I will admit, I was once like you. I would spend many glorious weekend afternoons lounging on the couch in front of the idiot box saying to myself, "Oh well, maybe I'll brew tomorrow." And as far as my faithful equipment figured, tomorrow never came. My pots, paddles and tubing have been cast into an unthinkable zymurgical gulag, exiled to the garage as my wife makes a little more room for herself while I am gone. I am hopeful they have not lost faith in me and that they wait eagerly for their freedom upon my return. Fear not, my little friends, for I will return. Alas, until then I can only dream of what will be!

As you may have already figured, I am serving my nation in Iraq. And as condition of any military deployment, we do not have beer. I confess I have tried to recreate the experience of sitting and talking with friends over a great beer by means of nonalcoholic Coors they keep on stock at the chow hall. For those of you who just experienced a shutter down your back and into your gut, I thank you for your sympathy. I have been incessantly reading articles and forum discussions so as to further my knowledge and skill for the day when I can brew again. I walk through the steps in my procedures that might be improved. I fantasize about delectable recipes that keep my friends coming back for more, and the catchy names I would call each brew. I visualize



> "Let not another weekend pass without celebrating with a brew day. Let not your equipment sit idle and alone. Invite a friend or loved one, because it will be time well spent."

my cluttered garage transforming to a brewhouse full of wondrous contraptions and gadgets. Then I am awakened from my soothing daydream by the crackling of gunfire from the guard towers on the roof and am reminded of where I am. So, until I am reunited with my passions (the first being my wife — come on, I'm not crazy!) I will have to make do with reading and dreaming.

Admittedly, I am just an intermediate brewer, sticking to extract and partial mash brewing in the kitchen for the past couple of years. But recently the ideas about brewing swim in my head night and day. It seems like brewing is all I think about, probably to block out the horrors that still occur here everyday. Despite what you see — or don't see — of our mission in Iraq, it is still war everyday. So, I escape into a dream of advancing to all-grain equipment, three-tier brewing systems, new glass carboys, Cornelius kegging systems, mash tuns, burners, paddles and hydrometers.

Needless to say, I look forward to a grand homecoming with my wife, my dogs . . . and my home. And maybe that's what this is all about: Brewing reminds me of home, and all the wonderful things about being there. Not just our loved ones, but the little things that make home a splendid place to be.

So my daydreams are not just simply about the great things I'll be able to get to enhance my brewing, but rather the enhancement I'll get just from being at home brewing again. Chilly Saturday mornings in the garage, burners roaring under the brew kettle, the smell of fresh grains and hops, fermenters waiting to be filled and those precious few moments for my wife and I to do something together.

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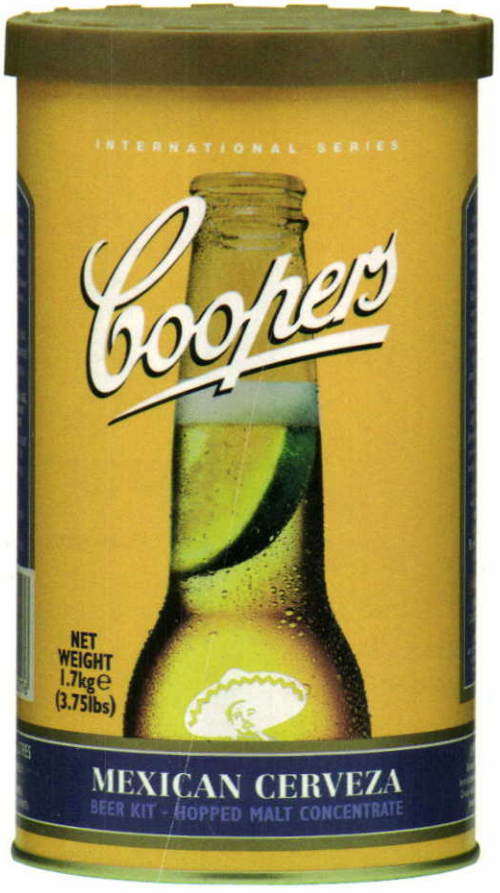

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