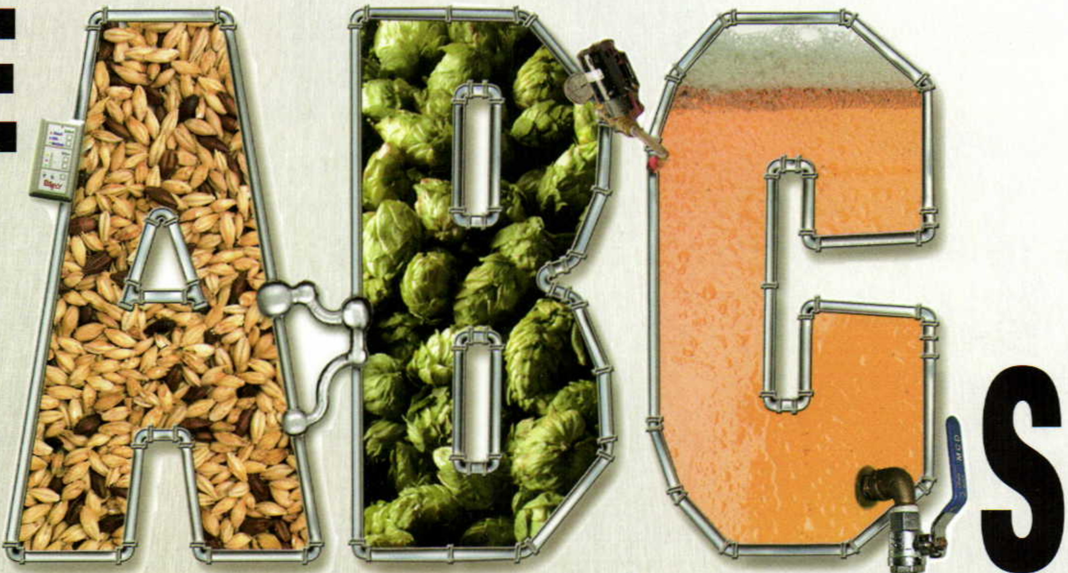
BREWING BOHEMIAN DUNKEL · TIPS, TECHNIQUES & RECIPES

Brew Your Own®

NOVEMBER 2006, VOL.12, NO.7

THE HOW-TO HOMEBREW BEER MAGAZINE

THE ABC's



OF ALL-GRAIN EQUIPMENT

understanding RIMS, HERMS and other acronym brewing systems

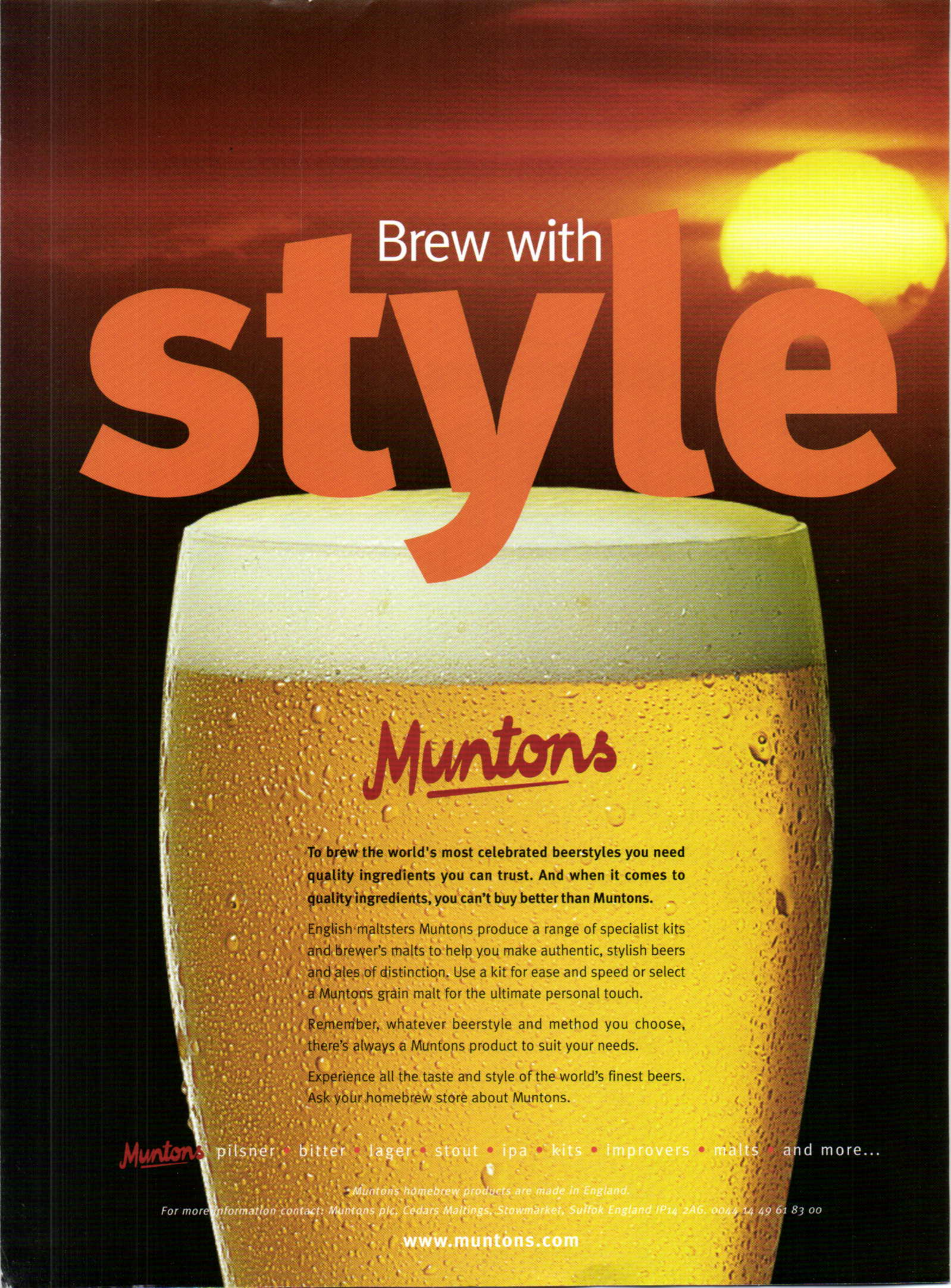
GET IN THE KNOW ABOUT YOUR H_2O

BUILD A SPARGING SYSTEM

www.byo.com
U.S. $4.99 • CAN. $6.99

$4.99US $6.99CAN

WITH THE STARS
e home set-ups of
Palmer & more!



Brew with
style
Muntons
To brew the world's most celebrated beerstyles you need quality ingredients you can trust. And when it comes to quality ingredients, you can't buy better than Muntons.
English maltsters Muntons produce a range of specialist kits and brewer's malts to help you make authentic, stylish beers and ales of distinction. Use a kit for ease and speed or select a Muntons grain malt for the ultimate personal touch.
Remember, whatever beerstyle and method you choose, there's always a Muntons product to suit your needs.
Experience all the taste and style of the world's finest beers. Ask your homebrew store about Muntons.
Muntons pilsner • bitter • lager • stout • ipa • kits • improvers • malts • and more...
• Muntons homebrew products are made in England.
For more information contact: Muntons plc, Cedars Maltings, Stowmarket, Suffok England IP14 2AG. 0044 14 49 61 83 00
www.muntons.com

ANNOUNCING...

the best of Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

150 CLASSIC CLONE RECIPES

FEATURES
80 PAGES OF RECIPES
& KNOW-HOW TO BREW
150 COMMERCIAL
MICROBREW AND IMPORT
BEERS

150 CLONE RECIPES IN ONE GREAT SPECIAL ISSUE!

Replicate your favorite commercial beers featuring the best clone recipes from the last ten years of BYO.

- Intro on how to clone brew commerical beers
- 150 recipes provided for all-grain and extract brewers
- Cross indexed so you can easily find your favorite recipes by brewery or style

At just $4.99 ($5.99 CAN) retail, you won't find a more valuable recipe collection to brew beers like the pros make!

This special newsstand only issue is available at better homebrew retailers
or order today by calling 802-362-3981
also available online at brewyourownstore.com

* Attention homebrew supply shop owners - call us today at 802-362-3981 to discuss volume discounts to resell the BYO 150 Classic Clone Recipes issue in your shop

NOVEMBER 2006
Volume 12 Number 7

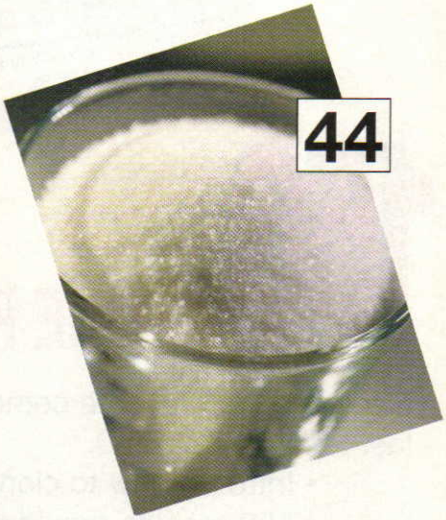
Departments

COVER PHOTO: CHARLES A. PARKER

Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

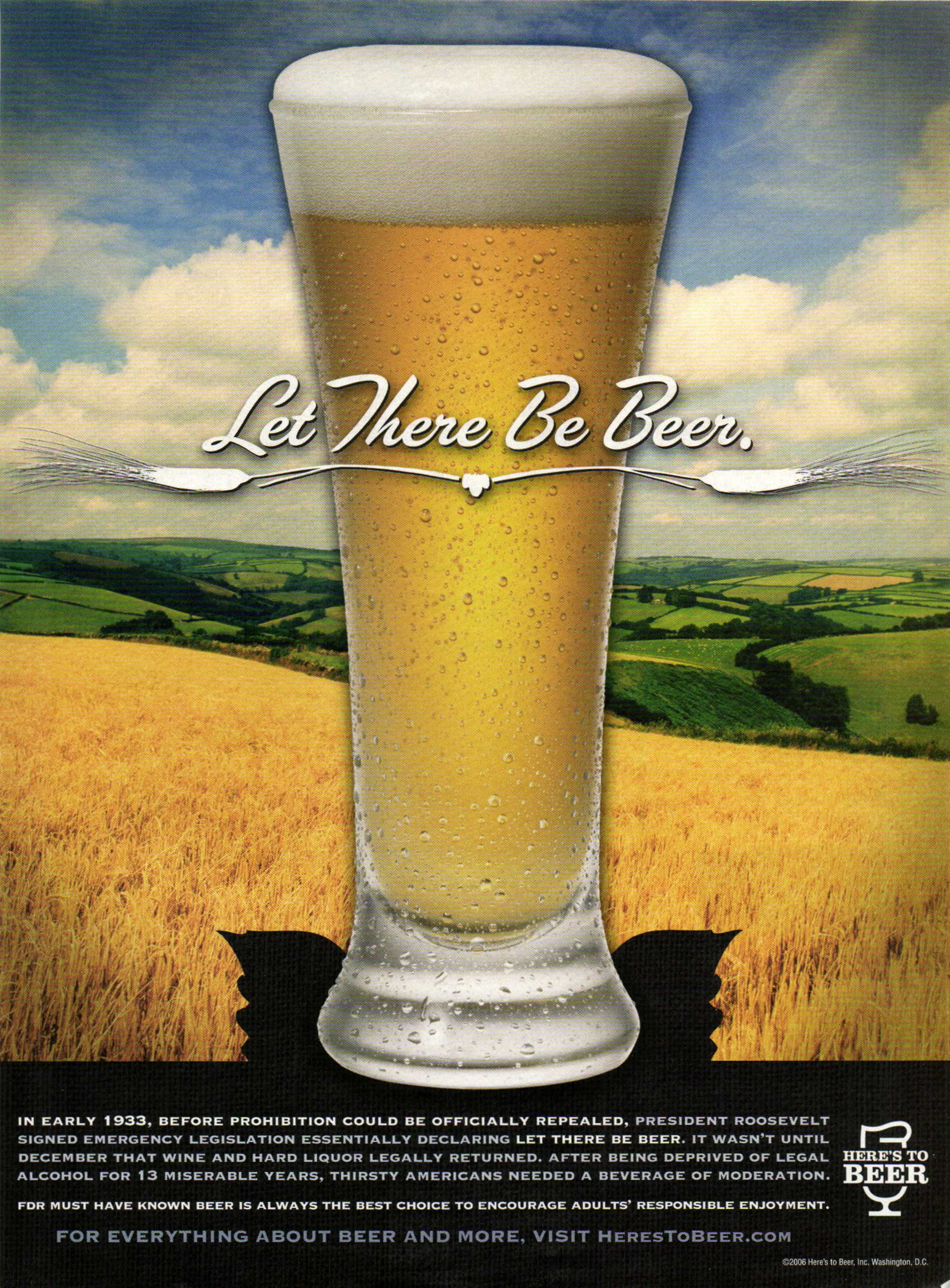
Features


32


44


26

Where to fiNd it


Let There Be Beer.
IN EARLY 1933, BEFORE PROHIBITION COULD BE OFFICIALLY REPEALED, PRESIDENT ROOSEVELT SIGNED EMERGENCY LEGISLATION ESSENTIALLY DECLARING LET THERE BE BEER. IT WASN'T UNTIL DECEMBER THAT WINE AND HARD LIQUOR LEGALLY RETURNED. AFTER BEING DEPRIVED OF LEGAL ALCOHOL FOR 13 MISERABLE YEARS, THIRSTY AMERICANS NEEDED A BEVERAGE OF MODERATION.
FDR MUST HAVE KNOWN BEER IS ALWAYS THE BEST CHOICE TO ENCOURAGE ADULTS' RESPONSIBLE ENJOYMENT.
HERE'S TO BEER
FOR EVERYTHING ABOUT BEER AND MORE, VISIT HERESTOBEER.COM
©2006 Here's to Beer, Inc. Washington, D.C.

Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

EDITOR
Chris Colby

ART DIRECTOR
Coleen Jewett Heingartner

ASSOCIATE EDITOR
Garrett Heaney

TECHNICAL EDITOR
Ashton Lewis

EDITORIAL INTERN
Dave Green

CONTRIBUTING WRITERS
Steve Bader, Thom Cannell, Horst Dornbusch, Bill Pierce, Marc Martin, Terry Foster, Glenn BurnSilver, Kristin Grant, Paul Zocco

CONTRIBUTING ARTISTS
Don Martin, Ian Mackenzie, Shawn Turner, Jim Woodward

CONTRIBUTING PHOTOGRAPHER
Charles A. Parker

CANINE ASSISTANT
Heidi

PUBLISHER
Brad Ring

ASSOCIATE PUBLISHER & ADVERTISING DIRECTOR
Kiev Rattee

ADVERTISING SALES COORDINATOR
John Ragozzine

BOOKKEEPER
Jim Moulton

NEWSSTAND DIRECTOR
Carl Kopf

How to reach us

Editorial and Advertising Office
Brew Your Own
5053 Main Street, Suite A
Manchester Center, VT 05255

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

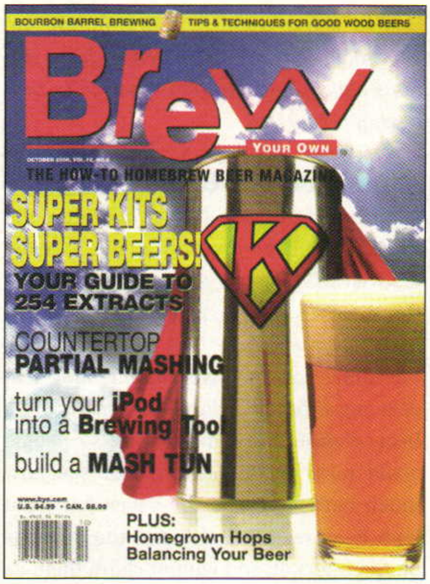
Subscriptions Only
Brew Your Own
P.O. Box 469121
Escondido, CA 92046

Tel: (800) 900-7594
M-F 8:30-5:00 PST
E-mail: byo@pcspublink.com
Fax: (760) 738-4805

Special Subscription Offer
8 issues for $24.95

Web Site
www.byo.com

Brew Your Own (ISSN 1081-826X) is published monthly except February, April, June and August for $24.95 per year by Battenkill Communications, 5053 Main Street, Suite A, Manchester Center, VT 05255; tel: (802) 362-3981; fax: (802) 362-2377; e-mail: BYO@byo.com. Periodicals postage rate paid at Manchester Center, VT and additional mailing offices. Canada Post International Publications Mail Agreement No. 40025970. Return undeliverable Canadian addresses to Express Messenger International, P.O. Box 25058, London BC, Ontario, Canada N6C6A8. POSTMASTER: Send address changes to *Brew Your Own*, P.O. Box 469121, Escondido, CA 92046-9121. Customer Service: For subscription orders call 1-800-900-7594. For subscription inquiries or address changes, write *Brew Your Own*, P.O. Box 469121, Escondido, CA 92046-9121. Tel: (800) 900-7594. Fax: (760) 738-4805. Foreign and Canadian orders must be payable in U.S. dollars plus postage. The subscription rate to Canada and Mexico is $30; for all other countries the subscription rate is $40.



A Sterner Warning

The home preservation of food is both fun and economical. I became interested in it for the same reasons I enjoy home-brewing, the desire to be self-sufficient, the ability to have a larger influence on foods that are normally only commercially available and the joy in giving a neighbor or friend a home-made gift. It is important however, to have a healthy respect for the dangers that could make you sick or even kill you if you don't use approved methods and recipes. The botulism warning you included in the article ("Can It!," by Jon Stika, September 2006) is not enough, you should not recommend a processing method not approved by the USDA for low acid foods even if "it has been successfully used for many years."

There are some other errors in the article that need to be highlighted to readers including the temperature recommended for processing lids, differences of processing times based on altitude and the difference between a "pressure cooker" and a "pressure canner." It is not my intention to scare anyone off from trying this fun hobby, just to ensure it is approached with a respect for safety. All of the equipment and references for safe home canning are available at your local Wal-Mart (at least they are here in Tennessee).

Additionally, I would recommend visiting the National Center for Home Food Preservation website or obtaining a copy of the USDA Complete Guide to Home Canning (1994) for the most up to date equipment and preservation recipes that are safe to use. Specifically for the processing of wort to be used as a starter, since I could not find an approved method I contacted Dr. Brian Nummer, an Extension Food Safety Specialist at Utah State University and former Master Brewer, and received this response.

> "'Canning' of wort is used to kill bacteria, yeasts and molds that would contaminate the starter culture. It is meant to be stored refrigerated, since a boiling water bath would not destroy botulism spores. I would recommend only storing unused starter for 3 months or so and only in the frig. After that the quality may suffer and no research is available to note whether psychrotrophic (cold loving) spore formers could grow."

Kevin M Kennedy
Millington, Tennessee

Thanks Kevin. We'll publish your letter so that homebrewers get the word. (We thought our warning would be enough, but it never hurts to think twice about safety.)

Just to recap — store canned wort in the fridge (for up to 3 months) if you use the boiling water method. Wort canned in a pressure canner (a pressure cooker that specifically says it can be used for canning) can be stored at room temperature indefinitely.

Extreme Fruit

I have a question regarding the recipe for the Kiwit from Sam Calagione (5 Extreme Beer Recipes, September 2006). It has to do with the fruit.

What is the best way to get the fruit into the fermenter? How do I seperate the fruit that I want in the fermenter from the hops and other spent items that I do not want in the fermenter?

Also, I have heard that fruit in a carboy can lead to CO_2 buildup and possible explosions. Is this true? Should I do a primary in a bucket and let the fruit ferment in there and rack to secondary without the fruit?

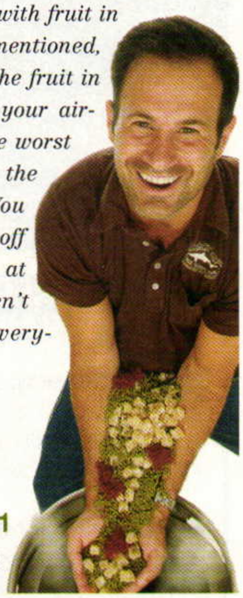
Just a touch confused on the fruit portion of this recipe.

Joe Ament
Chicago, Illinois

We asked Sam Calagione, President, Dogfish Head Craft Brewery to comment and he said: "Hello Joe, The easiest way would be to put it in a specialty grain bag toward the end of the boil and transfer it into a plastic bucket fermenter still in the bag. That way you have a wider neck than with a traditional carboy."

And yes, fruit can cause problems in fermentations. Fruit bits often float on top of the beer's kräusen and, in a vigorous fermentation, they can be forced into the fermentation lock. If this gets plugged, it is possible for a carboy to shatter from the pressure.

Most homebrewers use a bucket for fermenting beers with fruit in them. As Sam mentioned, it's easier to get the fruit in and out. Plus, if your airlock does clog, the worst that happens is the lid blows off. You may be cleaning off your ceiling, but at least there aren't glass shards everywhere.



The Extreme Yeast Formerly Known as 3021

In the recipe for Dema-Goddess Ale (5 Extreme Beer Recipes, September 2006), two choices for bottling yeast are given: Champagne yeast or Wyeast 3021. I find nothing on Wyeast's website for a yeast 3021. What is this supposed to be?

Philip Storvik
email

When we looked at the recipes, we were sure there was a Wyeast 3021, so we contacted Wyeast for the scoop. They explained that all their wine yeasts now start with a "4." The former yeast called Wyeast 3021 (Pasteur Champagne, Prise de mousse) is now called 4021.

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.

Extreme(ly) Small Boil

So I was wondering, in the September issue, there is an article about extreme brewing with a few recipes (5 Extreme Beer Recipes, September 2006). I am really interested in trying the peppercorn rye bock, but I was wondering about boil size. Is it possible to boil a smaller volume of water, say 2.5 gallons, instead of 4?

Erin
via email

You could boil a smaller volume of wort, but it will likely negatively affect the beer.

Boiling smaller amounts of extract wort means that the sugars in the wort are at a higher concentration. This can lead to excessive wort darkening and will also lower your hop utilization.

If you don't have any other choice, boiling 2.5 gallons (9.5 L) of wort won't be the end of the world — the peppercorn rye-bock is not a particlarly hoppy beer and a little extra color shouldn't hurt, either. Boil 4.0 gallons (15 L), if you can reasonably manage it — but if you can't, don't let that stop you.

Volcanic Bier

I've been a subscriber to *BYO* for many years now, and a homebrewer for 10 or more years.

However, I have been stumped with a recipe that I have been doing for many years with great success. The brew is called Austrian Fest Bier extract with Munich malt and Kölsch yeast. After aging this brew in my glass carboy for 3 months at 45 °F, I went to dry hop it with 1 ounce of Cascade hops. Almost immediately it started to fizz and basically pushed the hops right out of the carboy. I do not ever remember seeing this before, I smelled the beer and it seemed to smell normal. I later kegged the bier and it was great to drink! Any suggestions?

Shamus
Park City, Utah

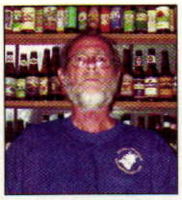
Most likely, adding the dry hops created nucleation sites for the formation of CO_2 bubbles. At 45 °F (7.2 °C), "uncarbonated" beer that just finished fermenting has a lot of CO_2 in it. You probably just triggered the release of that gas when you added the hops. Next time, try adding a few cones first and letting the beer foam if it's going to. Keep adding dry hops slowly until adding them quits provoking a reaction.

More Food and Beer Pairings?

I know this is a little while after the issue arrived at my house, but I really enjoyed the "Food & Beer Pairing" article (by Kristin Grant, in the July-August issue). We have a neighborhood Christmas progressive dinner and last year my wife and I did appetizers. I did a beer, cheese and wine tasting so people could taste the difference and see how much better most of the selections went with beer vs. wine. (I found the pairings on the internet, so I cannot claim them as my own.) As a group, most everyone agreed that the beer and cheese combinations were much more pleasing and enjoyable. Not all of them, of course, but those that had an open attitude enjoyed it. I think this would be a good monthly column for the magazine and could help others introduce friends, family, etc. to food and good beer. What beers would be good at Thanksgiving dinner, Christmas dinner, etc. Some of us without the expertise in food and beer pairings could really use the help. This article is a great reference, but when filed in my little brewery, well, it's like a library. Unless I know it's there I'll never find it when I need it. A monthly seasonal pairing article would keep it fresh in readers minds.

Lowell Renner
N. Attleborough, Massachusetts

Glad to hear you are spreading the word about how great beer pairs with food. We liked the article, too, but we aren't planning on making food and beer pairing stories a recurring feature. Here at BYO, *our editorial focus is on homebrewing. Although we run a food and beer article every once in awhile, and we have our annual label contest, we want our magazine to revolve around how to brew at home. This means that some general interest beer topics won't get covered by us, but we think our readers appreciate the tight focus on homebrewing. Don't let this stop you from exploring, though. Garrett Oliver's book (mentioned in the article) is a great jumping off point for anyone interested in pairing food and beer.*



Robert McGill is a retired PhD Chemical Engineer who spent over 30 years working in chemical process development and improvement. Bob developed a taste for good beer while participating in a NATO Scientific Conference at Cambridge, England in the early 1970s. Evenings were spent in technical (and other) conversions in the college pub while enjoying the tasty local ales. Upon returning, Bob made a failed attempt at brewing a good ale. A gift of a Mr. Beer kit about 10 years ago resulted in renewed interest and Bob quickly moved to brewing award-winning, all-grain beers. (He is a finalist in the Sam Adams homebrew contest.) Bob has used his process improvement background to improve, at low cost, on equipment he has read about.

Bob is an active member in the Golden Triangle Homebrew Club located in southeast Texas. His first article for *BYO*, on how to calculate your level of carbonation when priming with sugar, appears on page 44.

Dr. Chris White is a member of *Brew Your Own*'s review board (the pool of people who review manuscripts for this magazine). Chris has researched and developed a library of brewers yeast strains from around the world. Homebrewers know him as the founder of White Labs, which he started in 1995.

Chris did his undergraduate work in biochemistry at the University of California, Davis. Later, he earned a PhD in biochemistry from UC, San Diego.

In addition to his duties at White Labs, Chris is a chemistry and biochemistry lecturer at UC, San Diego and is a member of the Siebel Institute faculty.

Back in the October 2001 issue, Chris wrote the article, "Round it Up!," on collecting brewers yeast from bottle-conditioned beer and, of course, has served as a source of information for other yeast-related articles — most recently, the Jan-Feb 2006 story on how liquid yeast is made.

Craig Hartinger is another member of our review board. Born in Olympia, Washington, he attended the University of Washington in Seattle and became interested in good beer when he got a job as a waiter at a nice restaurant. Craig received a homebrew kit as a gift in 1993 and started to brew extract beers at a rate of about 1–2 batches per month.

Later, he became the manager of the homebrew store, Liberty Malt Supply, in Seattle. Within 6 months, he was an obsessive all-grain brewer. After a period working as a sales rep for Rogue Brewing (Newport, Oregon), he began working for Merchant du Vin, which imports European beers, including Samuel Smith, Ayinger, Lindemans, Orval, Westmalle, Melbourn, Pinkus and Traquair House. Craig is a BJCP beer judge and teaches a beer class at Bellevue Community College Extension. He also attends Washington Brewers Guild meetings and events.

homebrew NATION

homebrew CLUB

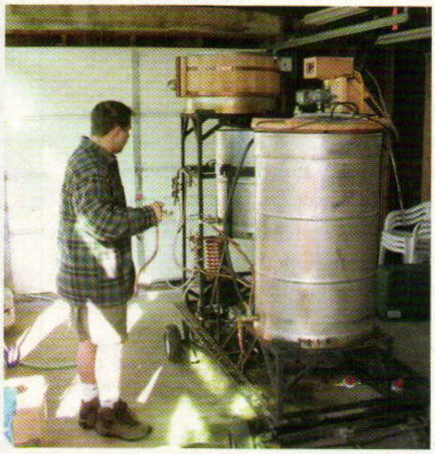
St. Paul Homebrewers Club • St. Paul, Minnesota

If attitude is everything, then the St. Paul Homebrewers Club (SPHBC) has it all. For example, when our former president learned about this Homebrew Nation profile, he said "I've seen that section and thought — *We're way cooler than those guys.*"

Members of the St. Paul Homebrewers Club get together to build their 50-gallon club system.

Oooh. Ouch. Maybe we really need to work on that whole attitude thing a bit. At least there's enough talent to back up the boasting. SPHBC brews good beer, and we're always trying to get better.

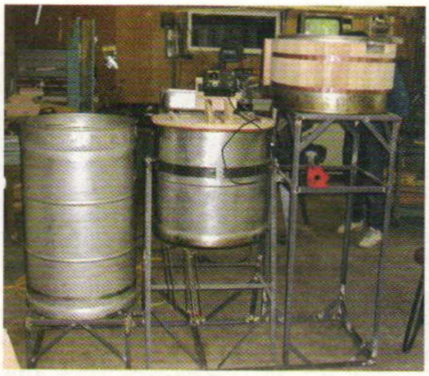
This year SPHBC ranked as the second best brew club in the nation based on medals earned in AHA Nationals and Club Only competitions. The previous two years saw SPHBC ranked fourth overall nationally.



Kris England sets up the system for a club brewing of their Double IPA.

We probably give some the wrong impression, but behind the joking, swagger and trash talk, SPHBC is really all about sharing knowledge and making brewing fun. Founded in 1997 by Curt Stock (2005 AHA Mead Maker of the Year) and Gary Hipple, SPHBC has grown from six guys sitting around in a garage brewing and watching "Die Hard" to more than sixty people today.

One way we share the craft is through our 50-gallon (189-L) club system, which we use to teach new brewers about the brewing process. The system lets 8–10 people get 5 gallons (19 L) of the same wort to pitch the yeast of their choice. Later, club members gather to sample, critique and compare notes on how the beer turned out. We're also proud of the work we've done for homebrewers beyond the Twin Cities.



The 50-gallon (189-L) club system fully assembled and ready for brewing.

Our members have served as officers for the BJCP and the AHA. SPHBC hosts the prestigious Masters Championship of Amateur Brewing (MCAB). The club also sponsors the Mid-West Home Brewer of the Year circuit and co-hosts one of the larger regional homebrew competitions, the Upper Mississippi Mash-Out.

As our club motto goes "Slam that, try this!" We take our beer seriously, but not much else. Feel free to visit us online at www.sphbc.org.

homebrew CALENDAR

November 4
Foam On the Range Homebrew Competition
Denver, Colorado

The Foam On The Range Homebrew Competition will be held on November 11. Entries are due on November 4. The awards ceremony will start at about 4:30 p.m. and the results will be posted on the Site below within a day of the scoring. The fee is $5 per entry. Delivery and drop off locations along with full competition details can be found online at www.foamontherange.org.

November 4
MALT Turkey Shoot
Baltimore, Maryland

The MALT Turkey Shoot homebrew competition will be held on November 11. The deadline for entries is November 4 and fees are $6 for the first entry, $5 for each additional entry. For details visit www.maltclub.org. For questions call Timothy Sauerwein at (443) 994-1399 or contact him via email at sourwine@comcast.net.

November 17
Great Brews of America Beerfest Homebrew Competition
Lake Harmony, Pennsylvania

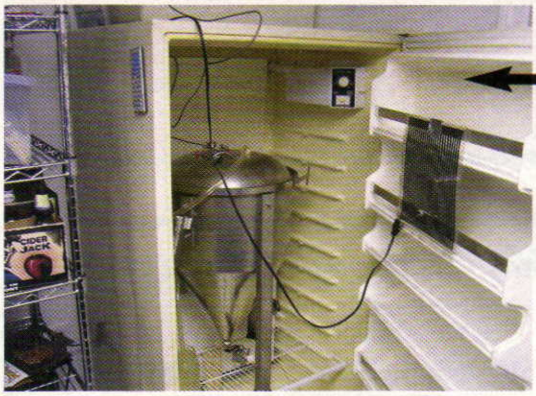
The Great Brews of America Beerfest will be held on November 18–19. This event includes a homebrew competition for which the entry deadline is November 17. Fees are $5 per entry and entries can be mailed to the Split Rock Resort in Lake Harmony. For full information visit www.splitrockresort.com.

homebrew systems that make you DROOL

Mark Bettez • Gardner, Massachusetts

My system — Tophat Brewery — consists of two Sabco universal kettles powered by 240V 4,500-watt heating elements used as my boil kettle and hot liquor tun. My mash tun is a cooler. I use a pump and counterflow chiller to transfer the wort into my conical fermenter. The wort is oxygenated with pure oxygen and a stainless diffusion stone. I use an upright freezer and temperature controller to regulate fermentation temperatures. All my beer is kegged and force carbonated, then served with my 6-tap kegerator. I've also built a positive pressure ultra low particulate air (ULPA) filter chamber to collect and manipulate my yeast collection. My sink is a large three-bay stainless commercial sink that makes cleaning and sanitizing a breeze. I use a JSP malt mill powerd by a Bodine motor.

The hot liquor tun is controlled by a PID controller and SSR (solid state relay) and the kettle heating element is controlled by a pulse width modulator and SSR. The electric setup allows brewing indoors with no worry of carbon monoxide. Steam is still an issue so a strong vent was installed and works well.



The fermentation chamber is a modified upright freezer and houses a stainless steel conical fermenter. The chamber is temperature controlled to ensure proper fermentation conditions.

Both the vent over the kettles and the sink in the background were gathered from a restaurant, giving the homebrewery an industrial feel.

The system has two Sabco kettles, one being the brew kettle, the other the hot liquor tun. Each has a 4,500-watt, 240-V electric heating element.

(top): Tophat Brewery keeps its shelves stocked. That's quite the collection of grains, bottles and kegs. And is that a DVD monitor above the fermentation chamber?

(middle): An industrial dishwashing sink makes cleaning and sanitation more efficient.

(bottom): An ultra low particulate air (ULPA) filter chamber houses Mark's yeast experimentation.

brewer PROFILE Brother Cuthbert • St. Gregory's Abbey • Three Rivers, Michigan

Brother Cuthbert started brewing two years ago at St. Gregory's Abbey.

When I first arrived at St. Gregory's Abbey (a Benedictine monastery in Three Rivers, Michigan), I had never before thought about brewing my own beer. Thanks to some Belgian friends of mine, I had already come to appreciate that some of the world's best beers are brewed by monks, but I never imagined I would be trying my own hand at brewing. Then I discovered that we had several 5-gallon (19-L) glass carboys in the monastery basement. I also discovered a collection of hydrometers, thermometers, airlocks and an old bottle capper. I learned later that back in the 1980s, a novice monk had tried his luck at brewing and after several failures gave up the hobby and left the equipment in the basement to gather dust.

Realizing that I had about half of the necessary equipment right in front of me, I did some research and bought a dinky one-gallon kit to see if I would have any success. Not surprisingly, the results were unimpressive. Undaunted, however, I bought a hefeweizen kit with ingredients to make a 5-gallon (19-L) batch, and when I brought it out at our Easter celebration, it proved to be more popular than I could have hoped.

I came up with a name for the beer that is suitably monastic: DOM – an acronym of the Latin "Deo Optimo Maximo," which very loosely translated means "only the best for God." In fitting with the image of a monk brewing beer, someone jokingly suggested that it might also mean "Dirty Old Monk." I'll let the reader decide!

As for myself, I have been a monk here for a little over two years. I don't imagine DOM will ever become the next Chimay or Orval, but it is kind of cool to think that I am carrying on an age-old monastic tradition five gallons at a time.

replicator

by Marc Martin

Real Ale Brewing Company

Blanco, Texas

Dear Replicator,

There is a small microbrewery in Blanco, Texas called Real Ale Brewing Company. It is almost impossible to get a six pack of their excellent brews outside of the Austin/San Antonio area, mainly because it moves off the shelves so fast. I have to drive 1½ to 2 hours to Houston and hope to get a sixer to bring home. If not, there is one tap house in Houston that serves up their regulars, Full Moon Pale Rye pale ale, Brewhouse Brown and their awesome seasonals. The Brewhouse Brown is like a liquid chocolate cake. I have tried my own attempt to clone this silky delight but came up short. Can you help me with this one?

Brian DeRouen
Nederland, Texas

Having lived in Austin, Texas for three years I am very familiar with both this brewery and their head brewer. You are right about the popularity of their beers. The stores in Austin are sometimes hard pressed to stay stocked! This is truly a brewery that started from the ground, or should I say underground, up. For their first years in business they were operating in a basement under an antique store on the town square in downtown Blanco. Their success however, is indicated by the recent celebration of their 10th anniversary. No small feat for a brewery in Texas. They are now ready for the opening of their new, state of the art, facility in Blanco.

Head brewer Tim Schwartz also started from the ground up as a homebrewer in 1990. He went on to become the head brewer at the recently closed Bitter End Brewery in Austin. He is now ready to man their new, massive, 60-barrel brewhouse. Plans are in the works to create some new unique brews since Belgian brewing legend Pierre Celis will soon be joining them. Tim says we should look forward to some Belgian-style fruit beers and an authentic Brussels Grand Cru.

Tim was flattered to get the request for details about the Brewhouse Brown. He reports that this is one of their mainstay beers and their second best seller. He describes it as a hybrid beer that combines the best attributes from both the American Brown and Brown Porter styles. The flavor profile is balanced in favor of malt with a good bittering hop support. He purposely brews this to be heavier on the roast malt finish. Plenty of crystal malt combined with a lower attenuating English ale yeast creates a higher finishing gravity.

For further information visit the brewery Website at www.realale.com or call them up at (830) 833-2543.

Real Ale Brewing Company Brewhouse Brown Ale

(5 gallons/ 19 L extract with grain)

OG = 1.055 FG = 1.014
IBU = 32 SRM = 23 ABV = 5.5 %

Ingredients

3.3 lbs. (1.5 kg) Muntons unhopped light malt extract
2.25 lb. (1 kg) light dried malt extract
1.25 lb. (0.56 kg) crystal malt (60 °L)
10 oz. (0.28 kg) Vienna malt
0.5 lb. (0.23 kg) chocolate malt
½ tsp. yeast nutrient (15 min.)
8.25 AAU English Target hop pellets (60 min.)
(0.75 oz./21 g of 11.0% alpha acid)
1.25 AAU Willamette hop pellets (10 min.) (.25 oz./7g of 5% alpha acid)
White Labs WLP 002 (English Ale) or Wyeast 1098 (British Ale) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 3 gallons (11.4 L) of water at 155 °F (68 °C) for 30 minutes. Remove grains from the wort, add the liquid extract and bring to a boil. Add the first additions of English Target hops and boil for 60 minutes.

During the boil, use this time to thoroughly sanitize a fermenter. Add the yeast nutrient after 45 minutes of boiling. Add the last addition of Willamette hops and boil for final 10 minutes of the boil. Now add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20 °C). Hold at that temperature until fermentation is complete. Transfer to a carboy, avoiding any splashing to prevent aerating the beer. Let the beer condition for one week and then bottle or keg. Allow to carbonate for 2 weeks and enjoy your brown ale!

All-grain option:

This is a single step infusion mash. Replace the malt syrup and DME with 8.5 lbs. (3.83 kg) 2-row pale malt and 1 lb. (0.45 kg) Munich malt. The other grains remain the same. Mix the crushed grain with 4 gallons (15.2 L) of 170 °F (77 °C) water to stabilize at 154 °F (68 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water.

Collect approximately 6 gallons (23 L) of wort runoff to boil for 60 minutes. Reduce the first addition (60 minute) of English Target hops to 6.6 AAU (0.6 oz./17 g) due to the higher utilization factor for a full wort boil. The remainder of this recipe is the same as the extract with grain recipe.

Steeping It Up

Adding specialty grains to the mix

by Garrett Heaney

Specialty malts allow brewers to work with malt extracts in order to create a base malt and, through a practice called steeping, introduce additional color and flavor elements. Many extract brewers use steeping to gain extra control over the color and flavor of their beer.

In all-grain brewing, you must mash your base malts to allow hot water to convert the starches of your grain into sugar. With specialty grains, there is no enzymatic conversion required; a brewer is able to leech sugars, flavors and color by steeping these grains. In this article, we will discuss steeping and the types of grain you can use it for.

Steeping is analogous to making a big cup of tea. Only in steeping, you are submerging specialty grains into a kettle of water in order to leech out color and flavor.

Specialty grains:

As mentioned above, there are two main classifications of grains: base grains and specialty grains. Base grains are all typically under 5 °L in color (with the exception of Munich malt that can be as dark as 20 °L) and require mashing. These grains are 2- and 6-row pale malts, Pilsner malts, wheat malts, Vienna malt, and Munich malt (as mentioned).

The grains that you use for steeping are specialty grains. These grains are much darker in color and include crystal malt (10–120 °L), Special B malt (180 °L), chocolate malt (300-350 °L), roasted barley (300-500 °L) and black malt (500 °L). Each of these malts can be steeped in order to leech their flavor and color into your wort.

Before you steep

The first thing to do before you begin steeping the grains is crush them. The grains need to be crushed in order to expose the sugar to the water that you will be adding to it. The second thing you need to consider is how you are going to add this crushed grain to your pot. To avoid the difficult task of removing crushed grains floating in hot water, use a grain bag when steeping. Grain bags are made of nylon or muslin, have a drawstring enclosure and typically hold about 2 lbs. (0.9 kg) of grain. These are similar to tea bags and will contain the grains, allowing you to easily remove them when steeping is complete.

Steep it up

Once your grains are crushed and bagged, it is time to get in hot water (literally!) You will need your brewing pot, in which you will heat an appropriate volume of water (no more than a gallon per pound of grain) to approximately 160 °F (~71 °C). However, you can steep as low as 150 °F (~66 °C) or as high as 170 °F (~77 °C), depending on how fine your grain is crushed, and how long you leave it in. Brewers should experiment to figure out what produces the results they seek.

When the water hits the right temperature, add the grain bag and swirl it around a bit to ensure that the grains inside are adequately soaked with water. The rest of the process is pretty simple — wait about 30 minutes, maintaining the temperature (i.e. 150–170 °F or 66–77 °C) and remove.

One thing to note when experimenting with durations and temperatures for steeping is that you don't want to steep too long or too hot. Steeping for too long (more than 30 minutes) and excessive heat (over 170 °F/77 °C) can lead to the extraction of astringent tannins (a.k.a. polyphenols) from the husks which add an unpleasant bitterness and dryness. While you will extract all the sugars and color you need, you'll be sacrificing the flavor of your final brew — which is a serious brewing foul!

photo courtesy of Briess

Specialty grains such as Crystal, Special B, Chocolate, Roasted Barley and Black malts are steeped rather than mashed.

Now that you know the the basics of steeping, go pick up some specialty grains, a grain bag and the extract-with-grains recipe you've been wanting to tackle. Cheers to you!

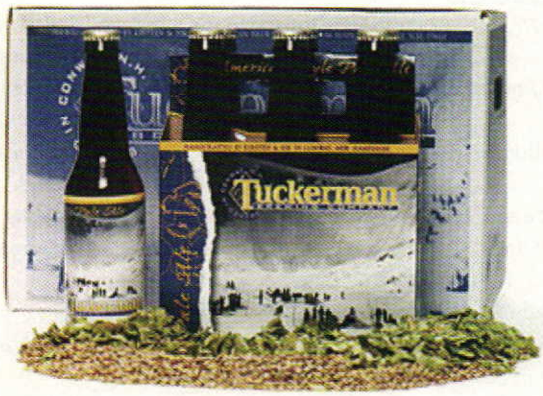
Garrett Heaney is Associate Editor of BYO *and writes "Beginners Block" and "Tips from the Pros" in each issue.*

Priming with Kräusen

Using fermenting wort to bottle condition

by Garrett Heaney

When it comes to brewing, there are several ways to achieve carbonation. Some brewers force carbonate, some add priming sugars, some add fresh wort (a.k.a. gyle) and some add young fermenting wort — also known as kräusen. Priming with kräusen is an effective way to bottle condition that not only produces carbonation, but also has some flavor advantages. Take it from two professionals who use this technique regularly.



Nik Stanciu is the Head Brewer and co-owner of Tuckerman Brewing Company in Conway, New Hampshire. All Tuckerman brands are bottle conditioned and many use kräusen.

Firstly, priming with kräusen is a method of natural carbonation. Secondly, it works extremely well. Most large breweries including craft/micro breweries "naturally" carbonate their beer to perhaps 90% of their final target carbonation. The last 10% is performed by forcing CO_2 into the final product via carbonation stones, etc. The advantage of this forced method is that the brewers should, in theory, get exact carbonation results. In practice, though, we have observed substantial carbonation variation from different breweries, even some very large breweries, that use this method.

Bottle conditioning, where the beer is primed with kräusen in the final package, i.e. bottle or keg, is less exact by nature. In fact, we have observed that in 8–10 days 95% of the fermentable sugars in the final beer will ferment out — however, over the next 60 days, the carbonation tends to creep upwards. This is predictable enough for us that we can actually tell how old our beer is by measuring the carbonation. Priming with kräusen in the final package has two very distinct advantages. First, bottle conditioning adds flavors to the final product that you just cannot get any other way. Second, adding kräusen to the final package is literally a "conditioning" process. When yeast digests wort to make beer, several intermediate metabolites are produced besides ethanol and CO_2.

Two prominent, generally considered unwanted, metabolites are acetaldehyde and diacetyl. To remove these unwanted flavors some brewers tend to age, condition, lager or secondary-ferment their beer.

This is why we call priming with kräusen a conditioning process. The idea is that kräusen contains very healthy and active yeast, which when added to well attenuated beer helps to push the intermediate metabolites to their final state, which is ethanol.

Breweries that produce lager often "lager" or age their beer in horizontal style tanks. Fresh kräusen is often added to help condition the beer, specifically to help remove diacetyl, which lager yeast tends to produce more of than ale yeasts. There is no reason not to use the same method with ales, though.

As far as flavors, if you taste fresh wort versus finished beer, wort has much stronger hop flavors both bitter and aromatic. During fermentation, iso-alpha acids from hops tend to adhere to the cell walls of yeast and thus as the biomass of yeast increases during fermentation, the overall bitterness of the wort-beer decreases. Aromatic components from the hops, are scrubbed from the fermenter by the evolution of CO_2. By adding fresh fermenting hopped wort to the final beer and then packaging it, these more intense hop flavors are captured in the finished product.

The method of bottle conditioning complicates the entire brewery process, because you need to have fresh fermenting wort when bottling, and you can't have fresh fermenting wort from a stout to use in conjunction with packaging a pale ale. For homebrewers, I would suggest hydrating, hopping and boiling some dried malt extract. Then, while it is still hot, pour it into clean 12-oz. (355-mL) bottles leaving no headspace, then cap it.

At this point, you should be able to refrigerate the bottles. Then, when you want to bottle condition a batch, open a bottle (room temperature), add some yeast, add an air lock and let the yeast get going. When it looks like it is fermenting well, add it to your finished beer and package it. It will obviously take some trial and error to figure out how much to add and how far to let the wort ferment.

We let the sugar in the wort drop about 20–25% of its full attenuation before bottle conditioning and add around 5% by volume to the finished filtered beer. Most homebrewers don't filter, so you might get away with adding the hopped wort from the 12-oz bottles directly to your finished beer, since it already has yeast in it. This should work, although you might have to wait longer before the beer is fully bottle conditioned, since the yeast is not at high kräusen.

Alan Sprints is the Head Brewer and owner of Hair of the Dog Brewery in Portland, Oregon.

I first discovered Belgian and British Ales that were primed with kräusen. These beers matured as they aged and got better as the years went by. Today in America, craft brewers are using bottle conditioning to help create unique beers, that will also improve with age. I think that sugar works fine until the beer gets above 7% ABV. Above that point, the yeast left over from fermentation will have a hard time refermenting in the bottle. This is when kräusening, or using newly fermenting wort, will benefit your beer. It will also produce a thicker, richer foam.

In the book "Vienna, Märzen, Octoberfest," by Dr. George Fix (Brewers Publications, 1991), you will find a great formula to figure the amount of fermenting beer to add. The formula reads:

$$\frac{V_P}{V_B} = \frac{SG_B}{SG_P} \times \frac{C_V}{2.44 \times SG_B \times G_P \times F - C_V}$$

In this formula, the following factors are represented as follows:

- V_P = volume of priming solution to be added
- V_B = volume of beer to be primed
- SG_B = specific gravity of beer to be primed
- SG_P = specific gravity of priming solution
- F = fractional fermentability of priming solution
- C_V = CO_2 level in volumes

So, as you will see, you need to use your hydrometer to measure both your youngly fermenting beer ("priming solution" in the formula above) and the beer to be primed. You will need to know how fermentable your young fermenting beer is (again "priming solution") — e.g. 60% fermentable or 0.60 as a fractional. And finally, you'll need to know the CO_2 volume you are shooting for in your final beer (typically between 2 and 3 volumes).

I brew two days before I bottle, and use that fermenting beer (a.k.a. kräusen) to prime when I start bottling. Using the formula in George's book, I add the right amount of priming beer into my finished beer then bottle as usual. Although this process is involved, I think the results are worth it, especially for strong beers, ales and lagers.

Garrett Heaney is Associate Editor of Brew Your Own *magazine.*

Home Yeast Propagation

"Help Me, Mr. Wizard"

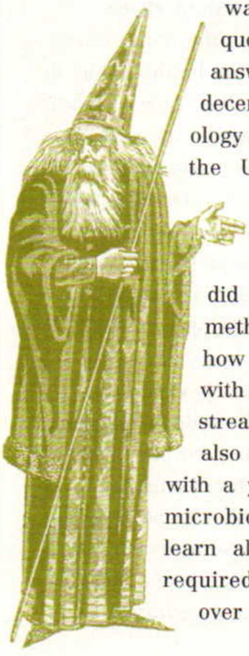
Twist off caps and a problematic Pilsner

by Ashton Lewis

Can't wait to propagate

I've been smacking a liquid yeast pack to activate it and preparing wort to pour into the bottles. When the yeast is ready I've been setting aside one bottle of wort with a small amount of the yeast in it for starting my next batch, while dividing the yeast between the other bottles. After I let the yeast grow a while, I put all the bottles except the one I intend to use immediately into the fridge. After a day or two I pour the starter into my wort. Then for my next batch I have a starter almost ready. This way I've been able to get about six or so starters from one package of yeast. Eventually, I want to learn how to use petri dishes and slants to store yeast to propagate. However, the articles I've read on the procedures leave a lot of details out. Can you recommend where I can find step-by-step procedures that are useful for homebrewers without laboratory equipment and training?

Rich Servatius
via email



This simple question — "Where can I find step-by-step instructions on growing yeast?" — strikes me as interesting because the answer is far from simple. I will offer some practical ideas but first want to address this question with no clear answer. I have taken a decent number of microbiology classes and labs at the University of Maryland, Virginia Tech and UC Davis. In none of these classes did I ever see a written method describing in full how to get from A to Z with something as basic as streaking a petri dish — also known as plating — with a yeast slurry. A good microbiology student will learn all of the techniques required for yeast plating over several years of lab classes, but not all in one class and not all from one professor or technician. Dr. Chris White of White Labs Yeast wrote such a step-by-step article in the March 2001 issue of *BYO* called "Culture in Your Kitchen," which walks you through the full process of plating, stirring and growing yeast at home.

The first step is to select the type of medium you want to use. A good all-purpose growth medium, such as a universal beer agar or UBA, works well for growing yeast and anything else that may be in the inoculum. However, if you suspect the yeast culture that you will be plating may not be pure or may be contaminated, then medium selection is the way to sort through your unknown culture.

Step two is to buy or round up the other basic tools you will need. This includes media, petri dishes, inoculating loop, alcohol flame, media bottles, a decent scale, a small pot robbed from the kitchen, a funnel from the same place and a pressure cooker. Petri dishes, media and media bottles must be purchased from a lab supply company or homebrew supply house that carries more advanced equipment.

Step three is mixing your dry medium powder with water and slowly bringing it to a simmer in a small pot (from the kitchen). This might make the wife mad but all-purpose media don't contain toxic compounds. Differential media contain things you do not want floating around the kitchen. A common medium used in brewing labs to suppress the growth of brewing yeast contains cyclohexamide and this compound is a teratogen, meaning that it may cause birth defects. Don't use this stuff at home! Once the liquid medium is mixed up, it's time to transfer to the media bottles using the funnel and sterilize in the pressure cooker.

After pressure cooking (I suggest 20 minutes at 15 pounds of pressure) the pressure cooker should be slowly cooled and unloaded after the pressure has fallen. The medium must be poured when it is hot and then allowed to cool and solidify in the dish. This takes some skill because if you pour the plates too hot then the lids are filled with condensate, but if you wait too long and pour the plates when the medium is beginning to solidify you get lumpy plates. The other important thing here is to pour the plates in a clean environment where you can cool the plates with the lids half way on to prevent lid fogging. If the environment is not clean then you get moldy plates. This whole headache can be skipped if you purchase pre-poured plates. But then your selection of medium is somewhat limited. Not a big deal if you just want to grow yeast.

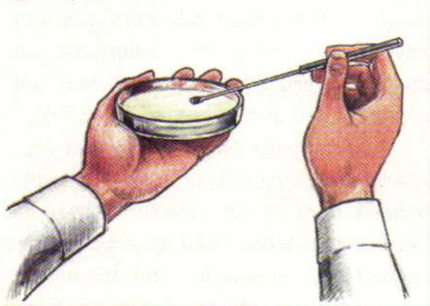


illustration by Don Martin

Streaking the plate is a step in the process of propagating yeast.

Step five is streaking the plate . . . and no, I don't mean crossing home plate nude! Streaking begins with flaming the inoculum loop with an alcohol or natural gas flame until it is red hot, dipping in the yeast slurry or beer sample and then transferring this to the plate.

A common technique used in labs is called streaking for isolation and this involves flaming the loop, cooling on a portion of the plate and streaking across the area streaked with the original sample. Doing this multiple times in a certain manner dilutes the sample and if done properly will result in isolated colonies of yeast or bacteria, depending on what you are growing.

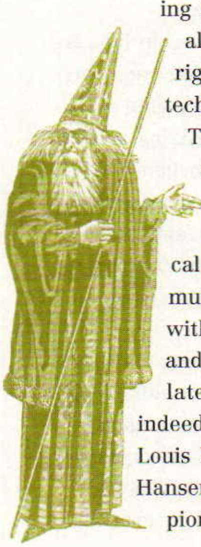
The final step is incubating the sample. Plates are usually sealed with a wax or plastic film to prevent contamination during the incubation step. Plates typically take one to two weeks to "develop" depending on what you are growing.

Yeast grows faster than bacteria and yeast plates usually show good growth within one week.

This process gets you to the point where you can now store your plate in a refrigerator for several months. You can routinely grab a single yeast colony and transfer using a flamed loop to a small flask of wort — 25 mL is a good starting volume. Then propagate this colony up to about 2 quarts (~ 2 L) if you are pitching into a 5-gallon (19-L) batch of wort.

It is critical during this entire process that you use good lab techniques to prevent contaminating the culture. This is where proper lab methods are required and nothing beats lab classes where an experienced instructor can demonstrate the methods. Explaining the intricacies of lab technique in a book is not a very good substitute for real life instruction in my opinion. Furthermore, if you are serious about checking your lab work you will have to do more plating using different media to verify that the yeast was not contaminated during this whole process.

I do not work for or in any way represent any yeast supply company so my opinion here is not biased. What I do know is that when you buy yeast from a reputable yeast supplier you are buying yeast that has been maintained by a staff of experienced professionals who, as a routine part of their method, run checks to verify that the cultures they sell are pure. The same companies who sell yeast to homebrewers sell yeast to commercial breweries. This is because yeast culturing and propagation is not easy and is an activity completely separate from brewing beer. You can certainly do all of this at home and to do it right requires proper tools, techniques and quality checks.



The downside to going to all of this trouble is that you may end up selecting a yeast colony that is atypical of the strain, for example a mutant, and/or you may end up with a contaminated starter and never know until it is too late. The end result could indeed be bad beer. The fact that Louis Pasteur and Emil Christian Hansen continue to be viewed as pioneers in brewing microbiology 125 years after their research related to beer spoilage and beer yeast culture, respectively, is testament to just how critical the microbiology lab is to all successful commercial breweries.

What I suggest is to buy yeast from a yeast lab, propagate before use in 1–2 quarts (~1–2 L) of wort to ensure a good pitching rate and harvest the yeast and re-use after fermentation is complete. If you brew fairly often you will always have a source of fresh yeast. Yeast slurry can be harvested and stored for 1–2 weeks before re-use and your $6.50 yeast investment can be spread over several batches. Each time that you use yeast is called a "generation" and the first use from the lab is referred to as "first generation yeast." When you crop the yeast from the first brew and re-use it in a second batch, it then becomes second generation yeast (the semantics here are important to clarify since yeast typically increases by about four-fold during one batch and the generation count would be very different if defined by a different rule).

Most lager breweries discard their yeast after no more than 10 generations and replace this with fresh yeast propagated from the lab. Ale breweries are much more varied in their yeast management where some have yeast management programs akin to lager breweries and others re-pitch their yeast with very infrequent replacement. Whatever path you decide to take with yeast, I wish you the best and hope your beers are always clean and tasty!

It's a twister!

I would like some helpful info on using twist-off bottles for homebrew. Have you ever tried or know anyone that has used twist-offs with success? I have searched the Web and all the homebrew shops tell you not to use them because the rim of the bottles are too thin, they break, you cannot get a good seal and carbonating in the bottle builds up too much pressure on a twist-off. However, some homebrewers on various posts on the Web say they have used them without any problems by using twist-off style caps and a bench top capper (and I did find a few shops that sell these caps). It seems it is getting harder to find the old style 16-oz bottles and most beer comes in the newer 12-oz twist-off style bottles anyway. I would hate to find out that you couldn't use them at the expense of a batch of my finest ale. I like to drink commercial beer, I did before I was a homebrewer and I will continue this ritual — if I could only use the twist-off bottles that hold a lot of it, I would be a happy brewer. I guess my question is if the big boys of brewing and even a lot of microbreweries use them, why not us homebrewers? Can you break it down for me, give me the pros and cons? What's the scoop?

David Vanlandingham
West Terre Haute, Indiana

After a grueling yeast answer, this one is a Nerf ball that I hope to smash out of the park! For starters, when it comes to bottle conditioned beers, there is very little difference between methods used at home and those used by commercial brewers. If a brewery like Sierra Nevada can add yeast and sugar to beer and package it in a bottle with a twist-off cap, then it follows that the same practice can be used at home. There are no ifs, ands or buts about it!

The key here is recognizing a few things about bottles, caps and cappers. There are two types of bottles sold for use by brewers: one-way and returnable. One-way bottles are intended for only one use and are lighter in weight than returnable glass. In this country, returnable glass, mainly in the form of long neck bottles, has all but vanished. The reason for this primarily relates to the logistics.

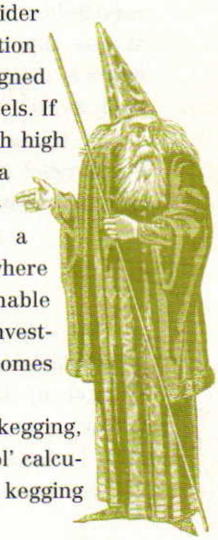
If a bottle that has the name of the brewery molded into the bottle or has a special shape, like the now extinct Michelob hour-glass bottle, the end user must somehow get this bottle back to the brewery who wishes to re-use the package. The most common re-used package in the United States is marketed to bars that can reclaim empties. The distributor then picks them up and returns them to the brewery. The brewery then has to verify the glass is what they expect (getting another brewery's bottle is obviously going to occur) removes the label, washes the bottle, inspects for cracks and then refills those bottles that can be re-used. These bottles show wear over time and can get down right ugly. Since a big part of good packaging is appearance, ugly bottles are not the best thing from an image point of view and the pressed shirts in marketing probably view this package in a negative light.

In Germany there is a standardized half-liter bottle that many breweries use and the logistics of having to get your package back to the brewery is eliminated. This makes recycling more convenient but prevents custom packages that help sell beer. In recent years even the environmentally proactive Germans have begun using more one-way bottles and recyclable cans.

The long and short of returnable glass is that these bottles are becoming more difficult to come by as the popularity of one-way glass continues to increase. The most important thing to recognize about re-using glass is that bottles fatigue after each use and they have a limited life. One-way bottles are designed for one use and are much lighter than their returnable cousins. This means that the first thing you need to find is a source of one-way bottles with a twist-off neck. I recommend finding a local brewery using this type of glass and asking if you can buy bottles from them. The price of new glass including the box and six-pack carriers is surprisingly expensive. We pay about $5.50 per case for our glass. This includes the case box, 6-pack carriers and delivery to the brewery. You can knock off about $2.00 per case if you can get bulk glass.

When you go to put a cap on a twist-off bottle you can use a standard style crown and do not need to worry about finding special twist-off crowns. I have heard this rumor before and know that any standard crown will work. Commercial brewers do like to have the words "Twist Off" accompanied by an area on twist-off bottles to let the consumer know that twisting will indeed remove the cap and permit consumption!

What you do need is a capper that does not grab the neck of the bottle when used. Most hand-held cappers grab the small ring around the perimeter of the neck and use that ring to hold the crowner tight to the bottle. In my experience I have found that this ring on the one-way, twist-off bottles we use breaks when capped with a hand-held capper. The ring on the bottle is simply too thin and too weak for use with hand cappers (at least the one I have). Bench top cappers do not grab onto this ring and are the preferred type of capper to put crowns on twist-off bottles.



The last thing to consider about bottles is carbonation level. One-way glass is designed for normal carbonation levels. If you want to do a beer with high carbonation, such as a Belgian-style or hefeweizen, you should use a stronger bottle. This is where your collection of returnable half-liter bottles or an investment in flip-top bottles comes in handy.

You didn't ask about kegging, but a few punches on the ol' calculator reveals that a simple kegging set-up will pay for itself pretty darn quickly when compared to the price!

Pilsner problems

I just tried my first all-grain brewed pale Pilsner malt beer. Bottled about 12 days ago, it had a very "unripe" somewhat sour taste to it. Kind of a "green" peach or something. Will this subside? Does it just need more time to age? I used 3–4 ounces (84–112 g) of Saaz hops at three different stages and a fresh hops flavor is present. The beer itself tastes fresh as well . . . but a little too fresh — like it needs to age and mellow out. Please help! Will time fix this? If so, will it take two weeks . . . six months?

Dave Morrow
via email

One thought comes to mind and that is acetaldehyde. Almost all homebrewers know about diacetyl and are often taught to dislike diacetyl with vigor. I am one of those brewers who really detests diacetyl in most beers. Oddly enough, I like a big buttery red wine or an oaky chardonnay with detectable diacetyl coming from malolactic fermentation. Acetaldehyde and diacetyl are two flavor compounds frequently associated with insufficient aging time and both flavors are easily reduced if a rest period is allowed between fermentation and cooling. (Diacetyl is also associated with bacterial contamination and time will not cure that problem!)

Acetaldehyde is a metabolic intermediate and is leaked from the yeast cell during fermentation. After vigorous fermentation is complete, yeast cells will absorb acetaldehyde and reduce this "green" aroma compound to ethanol. Most commercial lager brewers monitor the level of diacetyl, diacetyl precursor (alpha acetolactate) and acetaldehyde before cooling beer and moving forward in the process. When beer is prematurely separated from yeast and crash cooled (which effectively halts yeast activity) the likelihood of having a beer smelling of apples and butter increases.

If there is sufficient yeast in your bottled Pils the problem may subside. I would suggest taking a few bottles of your green beer, gently rolling them around to re-suspend the yeast and storing them warm for a week or two. If the flavor intensity does not drop in this timeframe you are probably stuck with it. In the future, especially when fermenting lagers, make sure you hold the beer at fermentation temperature for at least four days prior to cooling.

BYO Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard for the last 11 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!

Bohemian Dunkel

That dark Czech lager

by Horst Dornbusch

The year was 1295 when good King Wenceslas II of Bohemia convinced Pope Boniface VIII in distant Rome to revoke a papal ban on secular beer brewing in Wenceslas' kingdom. With this reversal of papal policy, the king wasted no time granting 260 burgher families in Pilsen the right to make their own beer — a

progressive homebrewing act that was to have momentous consequences for the evolution of beer throughout the world.

The citizens of Pilsen, as history is witness, have definitely been putting their privilege to excellent use ever since. By 1307, they had their first commercial brewery in operation. Soon they formed their own brewers guild, as did many other European brew cities. Under feudalism, such guilds were essential for the blossoming of the secular brewing trade, because burgher-brewers had to compete commercially on an uneven footing against the many monastery breweries, which were exempt from all feudal taxes and could rely on the free labor of their brethren in the brew house. In gratitude to their benefactor, Czech brewers named King Wenceslas II their patron saint.

Wenceslas had started a trend in his medieval realm that still reverberates today. "*Kde se pivo vari, tam se dobre dari*" goes an old Czech saying ("where beer is brewed, the people do well") — a motto to which Wenceslas' descendants obviously still subscribe with unfailing dedication, because the Czechs have become the world's most stalwart beer drinkers, downing more than 36 U.S. gallons (137 L) of beer per capita per year — almost double the amount of the average American. Wenceslas clearly would be proud of his subjects.

The brew, however, for which King Wenceslas fought and won in his struggle with the Holy See, was a far cry from what most modern beer lovers now have in mind when they think of Czech beers. While the wonderfully aromatic deep-golden lager from Pilsen, the Pilsner, first created in 1842, is now considered the epitome of Czech brewing and the symbol of that nation's beer identity, the standard medieval Czech brew was decidedly dark, not blond, and it probably was not even a lager. Though replaced in popularity by the blond Pilsner in the 19th Century, the original dark Czech brew did not die out entirely, just as, around the same time, the Dunkel in neighboring Bavaria held its own, albeit in much reduced circumstances, against the Munich Helles. Today, the Bohemian dark lager is often

BOHEMIAN DUNKEL by the numbers

OG	1.046–1.050 (11.5–12.5 °P)
FG	1.012–1.014 (3–3.5 °P)
SRM	25–35
IBU	15–25
ABV	4.6–5.2%

RECIPE

King Wenceslas Dunkel

(5 gallons/19 L, all-grain)
OG = 1.048 FG = 1.012
IBU = 21 SRM = 32 ABV = 4.7%

Ingredients

- 4.2 lbs. (1.9 kg) Weyermann Bohemian Pilsner Malt (1.5–2.5 °L)
- 5.2 lbs (2.4 kg) Weyermann Munich Malt Type II (9–11°L)
- 14 oz. (0.40 kg) Weyermann Caramunich® Type II (110–130°L)
- 0.1 lbs (0.05 kg) Weyermann Carafa® Special Type I (300–340°L)
- 4.1 AAU Czech Saaz hops (bittering) (1.0 oz./28 g of 4% alpha acid)
- 1 oz. Czech Saaz hops (flavor/aroma)
- 1 package of Wyeast 2278 (Czech Pils), White Labs WLP800 (Pils), or White Labs WLP802 (Czech Budejovice Lager); or 0.7 oz. (20 g) dried Fermentis Saflager W-34/70
- 1 cup light dried malt extract (for priming)

Step by Step

Dough in at about 122 °F (50 °C) and let the mash rest for 30 minutes. Then infuse the mash with near-boiling water, while stirring to avoid hot spots. Infuse until the mash reaches a temperature of about 144 °F (62 °C). Give the mash a 20-minute rest. Repeat the infusion to raise the mash temperature to about 162 °F (72 °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

recipe continued on page 20

recipe continued from page 19

1.044 (11 °P). Boil for 60 minutes. Evaporation losses should raise the density of the wort to the target original gravity of 1.048 (12°P). Add the bittering hops about 20 minutes and the flavor/aroma hops about 40 minutes into the boil.

After shut-down, check the kettle gravity and liquor the wort down if necessary. Let the wort rest about 30 minutes so the trub can settle. Then heat-exchange it to the preferred fermentation temperature of around 53 °F (12 °C). Next, aerate the cool wort and pitch the yeast. Allow about a week for primary fermentation. Rack the brew when the gravity has dropped to about 1.018 (4.5 °P). Then reduce the temperature to 41 °F (5 °C) and let the brew lager for three or four weeks. After a final racking, pressurize it in a Cornelius keg for about two days or add the conditioning agent and bottle it. Store bottles cool for about a week to let the priming agent carbonate the brew. Serve your finished Bohemian Dunkel at about 45 to 50 °F (7 to 10 °C).

King Wenceslas Dunkel

(5 gallons/19 L, extract-plus-grain)
OG = 1.048 FG = 1.012
IBU = 21 SRM = 32 ABV = 4.7%

Ingredients

4.0 lbs. (1.8 kg) Weyermann Bavarian Pilsner liquid malt extract
4.0 lbs (1.8 kg) Weyermann Munich Malt Type II (9–11°L)
14 oz. (0.40 kg) Weyermann Caramunich® Type II (110–130°L)
0.1 lbs (0.05 kg) Weyermann Carafa® Special Type I (300–340°L)
4.1 AAU Czech Saaz hops (bittering) (1.0 oz./28 g of 4% alpha acid)
1 oz. Czech Saaz hops (flavor/aroma)
1 package of Wyeast 2278 (Czech Pils), White Labs WLP800 (Pils), or White Labs WLP802 (Czech Budejovice Lager); or 0.7 oz. (20 g) dried Fermentis Saflager W-34/70
1 cup light dried malt extract (for priming)

Step by Step

Crack or coarsely mill the 5.0 lbs (2.3 kg) of specialty grains and divide them into three steeping bags. In your brew kettle, heat about 2 gallons (7.6 L) of water to about 180 °F (82 °C). Steep the grains in the liquid for about an hour. Lift, rinse each with 2 cups of cold water, and discard. Add another 2 gallons (7.6 L) of water and bring the liquid to a boil. Shut off and stir in the malt extract. Bring back to a boil. During the 60-minute boil, add the two hops additions as described in the all-grain instructions. At the end of the boil, check and adjust the gravity. Then follow the remaining steps from the all-grain recipe.

King Wenceslas Dunkel

(5 gallons/19 L, extract only)
OG = 1.048 FG = 1.012
IBU = 21 SRM = 32 ABV = 4.7%

Ingredients

2.2 lb (1.0 kg) Weyermann Bavarian Pilsner liquid malt extract
5.0 lb (2.3 kg) Weyermann Bavarian Dunkel liquid malt extract
4.1 AAU Czech Saaz hops (bittering) (1.0 oz./28 g of 4% alpha acid)
1 oz. Czech Saaz hops (flavor/aroma)
1 package of Wyeast 2278 (Czech Pils), White Labs WLP800 (Pils), or White Labs WLP802 (Czech Budejovice Lager); or 0.7 oz. (20 g) dried Fermentis Saflager W-34/70
1 cup light dried malt extract (for priming)

Step by Step

Bring about 4 gallons (15 L) of water to a boil. Shut off and stir in the two malt extracts. Bring back to a boil. During the 60-minute boil, add the two hops additions as described in the all-grain instructions. At the end of the boil, check and adjust the gravity. Then follow the remaining steps from the all-grain recipe.

referred to internationally as Bohemian Dunkel or by its German name of Böhmisch Dunkel. Now, always a lager, the Bohemian Dunkel is a rich, dark brew made, like its blond Pilsner cousin, with plenty of very malty base malt as well as aromatic Saaz hops. The brew's slight residual sweetness is offset by some roastiness from a good addition of chocolate-flavored caramel malt.

The Bohemian Dunkel reveals a more pronounced hop character and roastiness than does the Bavarian Dunkel. It is more reminiscent, in its overall character, of a Schwarzbier. The more robust interpretations might even remind one of a porter. Perhaps the most readily available modern commercial offering of the traditional Czech dark lager in the New World is the Staropramen Cerny by Pivovary Staropramen of Prague (now a subsidiary of Belgian brewing giant InBev).

Bohemian Dunkel malts

The authentic Bohemian Dunkel relies on barley grown exclusively in the Moravian region of the Czech Republic. This area has been known for producing some of the maltiest malts in the world. Traditionally, Moravian malt is flavorful, with a clean, slightly sweet finish. In the old days, Moravian malt tended to be high in unmodified proteins and thus required extensive decoction.

Today, however, the maltster already takes care of most of the protein conversion, thus making the job of the brewer much easier. Modern pale Moravian malts nowadays have a "standard" protein value of 9.5–11% and a color value of roughly 1.5 to 2.5 °L. Because they are high in enzymatic strength, saccharification in the mash rarely takes longer than 10–20 minutes. Moravian malt is very brewer-friendly in an efficient brew house, where it can reach an extract potential of slightly above 80%. If you start out with top-quality malt for your Bohemian Dunkel, therefore, a multi-step infusion with a protease, beta-glucanase and hydration rest of 30 minutes at 122 °F (50 °C), a beta-amylase rest of 20 minutes at 144 °F (62 °C) and an alpha-amylase rest of 20 minutes at 162 °F (72 °C), as well as a mash-out temperature of 172 °F (78 °C) is perfectly sufficient to produce a rich and satisfying brew.

Even if you do not have the time, means or inclination to ramp up your mash from a cool dough-in to a hot mash-out, a single-step infusion at the conventional diastatic conversion temperature of 152 °F (67 °C) will still lead to a more than acceptable result.

Moravian malt is now grown not just in its land of origin, but also abroad, including in Germany and the United States. In recent years, several malting companies have added pale base malts from Moravian barley strains to their portfolio. These are all of the pale variety, because they are intended primarily for blond Czech lagers. The most recent of these is the Briess Anniversary Malt — introduced in 2006 and named for the Briess Company's 130^{th} anniversary this year. It is made from domestically grown two-row Moravian-type barley. Weyermann of Bamberg, Germany, too, has been offering a Bohemian Pilsner malt since 2004. Theirs is made entirely from a Moravian-grown summer barley variety called Hanka, which happens to be a distant genetic derivative of the Hanna variety that was used in the first batch of Plzensky Prazdroj (Pilsner Urquell), in 1842.

In a typical Bohemian blond lager, the amount of Pils malt in the grain bill is rarely less than 90% and may be as high as 100%. The non-Pils malt portion, if any, is often made up of pale caramel malt for body and acidified malt for a reduced mash pH. In Bavaria, even the darker lagers tend to have a relatively high portion of pale Pils base malt in their grain bill, perhaps as much as 70%. These Bavarian brews impress with their soft, but pronounced, caramel notes that gently envelope the brew's smooth, malty body.

The Dunkels from the Czech Republic, by contrast, come across as more robust and slightly earthy, because they are made from a grist bill with a much smaller proportion of Pils base malt. In fact, in our recipe for Wenceslas Dunkel (see page 20), there is even less pale base malt than Munich malt!

Czech hops, water and yeast

Because Czech water is naturally soft (and thus ensures a low mash pH value), it — together with the slightly acidic character of the dark grains — mellows the brew and ameliorates perceived hop bitterness. The desired mash pH should be around 5.2 to 5.5. Should your mash lack acidity because your local water is too hard, consider replacing up to 5% of the grain bill with acidified malt, and reduce the pale Pils malt portion of the grain bill accordingly.

The Bohemian Dunkel, like its Bavarian counterpart, shows an even balance of maltiness and aroma in the finish, only on a much higher level. The balance is still there, but both the malt and the hop character of this Bohemian brew seems bigger to the pallet, while the Bavarian brew shows more restraint in both hops and malt. While the Czech brew relies more on strong aroma hops reverberations, the Bavarian brew relies more on typically German, floral, often citrus and sometimes slightly grassy hop notes. An authentic dark Bohemian lager, therefore, like virtually all Czech lagers, fares best when hopped entirely with Saaz from Zatec, the Bohemian hop-growing center. Zatec is known for producing some of the world's most aromatic hops. These give a brew an almost perfumey note, which is especially noticeable in the long-lingering finish. Saaz tends to have alpha-acid ratings between 3.5 and 4.5%, depending on the growing year and age of the hops. If your supplier does not carry imported Saaz, transplanted Saaz grown in the Pacific Northwest is a serviceable substitute.

For yeast, you can use a dry Fermentis Saflager W-34/70 (about 0.7 oz. or 20 g per 5 gallons/19 L). There are also Czech specialists available, such as Wyeast 2278 Czech Pils, White Labs WLP800 Pils, or White Labs WLP802 Czech Budejovice Lager. These Czech yeasts produce just a slight touch of buttery diacetyl that adds a bit more complexity to the brew. All of these Czech yeasts are very happy at a primary fermentation temperature of around 53 °F (12 °C). To mature a Bohemian Dunkel, lager it after primary fermentation for three or four weeks at 41 °F (5 °C). The optimum serving temparature of the finished beer is between 45–50 °F (7–10 °C).

Extract tips

Extract-plus-grain brewers can substitute the entire grain bill of approximately 10 lbs. (4.5 kg) — calculated for a system with a nominal extract efficiency of 65% — with approximately 4.0 lbs (1.8 kg) unhopped pale Pilsner-style liquid malt extract and then rely on the steeped grains for color and flavor.

Unfortunately, it is next to impossible to find a genuine Moravian barley-based unhopped liquid malt extract, either in light or dark. In this less than perfect situation, therefore, your best compromise is a malt extract such as Weyermann Bavarian Pilsner liquid malt extract. It produces a brew of 6.2 to 7.3 SRM if used just by itself. The 5.0 lbs. (2.3 kg) of steeped specialty grains supply the required color, extra flavor and a small amount of fermentables.

For all-extract brewers, too, the best solution is a combination of pale liquid malt extracts. To approximate the color and flavor of our authentic all-grain Bohemian Dunkel, use a 7.0-pound (3.2-kg) mix of Bavarian Pilsner and Bavarian Dunkel liquid malt extract, at a ratio of approximately 3:7.

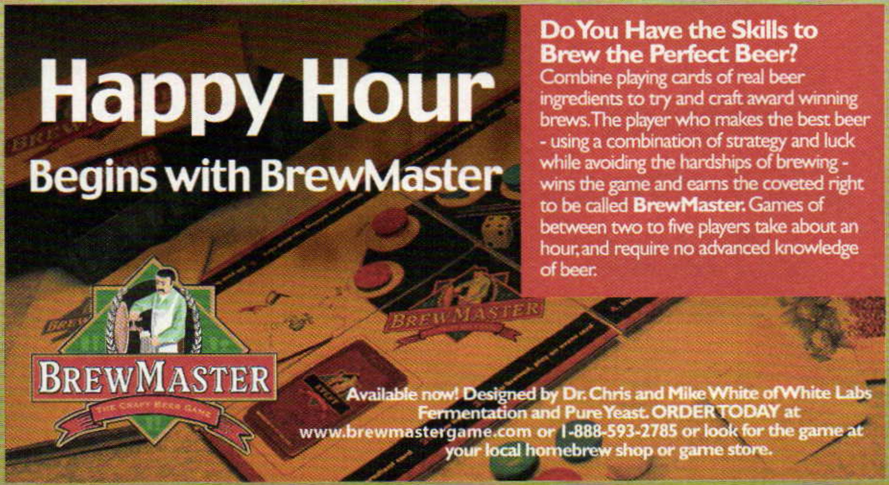
The Dunkel liquid malt extract is very suitable for the Bohemian purpose, because this malt is produced entirely from a double-decoction mash of a grain bill that resembles our all-grain Bohemian Dunkel mash. On its own, this extract makes a deep-amber to dark brown brew of roughly 24 to 29 SRM. Though the foundation malts in these partial and whole extract recipes are "merely" Bavarian, not Czech, our Wenceslas extract brews are not without proper Czech elements. These are furnished by Czech Saaz hops and Czech specialist yeasts.

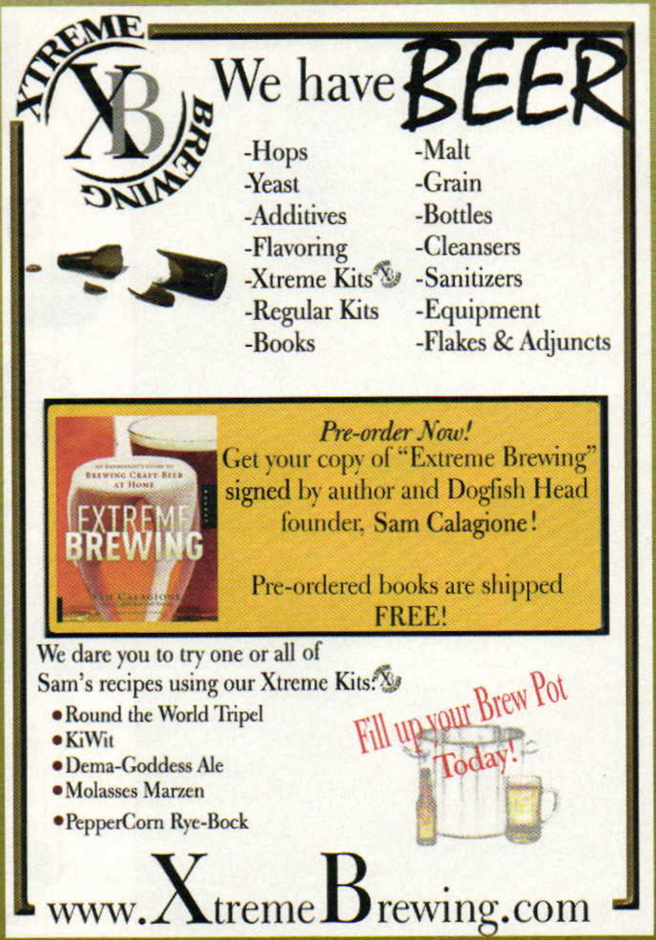
Horst Dornbusch is the author of several books on German beer and writes "Style Profile" in each issue of BYO.

holiday GIFT GUIDE

THIS HOLIDAY SEASON GIVE THE GIFT OF BEER!

Check out these businesses for some great gift ideas for friends & family or your own holiday wishlist...






BEERCOLLECTIONS.COM
Seasons Greetings
The Best Source for Beer Related Gifts and Collectibles
Glassware
Coasters
Crowns
Labels
Bottle Openers
Hats
Tap Handles
Tacker Signs
Neon Signs
& More !!
Great Christmas Gifts!


Brew YOUR OWN
GREAT Gifts For You Or Your Brewing Buddies
Shirts, Sweats, Hats & Lots More!
Go to
www.cafepress.com/brewyourown
and order your Brew Gear today!
www.cafepress.com/brewyourown
SHOW THE WORLD YOU'RE A HOMEBREWER!

BYO BINDERS!

- Gold-stamped logo on front and spine
- Opens flat for easy use
- Leather-grained in royal blue
- Each binder holds 10 issues

ORGANIZE!

Only $15 each (includes shipping)

Vermont residents add 6% sales tax Canadian residents add $1 per binder

YES! I want BYO custom-made binders!

Quantity	Amount	Total
______ x	$15 =	______

❑ Check enclosed ❑ Visa ❑ MC

Name ______________________

Address ______________________

City ______________ State ______ Zip ______

Credit Card # ______________________

Signature ______________ Exp. Date ______

Send your order to:
Brew Your Own
5053 Main Street, Suite A • Manchester Center, VT 05255
or order online at www.brewyourownstore.com
or call (802) 362-3981 • *or* fax (802) 362-2377

brew-4-less.com

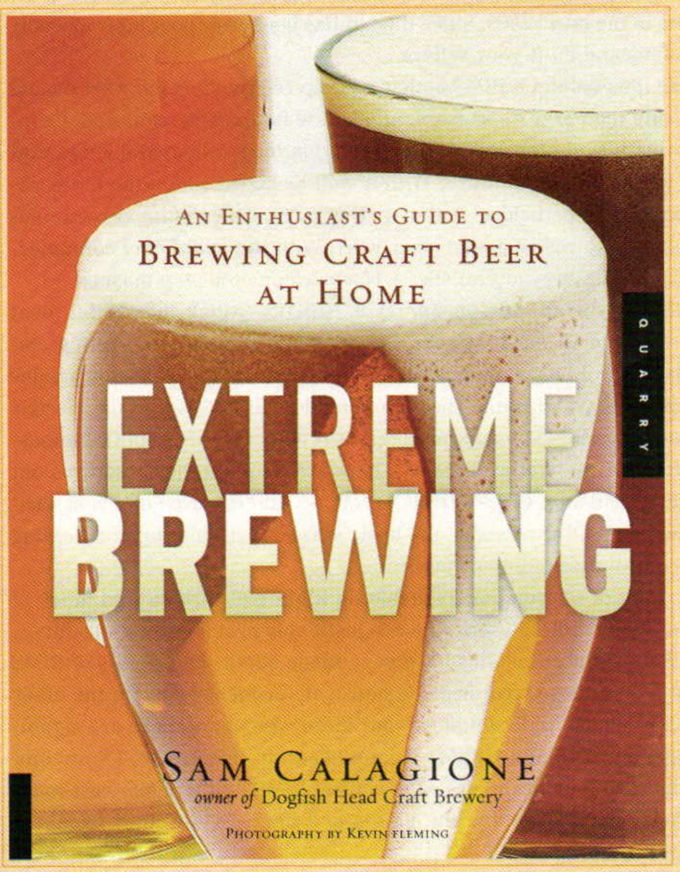
STAINLESS STEEL KETTLES
JUST $99.00
NO MIDDLE-MAN HERE ! !

9 GALLON # 304 STAINLESS STEEL KETTLE WITH LID, HANDLES, BRASS BALL VALVE AND STAINLESS BREWERS TEMPERATURE GAUGE.

WE SHIP FROM WAREHOUSE TO HOMEBREWER.

Visit our website and link directly to eBay
We accept paypal and all major credit cards

WEB: www.brew-4-less.com
EMAIL: brew4lessnow@aol.com



THE NEW BOOK FROM

SAM CALAGIONE,

FOUNDER & PRESIDENT OF DOGFISH HEAD

Off-Centered Brews for Off-Centered People

"...as for this book, *Extreme Brewing, An Enthusiast's Guide to Brewing Craft Beer at Home*, there's nothing particularly dangerous about it if you use it according to Sam's instructions. Just don't try to drink what you make in one night. My sense is that this is as much a book for beginning brewers as it is for those who've already brewed a few (or many) batches and would like to move on from making the same amber ales..."

– from the foreword by Ken Wells

"Let one of the beer industry's most irrepressible brewers lead you to extremes in your kitchen. Do try this at home—you'll be glad you did."

– Michael Jackson, The world's best known beer expert.

AVAILABLE AT AMAZON.COM AND BOOKSTORES NATIONWIDE
WWW.QUARRYBOOKS.COM

QUARRY

THE ABC's OF RECIRCULATED BREWING SYSTEMS

UNDERSTANDING RIMS, HERMS AND ALL THOSE OTHER BREWING SYSTEM ACRONYMS

by **Chris Colby**

In many ways, homebrewing is a scaled down version of commercial brewing. However, homebrewing has yielded some unique brewing solutions. One such solution is the RIMS, which stands for recirculated infusion mash system. The RIMS was invented by homebrewer Rodney Morris and was introduced to homebrewers in the late 1980s. Since then, it has been very popular, especially with gadget fans and do-it-your-selfers.

The basic idea behind a RIMS is that a pump recirculates the wort during the mash. Using temperature sensors, an electric heating element and a controller, the wort moving through the recirculation loop is heated enough that it stabilizes the mash temperature. With a well-designed RIMS, the temperature of the mash can be held to within 1 °F (0.6 °C). The continual recirculation of the mash also yields crystal clear wort. With the addition of computerized controls, a RIMS brewer can also perform automated step mashes.

A derivative type of wort-maker is a HERMS, which stands for heat exchanged recirculated mash system. In a HERMS, the electric heating element is replaced by a heat exchanger — most often a copper coil wort chiller submerged in a hot water bath. The idea behind a HERMS is that the electric heating element in a RIMS could scorch the wort whereas this would be impossible in a HERMS-type heat exchanger. There are a lot of other acronyms out there — RHEMS, HEMan, CHEM, HERMIT, etc. — that describe different variations on this theme. But all share the basic idea of recirculating and heating the wort to control mash temperatures.

There is a lot of information available on RIMS and HERMS and much of it comes from RIMS/HERMS users who are justifiably proud of their machines. However, a wide variety of claims have been made about the benefits of RIMS brewing, but few of these have been demonstrated conclusively. On the other hand, there are some "RIMS doubters" out there who claim there are significant downsides to RIMS and HERMS wort-makers. In this article, I'll attempt to take an objective look at the pros and cons of RIMS and HERMS wort-making. But before we can examine the pluses and minuses, we need to take a closer look at the equipment.

RIMS/HERMS Anatomy

RIMS/HERMS set-ups are 3-vessel systems, usually attached to a stand, frame or cart. Most are designed to make between 5- and 15-gallon (19- and 57-L) batches, with 10 gallons (38 L) being a popular size. The system may be 3-tiered, 2-tiered or all on one level.

Hot Liquor Tank (HLT)

The first vessel in a RIMS/HERMS is the hot liquor tank (HLT), where water is heated for the mash. It is usually a large pot or converted keg. In a HERMS, the HLT usually serves as the hot water bath for the heat exchange coil. The tank may have a stirrer to improve the heat exchange.

Mash/Lauter Tun

The second vessel in a RIMS/HERMS is a mash/lauter tun. It is usually either a pot or converted keg of the same size as the HLT. Less commonly, a picnic cooler — in the 40 to 60 quart (38-58 L) range — may be used. This is the vessel that the recirculating loop originates from. Wort exits the vessel and either goes directly to a pump, or into a small, open vessel (called a grant), which drains into the pump.

Grant

The grant is optional. It is just a small pot, usually holding about a gallon (3.8 L) of wort, with a drain and perhaps a false bottom. The grant ensures that the pump is only moving wort that drains freely from the grain bed. Without a grant, it is possible that the pump will start sucking on the mash if the flow rate slows, and this will compact the grain bed.

Pump

The pump is the heart of a RIMS or HERMS. In many RIMS systems, the rate of recirculation is around a gallon (3.8 L) per minute. Faster flow rates mean less contact time with the heating element. However, the upper limit of speed is determined by the rate of wort flowing freely from the grain bed.

Bringin' the Heat

In a RIMS, the wort in the recirculation loop is heated by an electric heating element. The heating element is usually

herms

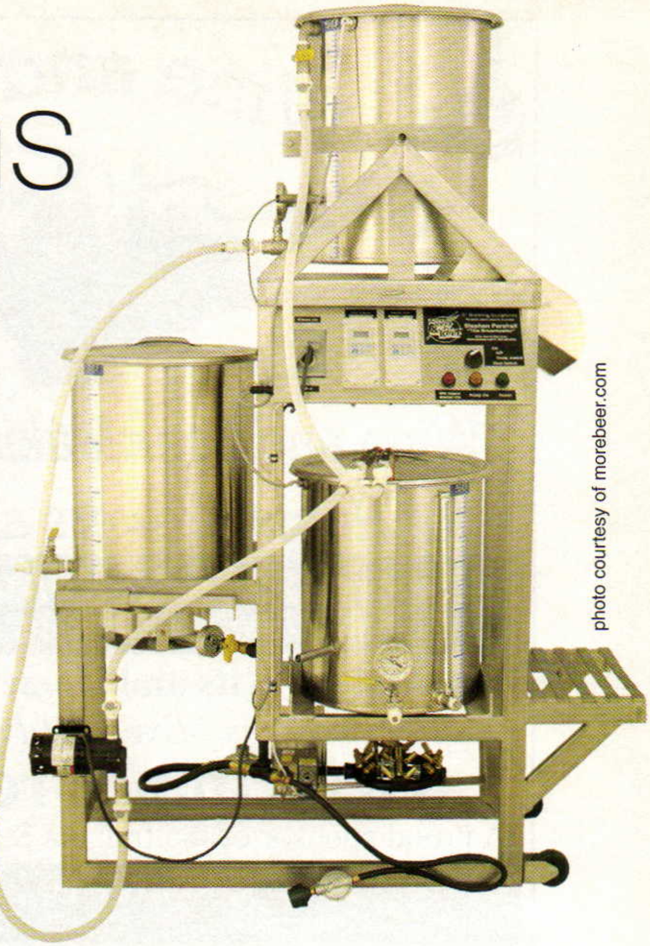


photo courtesy of morebeer.com

This HERMS system manufactured by Beer, Beer and More Beer has from top to bottom, the mash tun, the brew kettle and the HLT. The wort leaves the mash tun at top and is pumped through the copper wort chiller coil in the HLT before returning to the mash tun. Digital controllers run the pump and HLT burner.

rims

photo courtesy of SABCO

This RIMS system from SABCO features from left to right, the brew kettle, the mash tun and the HLT. The digital controller on the right controls the pump and temperatures. This "Brew-Magic" system also features three separate burners.

sealed within a copper pipe. For a 5–10-gallon (19–38-L) RIMS, a 1,500-watt element should suffice for a single infusion mash. For brewers wishing to perform step mashes, a 4,000-watt or greater element is required to ramp the temperature up at an adequate rate — around 2 °F (1.1 °C) per minute. Heating elements should be of the "low density" type. For elements of the same wattage, shorter lengths provide more concentrated heat. The lower heat density of longer elements is less likely to cause scorching.

In a HERMS, the wort in the loop is heated by a heat exchanger, usually between 15 and 30 feet (4.5 and 9.1 m) of ½-inch copper tubing.

Wort Return

Once the wort has flowed past the heating element or heat exchanger, it is returned to the top of the grain bed. The wort return works in a manner similar to that of a sparge arm, except that the wort is returned to the mash below the liquid level, to minimize the possibility of hot side aeration (HSA).

Complete Control

Most RIMS brewers use a PID controller to automatically control their mash temperature. A temperature probe reads the temperature of the mash and relays it to the PID controller. The controller then calculates how much power should be fed to the heating element. (For much more on this, see Marlon Lang's article, "Brewing on Autopilot" in the November 2003 issue of *BYO*.)

In a HERMS, the temperature of the water bath is constant. To achieve control over wort heating in the recirculation loop, a switch controls whether wort is routed through the copper coil or diverted past it.

The ultimate level of control in a RIMS or HERMS is a computer-controller that allows for programmed step mashing. If the pump is the heart of the system, this would be the brains. Using a computer, the brewer can input the length of various rests and then let his equipment do all the work.

Downstream stuff

The third vessel in a RIMS or HERMS is the kettle. From this point onward, the brewday is the same as any other.

Now that we're acquainted with the elements of a RIMS or HERMS, let's take a look at the claims made on behalf of these systems and the criticisms they have received.

The Pros of RIMS and HERMS

Perhaps the coolest benefit of a fully-automated RIMS or HERMS is the ability to do a programmed step mash. You can just input your mash profile, start your pump and let your system do the rest. Once the mash is finished, just redirect the recirculating wort from the wort return to the kettle. Very cool.

Rock Steady Mash Temperatures

With a RIMS or HERMS, it is possible to hold your mash temperature very steady. If you mash in a cooler or insulated pot or keggle with a false bottom, your temperature will drop at least 3 °F (1.7 °C) in an hour. If you mash in your kettle and heat and stir the mash occasionally, it's not too hard to keep the temperature within 2 °F (1.1 °C); however, you will spend most of your time attending to the mash. In contrast, with no attention at all, a RIMS or HERMS can keep temperatures within 1 °F (0.6 °C), perhaps as close as 0.1 °F (0.06 °C).

But, what do rock-steady mash temperatures get you? One term that crops up all the time in RIMS/HERMS discussions with regards to mash temperatures is "repeatability." The idea is that, since your mash temperature is well-controlled, your mash profile should come out the same (or very similar) every time. This sounds great, but is it true?

One thing to note in this regard is, although the temperature inside the mash/lauter tun remains steady, the wort goes through a "temperature rollercoaster" each time through the recirculation loop. The mash as whole may remain steady, during a mash, but little volumes of wort are constantly being heated and cooled by several degrees.

More importantly, although the claim of repeatability sounds logical, it has never been tested. Will a mash held to within 0.1 °F (0.06 °C) really yield more repeatable wort than one held within 2 °F (1.1 °C)? Is it really more repeatable than one that (repeatedly) drops 3 °F (1.6 °C) during every mash session? It would take a fairly involved experiment to prove this, and this experiment has not been done.

Also remember that mashing is a biological process. As with any biological process there is some variability that cannot be controlled. It's quite possible that the level of temperature control achieved in RIMS and HERMS mashing is swamped by the inherent variability in the biological system. It's also quite possible that it isn't — that's why assertions need to be tested.

Clear Wort

If the mash is not stirred, the constant recirculation of the wort in a RIMS eventually yields crystal clear wort. This is almost always cited as a major benefit of brewing with a RIMS or HERMS. But why is super clear wort a benefit at this stage? Most articles or Websites discussing these systems are silent on this point. The claim that crystal clear wort is better wort is taken to be self-evident. I did find one site that claimed that part of the cloudiness in ordinary wort was due to lipids, and lipids in beer lead to premature staling (which it true). But does the crystal clear wort that comes from these systems really yield better beer than the slightly cloudy runoff common to most non-RIMS brewers? Like the claim of repeatability, this has never been tested.

Another question to consider is, does the recirculation of wort in a RIMS or HERMS clarify the wort too much? Studies have shown that a small amount of lipids carried over into the fermenter helps with yeast nutrition. You can argue the point either way — that's why claims need to be tested.

The Cons of RIMS and HERMS

One of the drawbacks of a RIMS is the potential to produce scorched wort. If the heating element gets too hot or the flow of wort past the element is too slow, wort can carmelize on the surface of the heating element. In a poorly-designed RIMS, this can be a real problem. However, in a RIMS with a suitable low-density heating element and adequate pump, wort scorching should not be an issue. And of course, in a HERMS, there is no possibility what-so-ever of wort scorching.

Ichabod Crane Beers

Some RIMS detractors claim that the slow speeds in RIMS step mashes produce thin, headless beers. A slow ramp through the protein rest temperature range will degrade foam positive proteins, they say. Likewise, a slow ramp through the alpha amylase range (140–145 °F/60–63 °C) will yield a very fermentable wort — which in turn will yield a very dry (or thin) beer.

If the heating element in a RIMS (or heat exchanger on a HERMS) is inadequate, there is the possibility of making a thin, headless beer. However, a properly-designed system will have sufficient heating capacity such that this is not a problem. Commercial breweries that perform step mashes have ramp speeds comparable to RIMS and HERMS, and their beers are not uniformly thin or headless.

Actual Cons

Although the most common criticisms of RIMS with regard to beer quality are not true, there are some practical drawbacks to RIMS and HERMS.

RIMS and HERMS take a quite a bit of space and are more expensive to buy or build than other all-grain systems. It's a big jump from being a "bucket brewer" to brewing on one of these set-ups. But for many homebrewers, the extra investment in money and space is worth it.

Buy or Build

If you're thinking of becoming a RIMS or HERMS brewer, you have two options — buy or build. The advantage of buying a system is that you will get a tested design and have access to some tech support, should you need it. The downside is that they cost more.

The advantage of building your own RIMS or HERMS is much the same as the advantage of brewing your own beer — you can make it to your own specifications and tell people that you made it yourself. For those with the requisite skills, building a RIMS or HERMS can be a fun project. If you belong to a homebrewing club, there may be one or more members who have built their own systems. Inviting them over for a homebrew for your planning session and for key contruction steps would be well worth your while. The internet also has a vast amount of information from RIMS and HERMS enthusiasts, and you will likely get ideas for your system by taking a virtual tour of other set-ups.

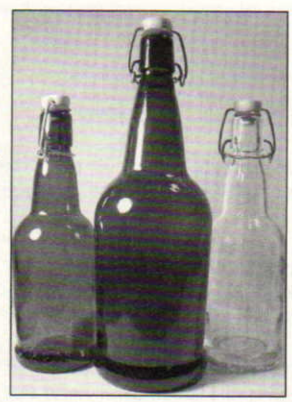
Is RIMS/HERMS Better Than Regular All-grain Brewing?

RIMS and HERMS machines do perform as described by the folks who brew with them. They hold mash temperatures constant and produce clear pre-boil wort. The claims of how these affect beer quality and repeatability are untested, however. But the big question is — do RIMS and HERMS make better beer than "ordinary" all-grain methods?

This again would take a fairly large and detailed experiment to answer, but we can look to homebrewing contests for an idea as to how the experiment might go. If brewing on a RIMS or HERMS inevitably led to better beer, we would expect RIMS and HERMS users to hog all the medals. On the other hand, if RIMS and HERMS could only produce thin, headless beers, these brewers would be crying until their PID controllers short circuit after the medals are handed out.

In reality, neither group dominates at homebrew competitions. In the hands of a good homebrewer, a well-designed recirculating system can yield great beer. In less capable hands, it can result in a wort that goes round and round.

Chris Colby is Editor of Brew Your Own *and writes "Techniques" in each issue. His ludicrously low-tech brewing system can be seen on page 42.*



Build Your Own

by FORREST WHITESIDES

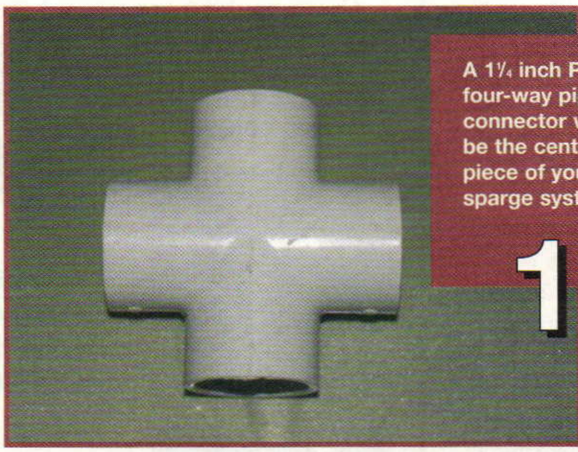
CONTINUOUS SPARGING SYSTEM

WHAT YOU'LL NEED

You can pick up all the parts for this project in a single trip to your local hardware store. Here's what you will need:

- 1¼-inch PVC pipe (3 feet or ~1 meter)
- 1¼-inch PVC four-way pipe connector (Fig. 1)
- 1¼-inch PVC pipe caps (4)
- ½-inch FPT to ½-inch hose barb
- Standard 6-inch (15 cm) shower arm (Fig. 2)
- Low-flow (2.5 gpm or less) shower head with flow control valve (Fig. 2)
- ½-inch ID vinyl tubing (4–6 feet or ~120–180 cm)
- Teflon pipe tape (1 roll)
- Sand paper, medium grit (optional)
- 100% silicone caulk (optional)

The above list assumes that you already have a hot liquor tank (HLT) to hold the sparge water. If you do not have an HLT, you can pick up a 5 or 10-gallon round cooler and a ball valve at the hardware store while you are collecting the rest of the parts for the project. Remove the cooler's plastic spigot and install the ball valve — now you've got an insulated HLT. As far as tools go, you'll need a drill, a small hacksaw or coping saw and an adjustable wrench or pliers.



A 1¼ inch PVC four-way pipe connector will be the centerpiece of your sparge system.

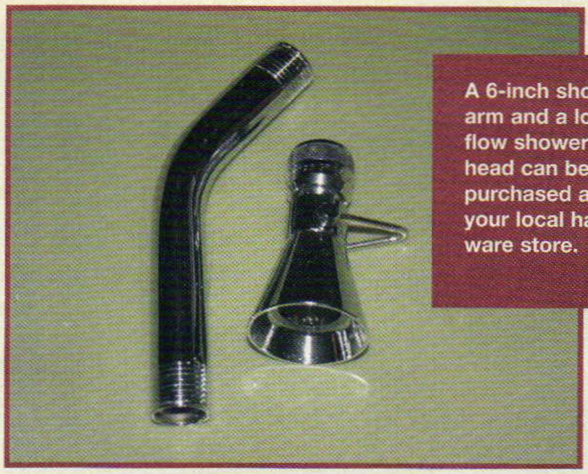
1

If you're looking to move from extract brewing to all-grain brewing, you'll need to become intimate with the details of sparging. In a nutshell, sparging is the process of rinsing the grain in order to extract as much sugar as possible while leaving behind grain husks and other particulate matter.

Continuous sparging, or "fly" sparging as it is often called, is a very common sparging method used by homebrewers. There are a number of commercially available products designed to aid in the process, most commonly in the form of sparge "arms" that distribute water to the grain bed via a gravity-fed rotating arm (not unlike a lawn sprinkler). But why pay for one when you can easily build your own?

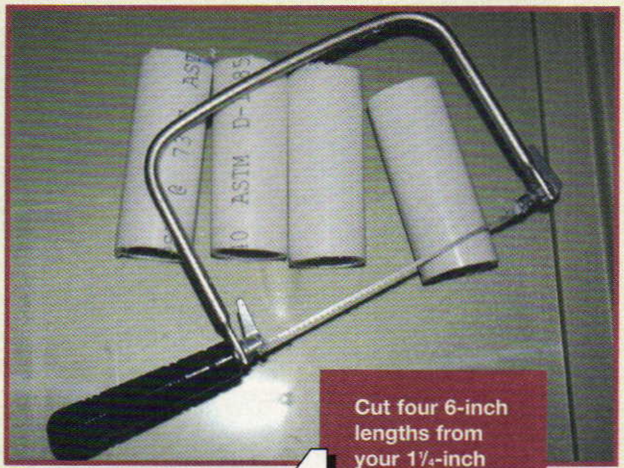
THE OLD RUGGED CROSS

Using the PVC pipe and four-way connector, we're going to make a simple four-armed fixture to suspend the shower arm and head above the grain in your mash tun. This project assumes that you are using a 5-gallon (19-L) round igloo-style cooler as a mash tun, but it can easily be adapted for use with a square or rectangular tun.



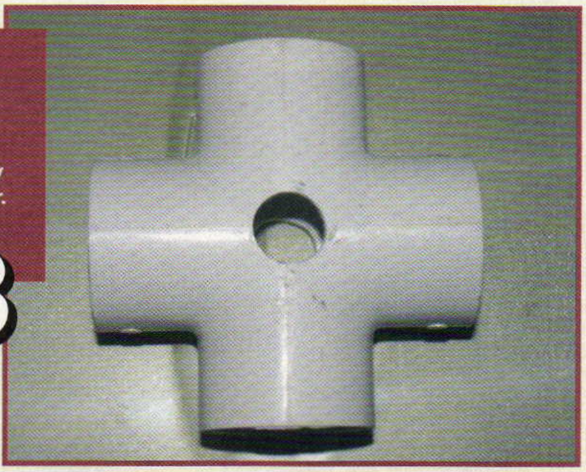
A 6-inch shower arm and a low-flow shower head can be purchased at your local hardware store.

2



Cut four 6-inch lengths from your 1¼-inch PVC pipe. A hack saw or coping saw will do the job well.

4



Your first step is to drill a ¾-inch hole into the center of the four-way pipe connector.

3

First, we're going to drill a ¾-inch hole in the center of both sides of the flat part of the PVC four-way pipe connector (Fig. 3). Use a drill with a paddle bit or small hole saw to get the job done. Once you've got the two holes drilled, insert the shower arm through each hole to check for a firm fit. If the holes are two small (which is likely), you can widen them with either medium-grit sand paper (the slow way) or with a Dremel Tool with grinding/sanding drums (the fast way). The ideal hole size will be just big enough to allow the shower arm to be pushed through but will be tight enough to hold it snugly. If your holes are a bit too large, you can either start over with a fresh four-way connector (you did buy two just in case, didn't you?) or you can easily caulk the shower arm in place. Once you have the holes at the proper size, remove the shower arm and put it aside.

Next, cut four 6" (15 cm) sections of PVC pipe (or use longer sections as needed for a rectangular mash tun). A hacksaw or coping saw will make quick work of the job (Fig. 4). Insert the four sections into the four-way connector. Finish off by applying the end caps to the piping. Optionally, you can caulk all the connection points for a more permanent fixture, but provided that everything fits snug, this is not necessary. Not using an adhesive also allows the fixture to be taken apart for easier storage.

A CALL TO ARMS

Now it's time to bring everything together. Insert the shower arm through the holes in the center of the fixture, with the angled portion of the arm sticking out of the top. Apply a liberal amount of pipe tape to both threaded ends of the shower arm (Fig. 5). Without the tape, it will be very difficult, if not impossible, to achieve leak-free operation.

Screw the hose barb into the pipe thread on the angled end of the shower arm. Hand tightening will likely not be enough to get a good seal, so use an adjustable wrench or pliers to tighten. Next, screw the shower head into the pipe thread on the straight end of the shower arm. The shower head has a rubber gasket in its connector threading, so hand tightening should be enough to eliminate leakage. (Fig. 6)

All that remains is to connect your HLT to the sparge fixture via a section of ½-inch vinyl tubing (Fig. 7). If you prefer, you can use ⅜-inch high-temp tubing. With a little coaxing, it will fit snugly on the ½-inch hose barbs on both the HLT and sparge fixture.

PARTS SUBSTITUTION

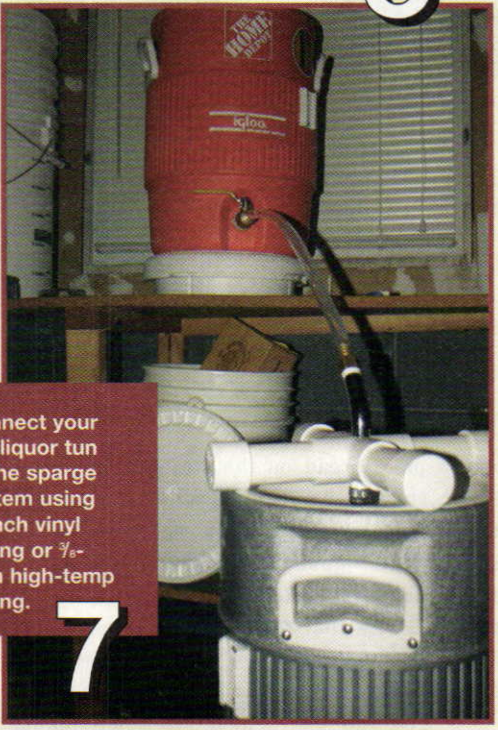
The above project parts list is almost infinitely configurable. You could use smaller diameter PVC pipe and fittings, for example. And you could easily spend half an hour at a big-box hardware store just sorting through your options for shower heads. Just make sure that the shower head you choose has a flow rate control valve. This will allow you to have maximum control over the sparge speed. For this project, I used the Europa Elite shower head, a commonly available and

Insert the shower arm through the connector and apply pipe tape to both of its threaded ends to avoid leaks.

5

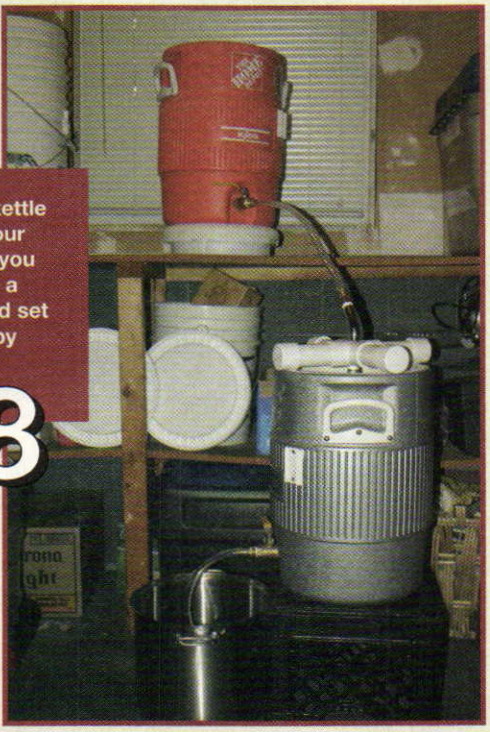
Screw the shower head onto the pipe threading on the straight end of the shower arm.

6



Connect your hot liquor tun to the sparge system using 1/2-inch vinyl tubing or 3/8-inch high-temp tubing.

7

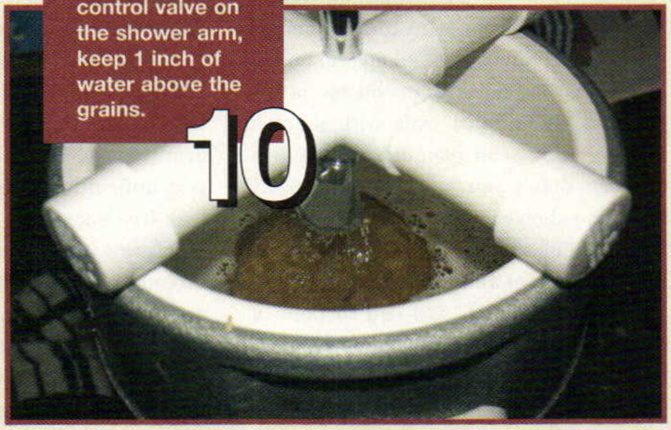


Putting a kettle beneath your mash tun, you can create a three-tiered set up driven by gravity.

8

The goal is to add your sparge water at the same flow rate as the wort run-off.

9



Using the ball valve on the HLT and the flow control valve on the shower arm, keep 1 inch of water above the grains.

10

inexpensive (about $10) model. You could even use some type of garden sprinkler head, so long as you make sure that it is safe for use with potable water and won't impart chemicals or metals.

A DECISION OF GRAVITY

Your new continuous sparging system operates solely with the help of gravity, so you'll need to position the HLT at least a foot or so above the mash tun. Putting the HLT higher above the mash tun will generate faster flow, but in continuous sparging, faster is certainly not better. Since you'll be collecting wort as you sparge, a three-tiered setup is ideal (i.e. - HLT at the top, mash tun in the middle, kettle on the bottom, (Fig. 8)). You'll have to experiment with the system in order to find the ideal set-up in your brewing space.

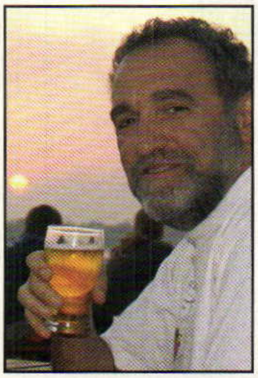
GO WITH THE FLOW

The goal in continuous sparging is to have an equilibrium of hot fresh water coming in the top of the mash tun and sugar-laden wort flowing out to the kettle (Fig. 9). The fresh water added to the top of the grain slowly makes its way through the grain bed, picking up fermentable and non-fermentable sugars (and also flavors and color) on its way down and out through the mash tun to the kettle.

At all times during sparging, there should be about an inch of water sitting on the grain bed (Fig. 10). By using an HLT with a ball valve and a sparge fixture with a flow control valve (on the shower head), you can fine tune the flow going in to the mash tun to match the outflow. Sparging with too high of a flow rate will negatively impact extraction efficiency. A low-flow shower head has a theoretical maximum flow rate of 2.5 gallons per minute, but this is at 80 psi. Your gravity-fed system doesn't create near this pressure, so your flow rate will be fine.

It should take about an hour to get all the sparge water through the grain bed and into the kettle. Another reason to go slowly is that a higher flow rate is more likely to disturb the grain bed, which acts as its own filter during mashing and sparging. Too much disturbance will result in cloudy wort going into the kettle.

Forrest Whitesides recently took over the "Projects" department in BYO.



CHARLIE PAPAZIAN

Homebreweries come is all shapes and sizes, from shiny, stainless steel three-tiered systems to collections of pots of buckets. And every brewery reflects the goals and personality of its owner. In this story, we profile the homebreweries of several well-known homebrewers. If you ever wondered what brew day looked like at Charlie Papazian's or John Palmer's house, we'll show you. We'll also take a look at the brewery of an award-winning brewer, Rob Beck, and that of our own editor, Chris Colby. So, sit back, grab a homebrew and enjoy the "systems of the stars."
—BYO

I didn't design my homebrewery — it happened.

A homebrewer can't be all things a homebrewer could possibly be. You've got to choose what you'll be emphasizing with each beer and decide what are your priorities. My priorities have always been to maintain the fun, relaxing aspects of brewing. To this end, my brewing regime and system has evolved to offer me "comfort" while brewing. I love making beer! And still do after 36 years!

I mash in a 10-gallon (38-L) stainless steel brewpot. A mash regime of 30 minutes at 133 °F (56 °C), to develop foam character, and then a 30-minute rest at about 150 to 158 ° F (66–70 °C), for starch to sugar conversion. I place the mash pot on a table and wrap large bath towels around it, losing only 2–3 °F (1.1–1.7 °C) of heat (at the most) over each 30 minute period. Simple. Easy.

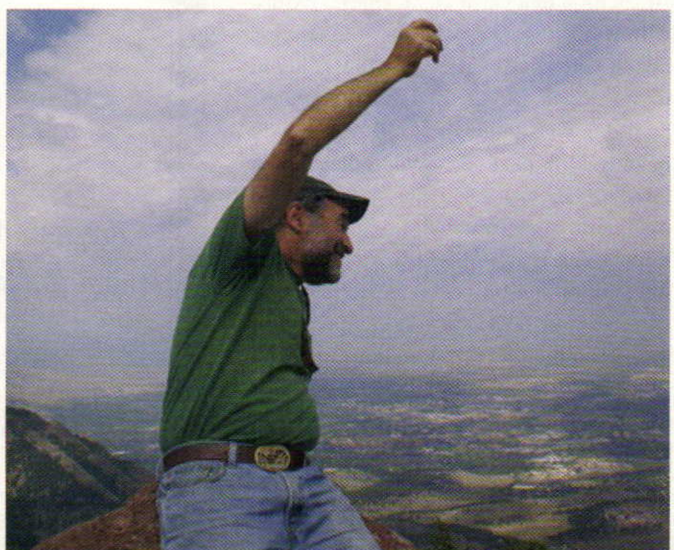
The brew is scooped out with a sauce pan into the false bottom lauter system. Call it a version of my Zapap lauter system, but in actuality it is one of the original prototypes of "Phil's Lauter System" that Listermann had developed early on. It still cranks out great wort after nearly 20 years!

The system is all hands on. All gravity and basic physics. Easily rinsed and cleaned. Wort boiling is either on a propane gas fired "cooker" during the nice weather and inside on a small garage gas stove. I have lots of different wort chillers, many quite sophisticated and very effective. But I have evolved, or should I say de-evolved, to simply placing the 10-gallon (38-L) wort kettle in a bath of cold running water for 30 to 60 minutes to slowly chill the wort. I do not have the theoretical problem of DMS, which causes sweet, corn-like aromas and flavors, from slow chilling. Theoretically, not good practice; but hell, it works for me. After chilling, the wort is poured into what I've dubbed my "hopback." It works great in separating the hops on its way directly to the carboy fermenters.

I consistently get 85% mash conversion efficiency. Crush my grains finer than most homebrewers — in a Corona grain mill. I don't get astringency, though I do need to cut the surface of the lautered mash to break up the dust turned muddy on the surface. No big deal.

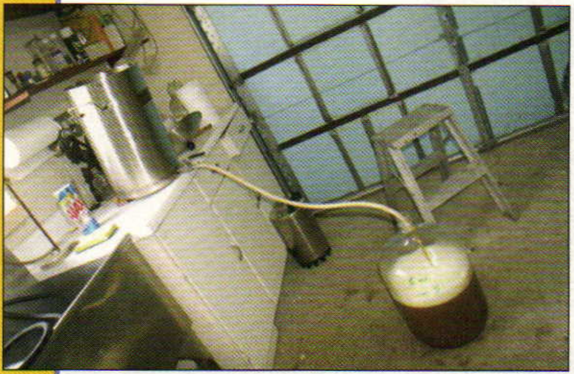
So, in essence, I have simplified my process so that I can maintain hands-on enjoyment and focus more on ingredient and formulation innovation with malt and hops choices and combinations. — Charlie Papazian

Charlie Papazian is the best-selling author of "The Complete Joy of Homebrewing," the book that inspired a generation of homebrewers (2003, Collins, New York). He is president of the Brewers Association in Boulder, Colorado.



Does this man look worried? No way, he's relaxing with a homebrew. Here's to homebrewers everywhere!

Papazian uses a simple but effective lautering system. A plastic bucket serves as the hot liquor tank. A "whirligig" rotating sparge arm sprinkles the mash with hot water, while wort is drained into the kettle. The lauter tun, a prototype for a commercial lautering device, is also a bucket. Liquid flow is adjusted via tubing clamps.



Papazian's "hopback" is actually a prototype stainless steel false bottom mash/lauter system by Stoelting Mfg. Cold wort is filtered into the carboy.

Like many homebrewers, Papazian uses a propane cooker to boil his wort. With a propane burner, you can easily do a full-wort boil. Also, boilovers don't mess up the kitchen.

Papazian's system shows that you do not need a ton of expensive equipment to have fun brewing and make great beer. He has designed his system to maximize his enjoyment of the hobby . . . and apparently, it's worked.

Papazian uses a large utility sink to chill his wort. Chilling times are longer than with immersion or counterflow chillers, but there's less equipment to clean up this way, leaving more time to relax.

JOHN PALMER

As a homebrewing author, my brewing system has to be flexible. I am often building new set-ups and evaluating new techniques in order to write about them more clearly. I need to be able to experiment with a new technique or integrate a new piece of equipment without worrying about the rest of the system. Like many brewers; time is a premium for me. I need an efficient brewing system that minimizes wort handling and time.

I brew with both malt extract and all-grain. There are several beer styles that I tend to brew as extract-only: session beers like American wheat beers, pale ales and American ambers. I like to use my 8-gallon (30-L) aluminum pot on a propane burner for extract brewing. (My wife generally frowns on me using the kitchen stove.) The high conductivity of aluminum reduces the heating time and prevents scorching. Another advantage of aluminum is that it is very easy to drill.

I use a three-tier, gravity fed system when I am all-grain brewing. This system consists of converted stainless steel kegs (keggles). The uppermost keggle is a hot liquor tank that heats the mashing or sparge water. The middle keggle contains a copper ring manifold and is used for step mashing. If I am conducting a single temperature infusion mash, then I will use a Gott cooler with a stainless steel braid instead. These mash tuns can be used with any sparging method, but are optimized for batch sparging. I am building a new three-tier system in my garage that will be very similar to my old system.

I use 3 Superb propane burners for my brewing. Superb burners are rated at 350,000 BTUs, and can take a little longer to reach a boil than the King Kooker type burners, but they are more fuel efficient and less likely to scorch the wort. They are sturdy and easily support the weight of a full keg during the boil.

When I want to brew more sophisticated beers, like porters and continental lagers, I also like the temperature control of a direct-fired mash tun for step mashing. Step mashing ensures that I will get the attenuation and body I want in the wort.

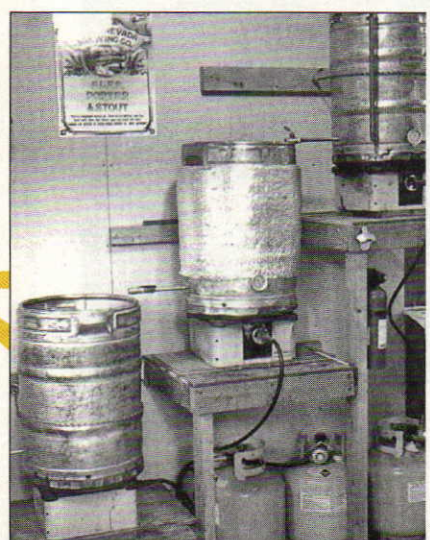
Direct heat also helps me conduct adjunct mashes for styles like wit, American cream ale and classic American Pilsner. I use a copper ring manifold that sits about ½ inch (1.3 cm) off the bottom of the keg. It is sturdy and allows me to forcefully stir the mash for even heating. I have a Blichmann Fermometer mounted in the keggle to monitor the mash temperature.

The HLT sits on a propane burner and supplies hot water to the mash and sparge. I built a sight glass for it and use another Fermometer to monitor the temperature. I am considering switching it over to be electrically heated, using a 240V, 3500W element. The burner throws a lot of heat into the garage and makes a fair amount of noise. The boiling keggle also contains a HopStopper stainless steel screen, which I have found to be foolproof for preventing hops from entering and clogging my plate chiller.

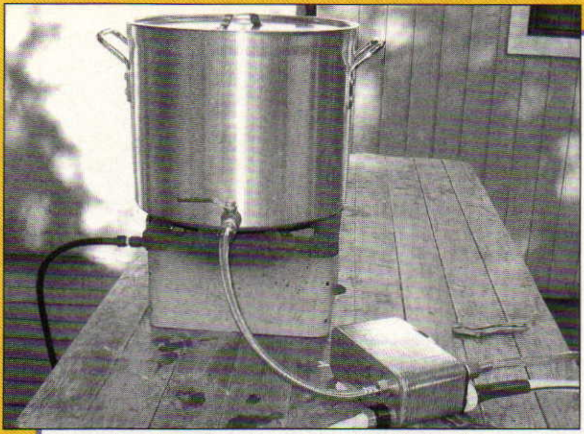
For fermentation, I use plastic buckets, 6.5-gallon (24.7-L) carboys or a stainless conical, depending on the type of beer being brewed. All of my fermentations are conducted inside a spare refrigerator with a Johnson temperature controller. The minimum temperature in Southern California is usually in the mid 70s (~24 °C), and often is pushing 100 °F (38 °C) in the summer. I find that the analog model is perfectly adequate for controlling the temperature within a few degrees of my target.

I use a variety of equipment for brewing a variety of beers; I want to use the right tool for the job. I look for efficient, elegant equipment solutions to make my brewing processes more robust. This way, I can brew any beer style I want, anytime I want. I like that. — John Palmer

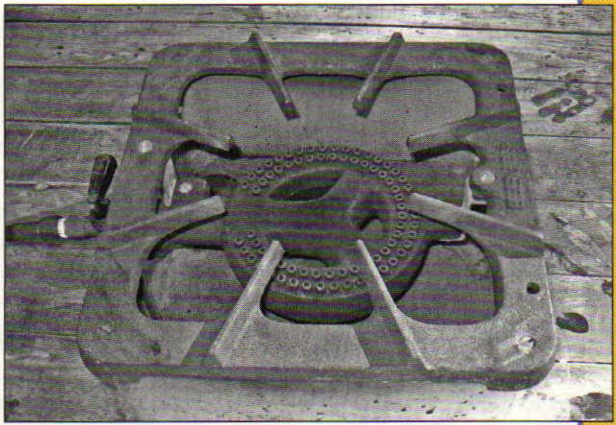
John Palmer is the author of "How to Brew" (2006, Brewers Publications, Boulder).



John's original three-tier system. The top two vessels have ball valves and the water or wort flows through vinyl tubing.

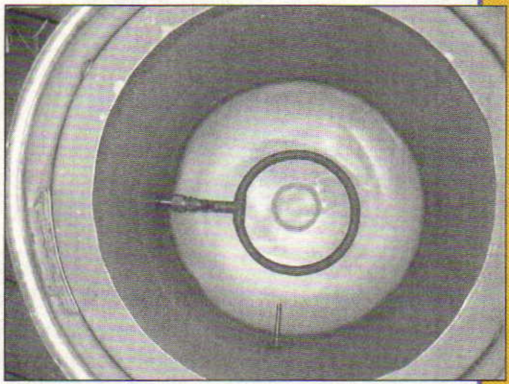


Here is Palmer's 8-gallon (30-L) aluminum pot on top of his propane burner, connected to his plate chiller. He drilled the hole for the ball valve and installed a weldless fitting.

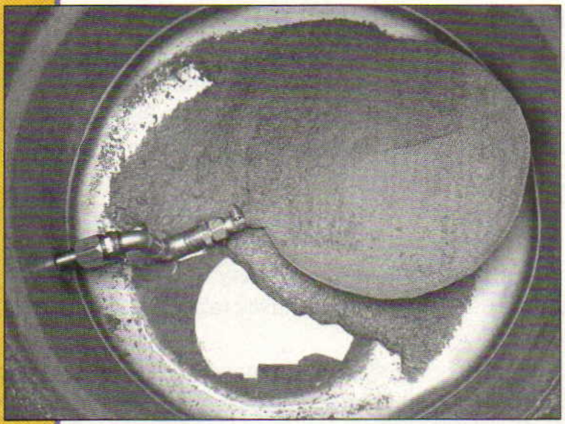


One of Palmers three Superb, 35,000 BTU burners. They can take a little longer to heat the wort to a boil, but are more fuel efficient and less likely to scorch the wort.

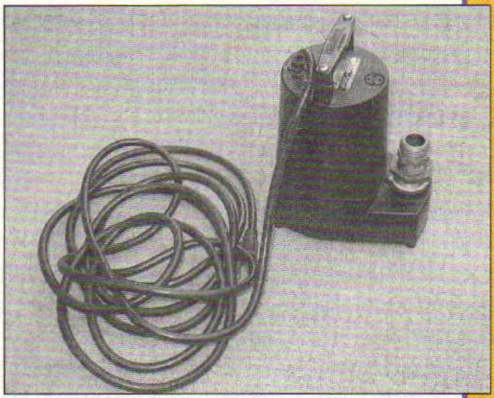
When making British ales — such as ESBs, brown ales and porters — Palmer frequently does a single infusion mash in one of his coolers fitted with stainles steel braid manifold.



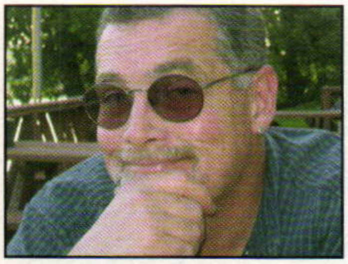
For step-mashed beers, such as Continental lagers, Palmer mashes in this keggle — which can be directly heated — fitted with a round copper manifold for draining the wort.



Palmer's keggle kettle is fitted with a HopStopper stainless steel mesh. This keeps hop debris from leaving the kettle and clogging his plate chiller. For each piece of his brewery, Palmer wants to select the right tool for the right job.



When using his immersion chiller (a double coil chiller made from 50 feet of ½-inch copper tubing) , Palmer uses this pump to recirculate cold water. He also occasionally uses it with his plate cooler.



ROB BECK

My system is not very high tech, but it does afford me the ability to mash in a variety of methods. I can do a single step mash, a multi step mash (my favorite) or a decoction mash. The lack of automation means that my brew days are very hands-on and I enjoy that aspect of it. Even after 10 plus years of homebrewing, I am still amazed at the chemistry and magic that occur when malted grains and different temperatures of water are combined. I feel like an alchemist during every brew session.

My homebrewing accomplishments include 5 gold medals, 1 silver medal, and 1 bronze medal in the National Homebrew Competitions, Best of Show in the 2005 MCAB, as well as some Best of Show awards and numerous awards in other regional competitions.

My favorite beers to brew and drink are American ales, Scottish ales, and German ales and lagers.

Brewing on my system is also very satisfying because I designed the entire set-up and actually fabricated many of the components.

I have a three-tier system in my basement. The hot liquor tank is on the top level and the mash tun is to the right of it, one level below. The pump is mounted below the mash tun and the boil kettle is on the right, at the lowest level. My system is located in the basement and is fired by natural gas.

There is a stainless ball valve attached to the outlet of the pump. The ball valves on the mash tun and the pump are fitted with stainless quick disconnects, as are all the hoses.

The false bottom of my mash tun sits 2.25 inches (5.7 cm) above the bottom of the mash tun and the dead space below the false bottom holds 1.5 gallons (5.7 L).

The mash tun has a recirculation loop with the recirculation hose and wand attached to the pump. I raise the mash temperature by recirculating the mash liquor, from under the false bottom back to the top of the mash, while applying very low direct heat to the mash tun. I can also control the speed of the temperature increase by opening or closing the ball valve on the outlet side of the pump.

The recirculation wand returns the heated mash liquor to the top of the mash. There are set screws that allow me to adjust the height of the wand to accommodate different sized grain bills.

A pick up ring is fitted in the bottom of my boil kettle. The ring fastens to the kettle wall with a Swage-Lock connector. The bottom of the copper ring has many, many slots cut into it (I personally cut each slot using a hacksaw) to filter hops and trub from getting into the fermenter.

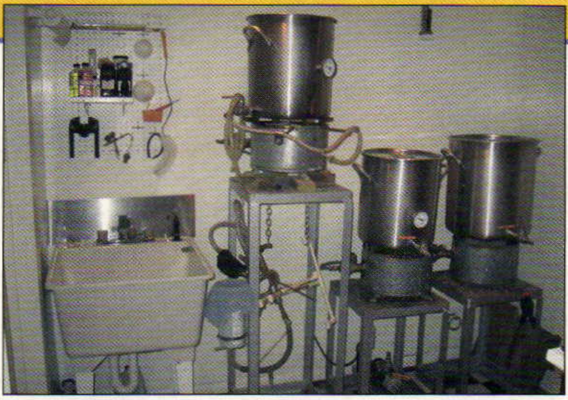
My immersion chiller is a double set of coils, which creates more surface area for heat exchange. The small coil (on the right in the photo) is a pre-chiller that sits in an ice bath. I will run tap water through the chiller for the first 10 to 15 minutes, then I hook it to a submersible pump that goes into the ice bath and I pump ice water through the chiller. I can usually lower the temperature of the wort to about 60 °F (16 °C) in 40 to 45 minutes.

I have pegboard that holds all my brewing paraphernalia above my stainless table. It's really nice to have everything at my fingertips and not have to dig around in boxes for stuff when I need it.

Finally, I have a Saint Arnold icon that sits above the boil kettle and watches over everything. Saint Arnold was the patron saint of brewers. I have another in my primary fermentation refrigerator. I'm not a terribly religious person, except when it comes to brewing. — Rob Beck

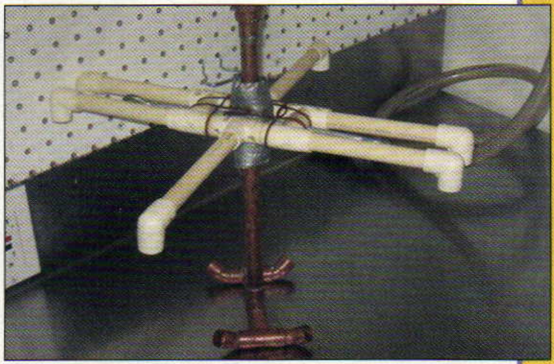
Ron Beck is a member of the Kansas City Brew Meisters and the winner of many homebrew medals. He is a finalist in this year's Sam Adams homebrew contest.

A close-up of Rob's pick-up ring (manifold). He cut each of these slots individually with a hack saw.



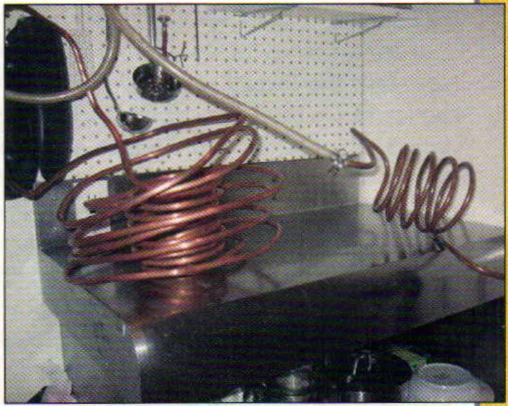
A look at Beck's hot-side equipment. From left to right, the hot liquor tank, mash tun and kettle. His system is located in his basement and is fired with natural gas.

A close up of Beck's mash tun with the pump mounted below it. The ball valves on the mash tun and pump are fitted with quick disconnects.

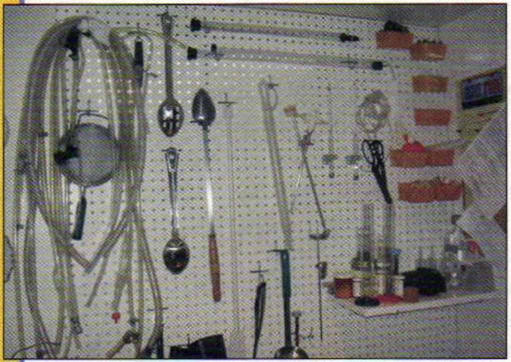


A close-up of the recirculation wand that returns the heated mash liquor to the top of the mash. There are set screws that allow Beck to adjust the height of the wand.

Beck's manifold attaches to the ball valve in the pot's bottom.



Beck's immersion chiller is a double set of coils, for more surface area. The small coil on the right is a pre-chiller that sits in an ice bath.



The pegboard that holds all of Beck's brewing paraphernalia above his stainless table. On brew day, everything is at his fingertips.

CHRIS COLBY

My brewery has steadily evolved as I've added new pieces. I started with a couple kitchen pots and a bucket, which I still have, and now I've got a whole room full of stuff.

In many ways, my brewery is adapted to its local environment, Texas. It's very hot here most of time and even in the cooler parts of the year, and despite air-conditioning, temperatures are really only suited to brewing high-temperature Belgian ales.

I am a sucker for low-tech solutions that work and one way I beat the Texas heat is to put a wet T-shirt on a carboy and let it sit in one of my picnic coolers. Add a few inches of water to the bottom of the cooler and I can maintain good, English-ale fermentation temperatures inside my house.

I am not a Luddite, however, and will go high-tech when needed. I have a 17 cubic foot chest freezer with an external thermostat that I use for fermenting and conditioning lagers. (I also have a dedicated brewing fridge that usually houses 3 Corny kegs and an assortment of bottles of commercial beer.)

I have also had to focus on my wort chilling equipment since I moved here. For most of the year, the temperature of my tap water is around 75 °F (24 °C). To combat this, I have three immersion chillers. The first two sit in ice baths, to cool the water flowing to the chiller in my kettle. I can also line up and use all three immersion chillers as pre-chillers for my counter-flow wort chiller.

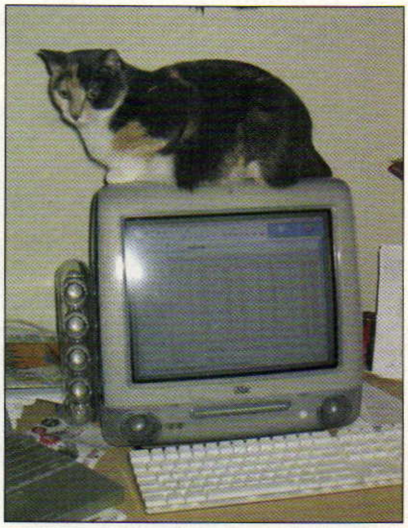
My brewery has also adapted itself to another aspect of it's environment — my inherent laziness. Often, when it comes time to rack to secondary, I put it off "for a couple days," until a couple days becomes a much longer stretch of time. Recently, I got a 7-gallon (26.6-L) stainles steel conical fermenter. Now when I need to separate my fermented beer from its yeast sediment, I just open the dump valve for a couple seconds and I'm done.

When I start thinking about brewing a new kind of beer, I begin with an idea of what the beer should taste like, not a set of style guidelines. I then go to my brewing spreadsheet, which I consider a part of my brewery, and figure out the amount of malt and hops I'll need. Once the beer has been-brewed, however, I forget about the numbers and focus on making the tweak required to make to beer turn out how I want the next time I brew it.

Coming from a biology and chemistry background, I have a fairly decent set of lab equipment for my brewery. I have a couple very good thermometers, a laboratory-grade hydrometer, a three-beam balance, a couple of pH meters, various media bottles and graduated cylinders and even a microscope and hemacytometer for counting yeast. I really only "go analytical" on one or maybe two beers a year, however.

My hot side equipment is really just a collection of big pots and three propane burners. I have a 20-gallon (76 -L) aluminum pot, a 15.5-gallon (58.9-L) keggle and two 10-gallon (38-L) stainless steel pots. I usually use the keggle as my HLT and mash in my plain 10-gallon (38-L) pot. This makes it easy to do step mashes and hold my mash temperatures reasonably constant. I lauter in my 10-gallon (38-L) pot with a false bottom. I have fitted "insulating jackets" for both 10-gallon (38-L) pots, to help them retain heat during rests or during lautering. I then rinse out the first pot and use it as my kettle.

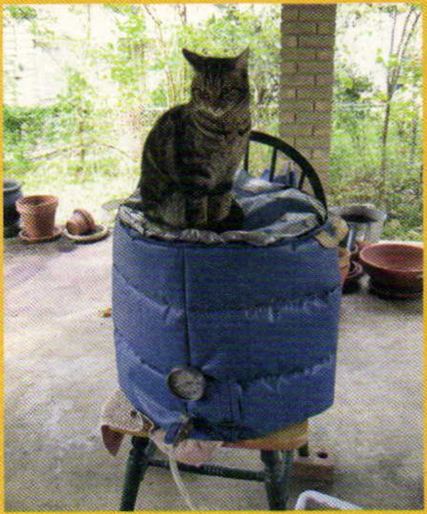
For stovetop brews, I have a 7-gallon (26.6-L) pot and two 5-gallon (19-L) pots. I usually boil 3 gallons (11 L) of wort and chill the brewpot in my sink.



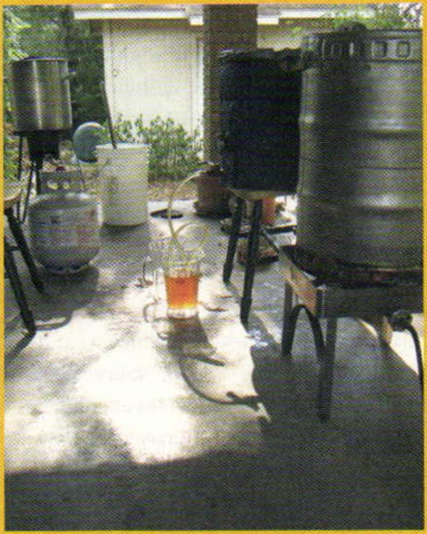
Beer formulation starts here, on a "homebrewed" Excel spreadsheet.

Chris Colby is Editor of BYO. He won a silver medal for his Vienna lager at the 2004 NHC. His gueuze — a blend of three lambics — won Best of Show at the 2004 Austin ZEALOTS Homebrew Inquisition.

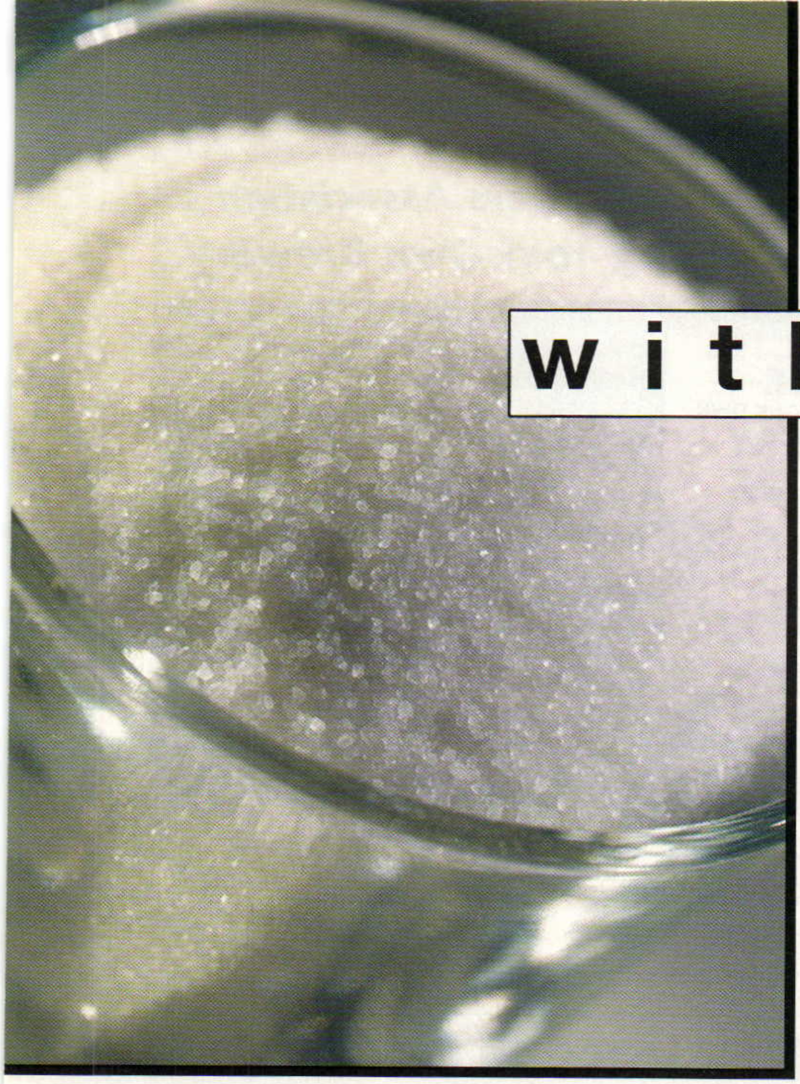
I usually mash in a 10-gallon (38-L) pot, shown here with its insulating jacket on. A keggle is my hot liquor tank (HLT).



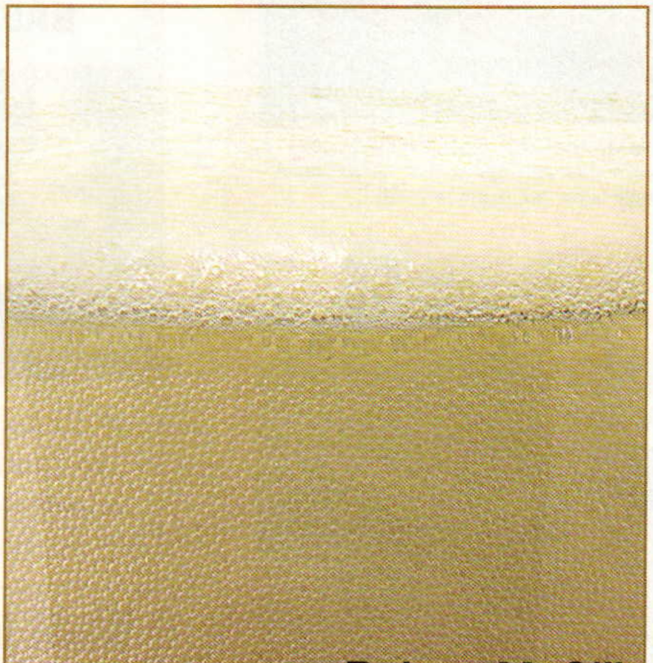
After mashing, I transfer the grains and wort to my 10-gallon (38-L) lauter tun. I recirculate and sparge manually.



The brewery in action. The wort for a Vienna lager is collected in a pitcher, which will be transferred to the kettle when full. The real fun starts when I cool the wort.



PRIMING with sugars



by Robert McGill

Proper carbonation of beer enhances its quality. The relatively low carbonation of British beers accentuates their maltiness while the higher carbonation of European and American beers gives them a lighter, more spritzy taste. It also brings out the aroma of the hops. An undercarbonated beer is flat and lifeless; an over carbonated beer fills your glass with foam and not beer. Proper carbonation for the style beer you brew is important to its enjoyment. An adequate level of carbonation in also required in order to have a good foam stand.

There are three methods used to carbonate beer: priming with sugar or wort, forced carbonation and the retention of carbon dioxide gas (CO_2) generated late in fermentation. Most homebrewers add a measured amount of corn sugar or cane sugar to their bottling bucket to bottle condition their beers. The sugar is consumed by the yeast and CO_2 is produced.

Glucose and Sucrose

Glucose is a six-carbon sugar. There are two isomers of glucose — D-glucose and L-glucose. The "D" form is produced and consumed by biological organisms and D-glucose is often called dextrose. D-glucose extracted from corn is often called corn sugar.

Glucose (or dextrose or corn sugar) powder is sold in two different forms — anhydrous glucose and glucose monohydrate, both of which are white powders. Anhydrous glucose is pure glucose. (Anhydrous means "without water.') Glucose monohydrate is glucose with one molecule of water complexed with each glucose molecule. Nine percent of the weight of glucose monohydrate is due to water and it will not contribute to CO_2 production during bottle conditioning. Anhydrous glucose is hygroscopic (it absorbs moisture from the air) and will form "rocks" if not stored in a sealed container.

If you are wondering whether your corn sugar is anhydrous glucose or glucose monohydrate, make a 3 x 3 inch (7.6 x 7.6 cm) tray out of aluminum foil, with 1-inch (2.5-cm) sides. Weigh out about an ounce (28 g) of corn sugar in the tray and put it in your oven at 275 °F (135 °C). This temperature will drive off the complexed water. Remove the tray after 30 minutes and reweigh. Kick your oven temperature up to 300 °F (149 °C), a temperature that will melt the glucose. Reweigh. I found a 10% drop in weight, confirming that my corn sugar is glucose monohydrate.

Sucrose is a two-subunit sugar composed of glucose and fructose (another six-carbon sugar). The major sources of sucrose is sugar cane (cane sugar) and sugar beets (beet sugar). Like glucose, sucrose is white powder. Unlike glucose, sucrose does not form hydrated complexes, nor is it hygroscopic.

From Chemistry to Carbonation

To the right are the chemical reactions that take place during bottle conditioning. Using these reactions, we can derive an equation to calculate carbonation levels from sugar additions.

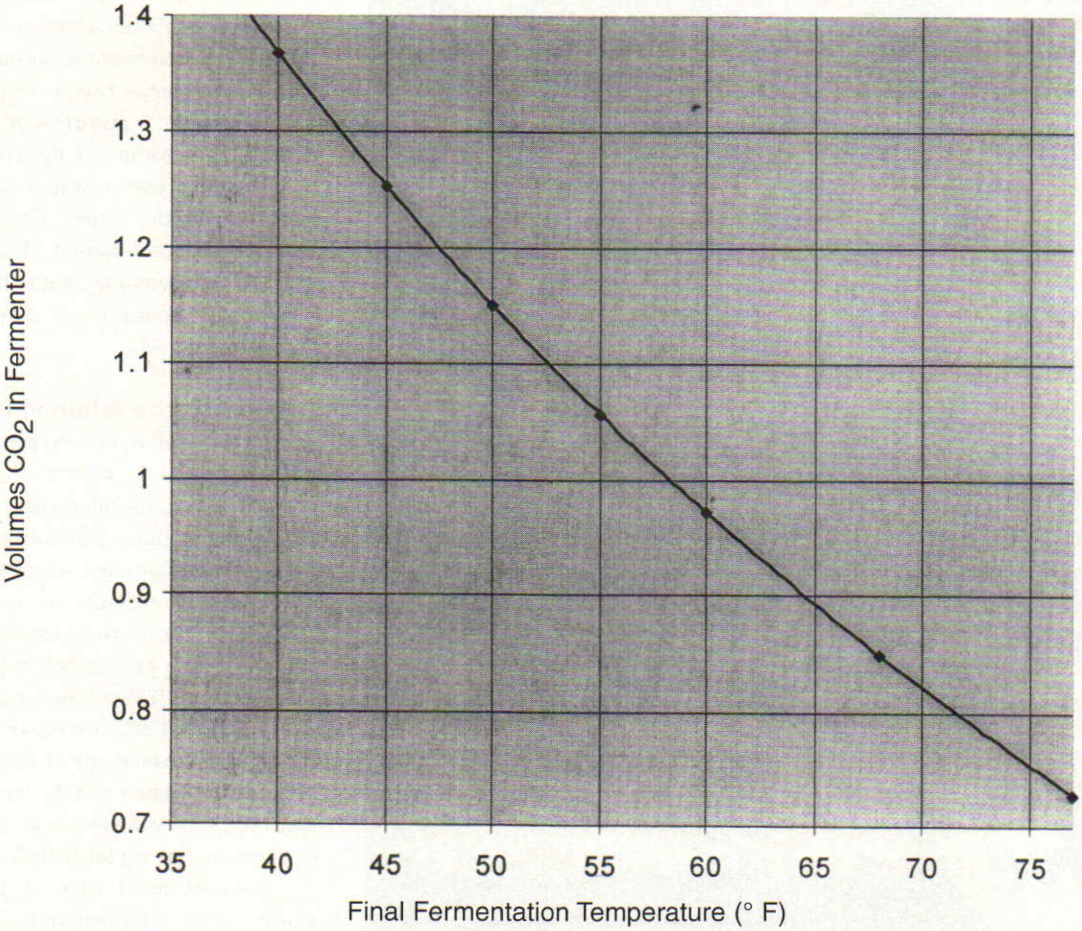
FERMENTATION OF SUGARS

anhydrous glucose		ethanol		carbon dioxide
$C_6H_{12}O_6$	→	$2\ C_2H_5OH$	+	$2\ CO_2$
FW 180		46(x2)		44 (x2)
1 gram		0.51 grams		0.49 grams

glucose monohydrate		ethanol		carbon dioxide		water
$C_6H_{12}O_6 \bullet H_2O$	→	$2\ C_2H_5OH$	+	$2\ CO_2$	+	H_2O
FW 198		46 (x2)		44 (x2)		18
1 gram		0.46 grams		0.44 grams		0.091 grams

sucrose		water		ethanol		carbon dioxide
$C_{12}H_{22}O_{11}$	+	H_2O	→	$4\ C_2H_5OH$	+	$4\ CO_2$
FW 342		18		46 (x4)		44 (x4)
1 gram		0.053 grams		0.54 grams		0.51 grams

CARBON DIOXIDE CONTENT PRIOR TO PRIMING



Using the information from this chart, and some basic chemical relationships, we can derive the following formula for 5.00-gallon (18.9-L) batches of beer:

(X g glucose) x (88 g CO_2/180 g glucose) x (1 mole/44 g CO_2) x (22.4 L/mole) x (1/18.9 L beer) = Y volumes of CO_2

where X is the weight of (anhydrous) glucose and Y is the level of carbonation.

For example, if you add 3.0 oz (85 g) of anhydrous glucose, you would generate 85 x 0.489 x 0.0227 x 22.4 x 0.0529 = 85 x 0.0132 = 1.12 volumes of CO_2 in 5.0 gallons (19 L) of beer.

Analogous equations can be derived for glucose monohydrate and sucrose using the information from their chemical reactions. These equations will tell you how many of volumes of CO_2 are generated by a given amount of sugar.

If you don't want to calculate these volumes on your own, download and print the companion tables to this article at BYO.com.

Residual Carbon Dioxide

One must remember that, after fermentation, your beer is saturated with carbon dioxide at atmospheric pressure. Although an ale may seem "flat" when sampled from the fermenter, there is a small amount of gas dissolved in it. Lagers usually have a low, but noticeable, level of carbonation immediately after fermentation.

Beer carbonation tables available in the books I have do not extend to zero gauge pressure (1 atmosphere at sea level). They also do not include fermentation temperatures above 60 °F (16 °C), because they are presented for force carbonation use, and beers — even in England — are not generally served at temperatures higher than this. For the same reason, these tables do not show carbonation levels at atmospheric pressure where many fermentations occur.

However, the data presented can be accurately extended to atmospheric pressure using Henry's Law, which says that the amount of gas absorbed in a liquid at a given temperature is directly proportional to the pressure of that gas in equilibrium with the liquid. Using Henry's Law for the carbonation charts and a curve fit to extend the data to higher fermentation temperatures, I developed the graph on page 45.

Level of Carbonation in Bottle

To determine the carbonation volumes expected in your final beer, you need to add the priming sugar contribution to the volumes present prior to the addition of the priming sugar. For example, I ferment my ales at about 65 °F (18 °C). This means that I have about 0.89 volumes of CO_2 present before priming. If the beer is a British bitter, I would add 2.5 oz. (70 g) of my corn sugar to my bottling bucket, which would add an additional 0.85 volumes of CO_2, giving me an expected 1.74 volumes, near the middle of the range shown for British ales.

Keep in mind that, if your beer warms up after fermentation, it will lose

CO_2. This will not happen instantaneously, though. However, lowering your beer's temperature will not increase the level of CO_2, unless a source of CO_2 is present. (Continuing fermentation or CO_2 from an outside source — like CO_2 cylinder — are the two most likely possibilities.) If you want to accurately estimate your residual amount of carbon dioxide, hold your fermentation temperature constant and add the priming sugar to the beer at this same temperature. You may then warm the beer up for bottle conditioning, if needed.

Priming in Style

Different styles of beer call for different levels of carbonation. The following table outlines the appropriate ranges for various beer styles:

Style	Volumes of CO_2
American ales	2.2–3.0
British ales	1.5–2.2
German weizens	2.8–5.1
Belgian ales	2.0–4.5
European Lagers	2.4–2.6
American Lagers	2.5–2.8

Three-Quarters of a Cup?

You may be wondering — do I need to bother with all of this? Can't I just keep adding 0.75 cups of corn sugar? The answer, of course, is up to you, but here are some facts.

Three quarters of a cup of corn sugar (glucose monohydrate), which weighs around 4.5 oz. (128 g), added to an ale fermented at 70 °F (21 °C) would yield about 2.5 volumes of CO_2. However, if you add the same amount to a beer that was fermented and primed at 50 °F (10 °C), you get about 2.9 volumes of CO_2. Using the equations here — or the tables at BYO.com — will allow you to fine tune your beer's carbonation.

This is Robert McGill's first article for Brew Your Own.

BYO.COM bonus:
Carbonation charts for priming with glucose or sucrose.

BYO BACK ISSUE SALE!

Buy 5 Issues...Get 5 More Issues FREE!

We are offering readers a very special deal on our limited quantities of back issues. Buy any 5 issues for $25 (plus $10 shipping) and receive 5 more issues for FREE! Buy 5 and get 5 FREE! Choose from these collectible classics still in stock from 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004 and 2005.

HURRY! SUPPLIES ARE LIMITED!

DEC. 95
- Controlling Beer Color
- Winter Brew Recipes

APR. 96
- Apartment Brewing
- Lager & Kegs

MAY 96
- Lautering Tips
- Troubleshooting Guide

JUNE 96
- Partial Mash Tips
- 15 Great Extract Recipes

JULY 96
- Big Batch Brewing
- Scotch Ale

SEPT. 96
- Brewing with Wheat
- Grain Milling Tips

NOV. 96
- Medieval Beer Recipes
- Build a Mash Stirrer

FEB. 97
- Lager Tips
- Microwave Mashing

MAR. 97
- Build Tap Handles
- Growing Backyard Hops

APR. 97
- Low-Alcohol Recipes
- American Pale Ale Recipes

AUG.97
- Make Your Own Malt
- Dry Hopping Tips

SEPT. 97
- Build a Keg Cleaner
- Tips from Sierra Nevada Brewing

OCT. 97
- Extract Kit Guide
- Decoction Mashing

NOV. 97
- Refining Your Mash
- Brewing with Adjuncts

DEC. 97
- Clone Recipes
- Keg Tips

FEB. 98
- Belgian Lambic Tour
- Belgian Abbey Ale Recipes

MAR. 98
- Super Hoppy Recipes
- Lautering Guide

APR. 98
- Scotch Ale Recipes
- Choosing the Right Yeast

JUNE 98
- Hop Profiles and Tips
- Malt Cooler Recipes

JULY 98
- 15 Clone Recipes
- 3 Beers, 1 Mash

AUG. 98
- Easy Beer Calculations
- Yeast Pitching

OCT. 98
- Great Bock Recipes
- Choose the Right Kit

NOV. 98
- Kegging Techniques
- Using Liquid Yeast

DEC. 98
- Cask Conditioning Tips
- Convert Freezer to Beer Chest

JAN. 99
- Aging in Wood
- Figuring Hop Bitterness

FEB. 99
- Malta Yeast Starter
- Organic Homebrewing

MAR. 99
- Imported Clone Recipes
- Build an Electric Brew Stove

APR. 99
- Kegging Guide
- Understanding Brewing Water

MAY 99
- Perfecting Pale Ales
- Nitrogen Homebrews

JUNE 99
- Nut Brown Ale, Pilsner Recipes
- Experimenting w/ Grains

JULY 99
- Summer Homebrew Recipes
- Hempen Ale Recipe

AUG. 99
- Wit, Kölsch Recipes
- American Lager Clones

SEPT. 99
- Build a $50 Mash Tun
- Lager Techniques

OCT. 99
- Homebrewing Soda Pop
- Doppelbock Recipes

NOV. 99
- Hop Flavor Chart
- Easy Partial Mashing

DEC. 99
- Cutting Edge Equipment
- Increasing Batch Size

JAN. 00
- 7 Czech Beer Recipes
- Your First Brew

FEB. 00
- High-Gravity Brewing
- Foreign Clone Recipes

MAR. 00
- Master Beer Conditioning
- Beer Tasting Lessons

APR. 00
- Making Smoked Beers
- Your First Keg

MAY 00
- Your First Mash
- Understanding Your Water

SUMMER 00
- 4 British Clone Recipes
- Put a Spigot in Your Brew Kettle

OCT. 00
- 20 Autumn Extract Recipes
- Build a Counterflow Wort Chiller

NOV. 00
- 6 Belgian Clone Recipes
- Expert Belgian Brewing Tips

DEC. 00
- Brewing Lagers
- Homebrew Lab Gizmos

JAN. 01
- Brew Indigenous Beers From 4 Continents
- Making Root Beer

FEB. 01
- 5 German Clone Recipes
- Decoction Step-by-Step

MAR. 01
- Growing Yeast Strains at Home
- Brew Low-Carb Beer with Beano®

APR. 01
- Grow Your Own Hops
- Strong Ales

MAY 01
- 20 Extract Recipes for Spring
- Build a Counter PressureBottle Filler

SUMMER 01
- 5 Clone Recipes for Summer
- Build a Big-Batch Mash Tun

SEPT. 01
- Learn to Brew with No-Boil Kits, Extract with Grains, Partial Mash, Single-Infusion Mash and Step Mash

OCT. 01
- 15 Classic Extract Recipes for Different Beer Styles
- Build a Hopback

NOV. 01
- Using and Building With Stainless Steel
- Build a Draft Jockey Box

DEC. 01
- Brewing Scotland's Classic Beers
- Build an Easy RIMS

JAN./FEB. 02
- 8 Ski Town Clone Recipes
- Thomas Jefferson's Homebrew

MAR./APR. 02
- Understanding Malt
- Computer Brewing Software

MAY/JUNE 02
- Faster Brewing Tips
- Big Batch Brews

BUY 5 ISSUES...GET 5 MORE ISSUES FREE!

Kräusening

A traditional conditioning technique

Story by Chris Colby

Kräusening is the practice of adding a small amount of vigorously fermenting lager beer to a larger amount of lager beer that has just finished fermenting. Usually, the volume of fermenting beer (called kräusen beer, because it is added at high kräusen) is equal to 10–17% of the main batch of green beer.

Related brewing practices — such as adding spiese (wheat ale wort or fermenting lager beer) to a green German weizen (an ale) prior to bottling or adding a small amount of fermenting ale to help along the fermentation of a high-gravity ale — are conceptually similar to kräusening, but are technically not called kräusening.

Traditionally, kräusening has been used for a couple reasons relating to beer quality. First, the addition of fresh, active yeast into just-fermented beer helps "clean the beer up." Diacetyl, acetaldehyde and perhaps other fermentation byproducts associated with green beer flavors are quickly taken up by the new yeast. Secondly, the addition of kräusen beer can help with attenuation, especially with big beers. In the case of very big beers, new, fresh yeast may be needed to finish the job started by the main yeast. For example, kräusening is one of the practices the brewers of Samichlaus (Eggenberg) use to get that 14% ABV lager to fully attenuate. And finally, if a commercial brewery kräusens their beer, they probably also trap the carbon dioxide gas (CO_2) given off by the renewed fermentation to carbonate their beer.

Additionally, there is a practical aspect to adding fermenting wort to green beer for commercial brewers. Let's say you're Joe Commercial Brewer. You arrive at work one day and check on the wort you pitched yesterday. It's fermenting nicely. Great. You also have several other fermenters full of conditioning beer. Super. Now let's say you've been busy and, when you check, you find that all of your fermenters are full. Bummer — now you can't brew again until you empty one of them.

But wait, all your fermenters have beer in them, but they aren't really full, are they? Around 20% of the space inside each tank is reserved for headspace over the brew. Now that primary fermentation has subsided in most of the tanks, this space is being wasted. However, if you pump dollops of yesterday's beer into six to 10 tanks (assuming all your tanks are the same size), you can empty the fermenter you filled yesterday. The receiving tanks will be almost full — there will be a smaller headspace to accommodate the less-vigorous renewed fermentation — and you've just expanded your brewery's capacity. When I toured the Spoetzel Brewery (makers of Shiner Bock), topping up their tanks was one way they increased the output of their brewery.

> One way to have a supply of kräusen beer is to save a bit of wort and a bit of yeast on brewing day.

Got Kräusen Beer?

Although a time-tested practice in commercial breweries, kräusening — and related practices involving blending small amounts of fermenting beer into green beer — is almost unheard of in home breweries. The reasons for this are practical. First of all, you don't need to kräusen a lager to make it turn out well.

Secondly, most homebrewers do not brew the same beer over and over on a regular schedule. Thus, when the time for adding kräusen beer arrives, they would need to brew a small new batch of beer. For homebrewers interested in trying kräusening, there are a couple ways around this — saving wort and making "quicky kräusen."

One way to have a supply of kräusen beer is to save a bit of wort and a bit of yeast on brewing day. If you clean and sanitize a 2-qt. (2-L) bottle to save some wort and clean and sanitize a smaller container — such as a White Labs yeast vial — to save some yeast from your yeast starter, you have all you need to make kräusen beer for a 5-gallon (19-L) batch of beer. Store the wort and yeast in your refrigerator and pull them out the day before you need your kräusen beer. Aerate the wort, let it warm to fermentation temperature and pitch the saved yeast. The next day — when the wort is at high kräusen — pitch it into your green beer. (Note that you can either ferment 4.5 gallons (17 L) of wort and add the 2.0 qts. (1.9 L) of wort to make a full 5.0 gallons (19 L), or you make and ferment 5.0 gallons (19 L) of wort, then add an additional 2.0 qts. (1.9 L) of kräusen beer to make 5.5 gallons (21 L) total.)

Quicky Kräusen

The biggest reason most homebrewers don't kräusen is that they don't brew the same beer repeatedly on a suitable schedule. When one beer is finishing fermenting, most homebrewers do not begin brewing the same thing again. However, there's no reason that your kräusen beer needs to be made from the same recipe as your green beer. If you plan to kräusen a batch, you can alter your recipe so that whipping up a batch of kräusen beer is very easy. Specifically, you can make your beer slightly darker and hoppier than your target beer, then add some pale kräusen beer. The pale kräusen beer can be made simply by boiling some light malt extract.

For example, let's say you planned on brewing 5.5 gallons (21 L) of Northern German Pilsner with a starting gravity of 12 °Plato (specific gravity 1.048) and 37 IBUs. You have a 5.0-gallon (19-L) recipe for the Pilsner and plan to brew 5.0 gallons (19 L) of beer, then kräusen it with a half gallon (1.9 L) of kräusen beer. To do this, you would first need to convert your recipe to the full batch size, including the original beer and kräusen beer. In this case, you'd multiply all the ingredients in the 5.0-gallon (19-L) recipe by (5.5/5.0 =) 1.1 to yield a 5.5-gallon (21-L) recipe.

Next, determine how much light malt extract it would take to brew your kräusen beer at your target gravity. In this case, 0.5 gallons (1.9 L) with light dried malt extract (DME) yielding 45 points/pound/gallon, would mean 8.5 oz. (0.24 kg) of DME. Finally, calculate the equivalent amount of pale malt you would need to yield that gravity of kräusen beer, about 1.0 lb. (0.45 kg).

Now, brew your 5 gallons (19 L) of beer, using the 5.5-gallon (21-L) recipe minus the amount of pale malt calculated above. (If you're an extract brewer, just subtract the same amount of DME from your 5.5-gallon (21-L) recipe.) This will yield 5 gallons (19 L) of beer at 12 °Plato, but with 41 IBUs — a little higher than your final target. (If specialty malts are used, the color will be slightly darker than the target, too.) When primary fermentation ends, make your kräusen beer — in our example, also at 12 °Plato — and add it to the main batch of beer. Now your beer will be kräusened and at the right strength, bitterness and color.

One benefit of making quicky kräusen is you can add kräusen beer to multiple batches of beer with different recipes. This assumes that you planned ahead and made the recipe adjustments outlined above and all the batches used the same (or similar enough) yeast for primary fermentation. For example, let's say you are brewing for a party and you make four batches of lager — all you have room for in your chest freezer. If you brew 5-gallon (19-L) batches and ferment in 6-gallon (23-L) carboys, you'll have 4 gallons (15 L) of headspace that can be (at least mostly) filled with kräusen beer.

Classic Kräusening

If you're a lager brewer who wishes to kräusen, first prepare your kräusen beer. Either pitch your saved yeast to your saved wort or make a batch of "quicky kräusen" as described earlier. Be sure to aerate the kräusen wort well and let it arrive at high kräusen — the most vigorous stage of fermentation. You should keep the fermentation temperature of your kräusen beer near the fermentation temperature of your main batch. If you're using a modified chest freezer, just place your kräusen beer vessel in the freezer with your main batch.

Transfer your fermenting kräusen beer either to a secondary fermenter or a Corny keg, then rack your green lager into the kräusen beer. In the case of a secondary fermenter, just place an airlock on the vessel and let the kräusen beer work at your previous fermentation temperature. In other words, there is no need to raise the temperature as you would with a diacetyl rest. If you have a cylindro-conical fermenter with a bottom dump, just dump the yeast from primary and add your kräusen beer to the fermenter.

The kräusen beer will absorb diacetyl and acetaldehyde and begin turning the green lager into a conditioned lager. It will also generate CO_2, which can be trapped if you have the right equipment.

In order to trap CO_2, you will have to rack your beer to a Cornelius keg and build yourself a spunding valve. (Do not try to trap CO_2 in a glass carboy.) A spunding valve is a pressure relief valve attached to a fermenter or conditioning tank. The brewer selects a set point on the spunding valve and pressures below this point are retained in the tank. When the pressure climbs above this level, the tank is vented until the pressure dips below the set point. Brewers sometimes refer to using a spunding valve as "capping the tank."

By retaining some CO_2 pressure in the conditioning tank, the brewer naturally carbonates his beer with the CO_2 produced during fermentation. He does not need to add priming sugar to the beer or add exogenous CO_2 (under pressure) to force carbonate the beer. A small amount of sulfur, given off during lager fermentations, may also be retained when a spunding valve is used.

A homebrew spunding valve is easy to make. Marc Martin — former Primary Fermenter of the Austin ZEALOTS and current Replicator here at *BYO* — showed me how to build one. In a later issue of *BYO*, we'll have an article that gives the full details, but I'll sketch out the construction here for those who can probably figure it out for themselves when pointed in the right direction.

To build a spunding valve you need a "gas in" connector for a Cornelius keg, a relief valve, a pressure gauge and a "T" connector. Connect the relief valve (which can be found at Grainger or McMaster Carr) and the pressure gauge (the low pressure gauge on a CO_2 regulator) and the "gas in" keg connector to the "T" connector. That's it.

To use the device, simply seal a Corny keg containing green beer and kräusen beer. Attach the spunding valve to the "gas in" side — so it's connected to the short tube that ends in the headspace, not the dip tube extending to the bottom of the keg — and wait for the pressure to come up. Once the pressure starts to rise, you can adjust the relief valve to retain more or less pressure. You can read the level of pressure (in PSI) from the gauge.

Whether you trap your CO_2 in a Corny keg or kräusen in a secondary fermenter, let the kräusen beer work until the renewed fermentation subsides, then lower your beer to lagering temperatures and let it condition until ready.

Chris Colby, editor of BYO, *likes to fill himself with lager beer.*

Water Usage

Water volume calculations that won't leave you all wet

by Bill Pierce

Because it typically comprises more than 90% of beer both by weight and by volume, it can be argued that no brewing ingredient is more important than water. In the May-June 2005 issue of *BYO*, this column examined water quality, specifically the mineral content of brewing water, the chemistry involved and its effect on the mash and the resulting beer. Just as important — and extraordinarily practical — is the quantity of water used. Such questions as how much water to use for mashing and sparging the grain, and boiling the wort are of great interest to brewers.

If you are using water that is filtered or adjusted for mineral content, you will want to know the total volume needed for a brewing session. The volume of water also impacts brewing equipment and system design because it is a major factor in determining the capacity of the vessels required. By keeping several concepts in mind — and using a few handy formulas — you should be able to calculate accurately the volumes of water needed, both overall and during each step of the brewing process.

All of the good comprehensive brewing software packages available have a brewing session water volume calculator that performs this task for you. It is also possible to construct a spreadsheet using the various formulas involved. However, even if you rely on the computer to do the routine calculations, an understanding of the underlying principles will make you a more knowledgeable brewer and might even improve your beer.

Beginning at the end

When calculating water quantity, it is helpful to begin by considering the final volume of beer you intend to brew. Recipes are usually expressed in round numbers, for example, 5.0 gallons (19 liters), and often they reflect the volume that is bottled or kegged. During fermentation, racking to other vessels and the bottling or kegging process, some beer is absorbed by hops or yeast, while an additional volume is evaporated or left behind in the equipment. After some experience, brewers come to know approximately how much wort is necessary in the fermenter in order to end up with a given volume of beer. I call this the "fermenter volume," and to my mind, this is the real volume of a recipe. For 5.0–10 gallon (19–38 L) batches, typically this will be 1.0–4.0 quarts (0.9–3.8 L) larger than the published volume of the recipe.

Once experience has taught you the desired fermenter volume, you can work backwards to determine the total water volume needed, subtracting the various losses that occur during the brewing process. In reverse order, these will include many of the following:

- Wort left in lines and equipment, such as a chiller or pump, between the brewing kettle and the fermenter
- Wort absorbed by hop residue and protein break material in the kettle at the end of the boil
- Evaporation losses during boiling of the wort in the kettle
- Liquid left in lines and equipment between the mash tun and the kettle
- Mash "dead space," that is, liquid that is left in mashing and sparging vessels due to their design and geometry
- Sparge water dead space, that is, water similarly left in the hot liquor tank or other sparge water vessel
- Water absorbed by the grain in the mash tun

Of course these losses are offset by water additions, which typically will include at least some of the following, listed in order of earliest to latest:

- Strike water, that is, the water initially mixed with the grain at the beginning of mashing
- Any additional water infusions during mashing
- Sparge water added to the mash in order to extract the sugars converted from the starches in the grain
- Any water added to the kettle to achieve the target pre-boil wort volume
- Any water added after the boil, either to the kettle or the fermenter, to achieve the target post-boil and fermenter volumes

Some of these values can be calculated from the recipe and brewing method, while a number of them are derived from the relationships among values, and still others are measured empirically based on the specifics of the equipment and brewing system. The last group includes the volume of liquid left in the various vessels, lines, chiller, pump, etc. Those values that depend on relationships are the boiling losses and any "top-off" water added to the kettle or fermenter. The remaining values, the volumes of strike water, water absorbed by the grain, any additional mash infusions and the sparge water, can be calculated from the recipe. I'll provide those formulas shortly.

Trial and no error

Once you have extensive experience with a single brewing system, you should be able to estimate equipment losses (liquid left in vessels, lines, etc.) with a fair degree of accuracy. Even if you have a new system, however, or if you desire maximum accuracy, you can conduct a trial using ordinary water and measure the various volumes. The water should be at about the same temperature as is used during each stage of the brewing process, because at temperatures above 38 °F (4 °C), the volume of water or wort increases with the temperature — approximately 4% between 68 °F and 212 °F (20 °C and 100 °C).

For mashing and sparging purposes, it is very helpful to know the useful capacity of the mash tun and hot liquor tanks.

Often this is not the same as the total capacity of a vessel. Dead space and other geometric considerations such as the space above the lid must be subtracted. The best way to determine the useful capacity is to measure the volume of water required to fill the vessel and then measure the volume of water drained.

Boiling losses depend on the heat source, the geometry of the kettle and the environmental conditions (mainly the temperature and any wind) during the boil. The value is typically expressed in terms of gallons (or quarts or liters) per hour. Again this can be measured during an actual brewing session, or you may wish to do a test boil with water. Measure and divide the actual volume loss by the total boil time in hours to calculate the value for a specific brewing session.

More difficult to measure is the liquid absorbed by hops and protein break material during the boil, but an estimated average value for all the recipes you brew is normally accurate enough for these purposes.

Mashing

The volume of strike water for the mash is a function of the amount of grain and the desired mash thickness. The mash thickness can vary with the recipe, the mash tun configuration, the volume of any additional mash water infusions, the sparge water volume and individual brewer preferences, but a value in the range of 1.0–1.5 quarts of water per pound of grain (2.1–3.1 liters per kilogram) is typical for homebrewers.

Therefore the formula for calculating the strike water volume is:

Strike water volume =
weight of grain * desired mash thickness

For example, for a mash thickness of 1.25 qts./lb. (2.6 L/kg) and a grain bill calling for 10 lbs. (4.5 kg) of grain, the calculated strike water volume is 12.5 quarts (11.8 liters).

The water absorbed by the grain will vary with the specifics of the grain bill, the type of malt and adjuncts and their moisture content, but an average value of 0.50 quarts per pound (1.04 L/kg) has proven to be a very reasonable assumption in most cases. In the hypothetical recipe above (10 lbs. or 4.5 kg of grain), the volume of water absorbed is 5.0 quarts (4.7 L).

In order to ensure adequate capacity of vessels for mashing and sparging, it is useful to know the total volume of the mash. The following simple formula should be rather obvious:

Total mash volume =
volume of water + volume of grain

Of course first it is necessary to know the volume that the grain displaces when mashed (which is different from its dry volume). Once again this depends on the specifics of the grain bill, but a value of 0.32 quarts per pound (0.67 L/kg) is a reasonable average. Therefore, in the example above, the mash volume is 12.5 + 3.2 = 15.7 quarts (14.8 L).

Sparging

Calculating the correct volume of sparge water is of particular importance because it greatly determines the wort pre-boil volume, which is critical to achieving the target original specific gravity. An old very general rule of thumb is to use approximately two quarts of sparge water per pound of grain (4.2 L/kg), but other factors such as the mash thickness and any additional water infusions can change this considerably.

It is becoming increasingly popular for homebrewers to batch sparge, that is, to add the sparge water in one or more batches, followed by stirring the mash, allowing it to settle and briefly recirculating the runoff until it clears before draining it into the boiling kettle. This can simplify and shorten the brewing session somewhat.

A useful value to know is the volume of first runnings that are drained from the mash tun prior to adding the sparge water. This is calculated using the following formula:

Volume of first runnings =
Strike water volume + volume of any other water added to the mash - volume of water absorbed by the grain - volume of liquid remaining in the bottom of the mash tun - volume of liquid remaining in lines or pump

In our example from the section on mashing earlier, and also using values of 1.0 quarts (0.9 L) for the liquid remaining in the mash tun and 0.25 quarts (0.2 L) for line losses, the calculated volume of the first runnings is 12.5 + 0 - 5.0 - 1.0 - 0.2 = 6.3 quarts (11.8 + 0 - 4.7 - 0.9 - 0.2 = 6.0 L).

Whether you employ continuous sparging or batch sparging, the total volume of sparge water is calculated from the target pre-boil volume by subtracting the volume of the first runnings. Therefore the formula is:

Total volume of sparge water = Target pre-boil volume - volume of first runnings

In our example, the target pre-boil volume may be 28.0 quarts (26.5 L) and the volume of first runnings is 6.3 quarts (6.0 L). Therefore the total volume of sparge water is 28.0 - 6.3 = 21.7 quarts (26.5 - 6.0 = 20.5 L). For the purposes of providing an adequate volume of sparge water, add to the calculated value the volume of any dead space in the hot liquor tank or sparge water vessel.

How many times?

If you batch sparge, in many cases the mash tun is not large enough for the entire volume of sparge water to be added in a single batch. Often more than one sparge water batch is required. The usual procedure is to divide the total sparge water required into equal batches based on the vessel's useful capacity and the volume of the mash after the first runnings are drained. The formula for calculating the number of batches required is:

Number of sparge water batches = (Volume of sparge water - volume of sparge vessel dead space) / (sparge vessel useful capacity - volume of grain - volume of water absorbed by the grain)

Then round the result up to the next whole number.

In our example, we will assume a mash tun useful capacity of 24 quarts (22.7 L). Therefore the calculations are:

(21.7 - 1.0) / (24.0 - 3.2 - 5.0) = 1.3
or (20.5 - 0.9) / (22.7 - 3.0 - 4.7) = 1.3

Rounded up to the next whole number, the result is two sparge batches.

The formula for the volume of sparge water per batch is simply the volume of sparge water divided by the number of sparge batches, in our example 21.7 / 2 = 10.9 quarts (20.5 / 2 = 10.3 L).

Putting it all together

Armed with all this information, we are able to calculate the total volume of water required for a brewing session. Reviewing the list earlier in this article, we recall that the total water needed consists of the sum of the volumes of the strike water, any additional mash water infusions, the sparge water (including any sparge water vessel dead space), any water added to the kettle prior to the boil, and any water added to the kettle or fermenter after the boil. Expressed as a formula, it is:

Total volume of water needed =
Volume of strike water + volume of any additional mash water infusions + volume of sparge water (including any sparge water vessel dead space) + any water added to the kettle pre-boil + any water added to the kettle or fermenter post-boil

Our hypothetical example had no additional mash water infusions, sparge water dead space, or water added to the kettle or fermenter either prior to or after the boil. This results in the calculation of the total water volume for the brew session as the simple addition of the strike water and the sparge water, or:

12.5 + 6.2 = 18.7 quarts
(11.8 + 6.0 = 17.8 L)

While the hypothetical calculations above have been expressed to a precision of 0.1 quart or liter, in real-world homebrewing situations you may find it necessary only to measure the volume of the actual water additions to the nearest whole unit. For the 5–10 gallon (19–38 L) batches of many homebrewers, this represents an accuracy of about 5% or less and is likely to produce meaningful and useful results.

Of course, many homebrewers detrmine their water needs by simple trial and error. The benefit of knowing how calculate water usage comes when you upgrade or modify your brewery, or buy or build a new one.

Bill Pierce's water quality article appeared in the May-June 2005 issue of Brew Your Own.

Municipal water supplies are treated to be devoid of biological activity and disinfectants are added to the water to keep it that way as it travels through the city's pipes. Before you can use your tap water, it should be treated to eliminate them.

CHLORINE AND CHLORAMINES

In the past chlorine (Cl_2) was a common disinfectant. However, chlorine is highly volatile and could dissipate from the water before it arrived in homes. In addition, chlorine would react with organic material dissolved in water to form chloroform and carbon tetrachloride, which are carcinogens. At the typical level of use, chlorine could also gave tap water a distinct "swimming pool" aroma.

For homebrewers, the positive aspect of chlorine was that it could be boiled out of water. Or, the water could be drawn into their hot liquor tank and allowed to sit overnight, which allowed enough time for the chlorline to evaporate.

These days, chloramines (NH_2Cl, $NHCl_2$ and NCl_3 - with NH_2Cl being the most prominent in tap water with a pH over 7 and $NHCl_2$ being dominant from pH 4–7) are the disinfectant of choice for most municipal water supplies. Chloramines are produced by a reaction of ammonia and sodium hypochlorite (chlorine bleach) in a dilute solution. (It is very unstable at higher concentrations.) They have several advantages over chlorine. First of all, chloramines are less likely to react and form dangerous carcinogens. Second, they are virtually odorless at the typical concentrations found in water supplies (0.5–4 ppm). Finally, they will not dissipate before reaching homes.

It is this final aspect of chloramines that makes them more problematic than chlorine for homebrewers. Letting the water sit out or boiling it will not remove these chemicals. And, if they remain in your water, they can cause off flavors in beer. There are a few ways to potentially remove chloramines — carbon filtration, reverse osmosis and treatment of the water with Campden tablets.

Activated Charcoal Filters

Carbon filters are sometimes recommended for the treatment of brewing liquor. In theory, carbon filters should work well. In practice, however, they aren't always as effective as they should be. A large carbon filter, such as an undersink model, may be adequate for chloramine removal. Smaller filters, like those that attach to faucets are not up to the task.

Reverse Osmosis

Reverse osmosis (RO) filtration greatly reduces the presence of most minerals or ions present in water. Although NH_2Cl is a small molecule that may slip through some RO membranes, most should reduce its level to an acceptable range. (When shopping for an RO filter, look on the box to see if the unit mentions chloramines.) A charcoal filter placed before the RO membrane may increase the amount of chloramines removed.

Campden Tablets

Campden tablets (sodium or potassium metabisulfite) are a sure way to remove chloramines from your water. One tablet will treat 20 gallons (76 L) of water. Draw off your brewing liquor (perhaps into your hot liquor tun) the night before and add the Campden tablet. Let the water sit overnight, covered lighty and it will be ready to use in the morning.

Testing For Chloramines

Chloramines are extremely toxic to fish and most pet stores sell cheap kits to test for it. If you have concerns about your tap water, or if your water treatment methods are removing chloramines, a test kit is a good place to start.

READER SERVICE

For direct links to all of our advertisers' Websites, go to www.byo.com

CLASSIFIEDS

APPAREL
GET YOUR BYO GEAR!
Logo shirts, sweats, hats, & lots more.
www.cafepress.com/brewyourown

BREWING EQUIPMENT
The Barley Crusher MaltMill
"Homebrewer's best friend."
Mills for the homebrewer, brew shop and microbrewer.
www.barleycrusher.com

LATEST AND BEST Homebrew Heaters now available in the U.S.! See them at www.quickheat.net E-mail us for a list of the Homebrew Shops who stock them – Dealer enquiries welcome.

PROFESSIONAL OPPORTUNITIES
Go Pro in Costa Rica
microbrewery start-up
25kL max annual production
http://hotel-tilawa.com/volcanobrew/
or contact jp@tilawa.com

SOFTWARE
BEERSMITH BREWING SOFTWARE
Take the guesswork out of brewing!
Free 21 day trial!
www.beersmith.com

SUPPLIES
DRAFTSMAN BREWING COMPANY
Don't dodge the draft!
Call today for our FREE homebrew supply catalog.
1-888-440-BEER
www.draftsman.com

MICRO DISTILLING
Stills, Flavours, All Equipment.
Ex Factory
www.spiritsunlimited.co.nz

ZYMURGY OUTFITTERS
Specializing in custom ingredient kits from the ordinary to the extraordinary for all your homebrewing adventures.
www.zymurgyoutfitters.com
(608) 835-7370

WINEMAKING
WINEMAKER BACK ISSUES
Tips, techniques and recipes from magazine issues dating back to 2001.
Call 802-362-3981 or visit
www.winemakermagstore.com

BREWER'S MARKETPLACE

ALABAMA

Werner's Trading Company
1115 Fourth St. S.W.
Cullman
1-800-965-8796
www.wernerstradingco.com
The Unusual Store.

The Wine Smith
6800 A Moffett Rd. (US Hwy. 98)
Mobile 36618
(251) 645-5554
Fax (251) 645-6446
e-mail: winesmith@bellsouth.net
Serving Central Gulf Coast Homebrewers

ARIZONA

Brew Your Own Brew
2564 N. Campbell Ave., Suite 106
Tucson
(520) 322-5049 or
1-888-322-5049
www.brewyourownbrew.com
Where the art of homebrewing starts.

Homebrewers Outpost & Mail Order Co.
801 S. Milton Rd., Suite 2
Flagstaff
1-800-450-9535
www.homebrewers.com
Free Shipping in Arizona on orders over $50.

What Ale's Ya
6363 West Bell Road
Glendale
(623) 486-8016
www.whatalesya.com
Great selection of beer & wine making supplies.

ARKANSAS

Fermentables
3915 Crutcher St.
North Little Rock 72118
(501) 758-6261
www.fermentables.com
Complete homebrew & winemakers supply

The Home Brewery
455 E. Township St.
Fayetteville 1-800-618-9474
homebrewery@arkansasusa.com
www.thehomebrewery.com
Top-quality Home Brewery products.

CALIFORNIA

Beer, Beer & More Beer Riverside
1506 Columbia Ave. #12
Riverside 92507
1-800-622-7393
www.morebeer.com
Top-quality Supplies for the Home Brewer or Vintner.

The Beverage People
840 Piner Road, #14
Santa Rosa 1-800-544-1867
www.thebeveragepeople.com
Fast Shipping, Great Service!

Brewers Discount
8565 Twin Trails Dr.
Antelope 95843
1-800-901-8859
sales@brewersdiscount.com
www.brewersdiscount.com
Lowest prices on the Web!

Doc's Cellar
855 Capitolio Way, Ste. #2
San Luis Obispo
805-781-9974
www.docscellar.com
Largest beer & wine supplier on the central coast.

The Good Brewer
2960 Pacific Ave.
Livermore 94550
(925) 373-0333
Fax (925) 373-6232
www.goodbrewer.com
Home brew and wine making supplies

Home Brew Shop
1570 Nord Ave.
Chico 95926
(530) 342-3768
e-mail: homebrushop@yahoo.com
Years of experience, advice always free!

HopTech Home Brewing Supplies
6398 Dougherty Rd. #7
Dublin 94568
1-800-DRY-HOPS
www.hoptech.com
Beer, Wine, Root Beer-Kits & Brew Supplies!

HydroBrew
1319 South Coast Hwy.
Oceanside 92054
(760) 966-1885
www.hydrobrew.com
Homebrewing & Hydroponics supplies serving the San Diego area.

Morning Glory Fermentation Supply
6601-C Merchandise Way
Diamond Springs 95619
1-866-622-9660
www.morninggloryfermentation.com
Great selection. Best quality. Awesome service!

Napa Fermentation Supplies
575 3rd St., Bldg. A (Inside Town & Country Fairgrounds)
P.O. Box 5839
Napa 94581
(707) 255-6372
www.napafermentation.com
Serving your brewing needs since 1983!

Original Home Brew Outlet
5528 Auburn Blvd., #1
Sacramento (916) 348-6322
Check us out on the Web at www.ehomebrew.com

O'Shea Brewing Company
28142 Camino Capistrano
Laguna Niguel (949) 364-4440
www.osheabrewing.com
Providing southern California with great beer!

San Francisco Brewcraft
1555 Clement Street
San Francisco 94118
(800) 513-5196
or 415-751-9338
www.sfbrewcraft.com
Low Prices, Large Selection

Seven Bridges Organic Homebrewing Supplies
325 A River St.
Santa Cruz 95060
1-800-768-4409
Fax 831-466-9844
www.breworganic.com
Certified Organic Brewing Ingredients

Stein Fillers
4160 Norse Way
Long Beach (562) 425-0588
www.steinfillers.com
brew@steinfillers.com
A nonprofit public benefit company.

COLORADO

Beer and Wine at Home
1325 W. 121st. Ave.
Westminster
(720) 872-9463
www.beerathome.com
Now Open!

Beer at Home
4393 South Broadway
Englewood
(303) 789-3676
1-800-789-3677
www.beerathome.com

The Brew Hut
15108 East Hampden Ave.
Aurora
1-800-730-9336
www.thebrewhut.com
Beer, Wine, Mead & Soda — WE HAVE IT ALL!

Lil' Ole' Winemaker
516 Main Street
Grand Junction 81501
(970) 242-3754
Serving Colorado & Utah brewers since 1978

Stomp Them Grapes!
2563 15th Street, 101
Denver 80211
(303) 433-6552
www.stompthemgrapes.com
Because making it is almost as fun as drinking it!

CONNECTICUT

Beer & Wine Makers Warehouse
290 Murphy Road
Hartford 06114
(860) 247-BWMW (2969)
e-mail: bwmwct@cs.com
www.bwmwct.com
Area's largest selection of beer & winemaking supplies. Visit our 3000 sq ft facility with class & demo areas. New grain crushing room.

Maltose Express
887 Main St. (Route 25)
Monroe 06468
In CT.: (203) 452-7332
Out of State: 1-800-MALTOSE
www.maltose.com
Connecticut's largest homebrew & winemaking supply store. Buy supplies from the authors of "CLONEBREWS" and "BEER CAPTURED"!

DELAWARE

Delmarva Brewing Craft
24612 Wiley Branch Road
Millsboro 1-877-556-9433
Fax (302) 934-1701
www.xtremebrewing.com
contact@xtremebrewing.com
Make your own great beer or wine.

FLORIDA

The Shady Lady
2475 B East Nine Mile Rd.
Pensacola 32514
(850) 436-4436
www.theshadylady.net
From bottles to books, from kits to chemicals - We have everything to brew your own!

GEORGIA

Beer Necessities
9850 Nesbit Ferry Rd.
Alpharetta 30022
(770) 645-1777
www.brewvan.com
Located North of Atlanta off of HWY 400

Just Brew It
103 Rainbow Way
Fayetteville 30214
1-888-719-4645
Fax (770) 719-0274
www.aardvarkbrewing.com
9 miles south of Perimeter on GA Hwy. 85

Wine Craft of Atlanta
5920 Roswell Rd., C-205
Atlanta 30328
(404) 252-5606
winecraftatl@bellsouth.net
Helping customers make beer and wine since 1969!

IDAHO

Your Place or Mine?
9424 N. Government Way
Hayden Lake 83864
1-800-606-6046
or (208) 762-2550
www.vintit.com
"Check us out again for the very first time."

ILLINOIS

Bev Art Brewer & Winemaker Supply
10033 S. Western Ave.
Chicago
(773) 233-7579
www.bev-art.com
Mead supplies, grains, liquid yeast and beer making classes on Premise.

The Brewer's Coop
30 W. 114 Butterfield Road
Warrenville 60555
(630) 393-BEER (2337)
www.TheBrewersCoop.com
DuPage County's LARGEST homebrew shop!

Chicagoland Winemakers Inc.
689 West North Ave.
Elmhurst 60126
Phone: 1-800-226-BREW
e-mail: cwinemaker@aol.com
www.cwinemaker.com
Personal Instruction!

Crystal Lake Health Food Store
25 E. Crystal Lake Ave.
Crystal Lake
(815) 459-7942
Upstairs brew shop - Complete selection incl. Honey, Maple Syrup & unusual grains.

Home Brew Shop LTD
225 West Main Street
St. Charles 60174
(630) 377-1338
www.homebrewshopltd.com
Full line of Kegging equipment, Varietal Honey

Somethings Brewn'
401 E. Main Street
Galesburg 61401
(309) 341-4118
www.somethingsbrewn.com
Midwestern Illinois' most complete beer and winemaking shop.

INDIANA

The Brewers Art Supply
1520 N. Wells Street
Fort Wayne 46808
(260) 426-7399
e-mail: francie.brew@verizon.net
www.brewersartsupply.com
Friendly, Reliable service in house and on-line

Co-op Corner General Store
5015 N. St. Joe Ave.
Evansville 47720
1-800-398-9214 or
(812) 423-6481
raad@warrickcountycoop.com
Beer & Wine. Brew supplier for Southern Indiana.

Great Fermentations of Indiana
5127 E. 65th St.
Indianapolis
(317) 257-WINE (9463)
Toll-Free 1-888-463-2739
www.greatfermentations.com
E-mail us at anita@greatfermentations.com

Kennywood Brewing Supply
Crown Point
(219) 765-BREW
www.kennywoodbrew.com
Visit us online. Fresh homebrewing ingredients and more!

Quality Wine and Ale Supply
530 E. Lexington Ave., Suite 115
Elkhart 46516
Phone or fax (574) 295-9975
e-mail: info@homebrewit.com
www.homebrewit.com
Quality wine & beer making supplies. 24/7 secure online ordering w/fast, safe & reliable worldwide shipping. Visit our FULLY STOCKED retail store in Elkhart for everday supplies and over 200 wine and beer kits always in stock.

IOWA

BlueStem Winery
305 Third St.
Parkersburg
(319) 346-1046
www.bluestemwine.com
e-mail: bluestemwine@mchsi.com
Brewing & Winemaking Supplies

Bluff Street Brew Haus
372 Bluff Street
Dubuque
(563) 582-5420
Fax (563) 582-5423
e-mail: jlarocks@aol.com
Complete line of wine & beermaking supplies.

KANSAS

Bacchus & Barleycorn Ltd.
6633 Nieman Road
Shawnee 66203
(913) 962-2501
www.bacchus-barleycorn.com
Your one stop home fermentation shop!

Homebrew Pro Shoppe, Inc.
2059 E. Santa Fe
Olathe
(913) 768-1090 or
Toll Free: 1-866-BYO-BREW
Secure online ordering: www.brewcat.com

Kramer's Ale-N-Vino
925 N. Kansas Ave.
Topeka 66608
(785) 232-1990
e-mail: ale-n-vino@kscoxmail.com
www.ale-n-vino.com
Not the largest, just the best. Personal service.

MARYLAND

Annapolis Home Brew
836 Ritchie Hwy., Suite 19
Severna Park 21146
(800) 279-7556
Fax (410) 975-0931
www.annapolishomebrew.com
Friendly and informative personal service; Online ordering.

The Cracked Cork LLC
19202 Poffenberger Rd.
Hagerstown 21740
(301) 791-2882
e-mail: egbowles1@earthlink.net
www.crackedcork.com
Brew on Premise and brewing supplies.

The Flying Barrel
103 South Carrol St.
Frederick
(301) 663-4491 or
Fax (301) 663-6195
www.flyingbarrel.com
Maryland's 1st Brew-On-Premise; winemaking and homebrewing supplies!

Maryland Homebrew
6770 Oak Hall Lane, #115
Columbia
1-888-BREWNOW
www.mdhb.com
We ship UPS daily.

MASSACHUSETTS

Beer & Wine Hobby
155 New Boston St., Unit T
Woburn
1-800-523-5423
e-mail: shop@beer-wine.com
Web site: www.beer-wine.com
One stop shopping for the most discriminating beginner & advanced beer & wine hobbyist.

Beer & Winemaking Supplies, Inc.
154 King St.
Northampton
(413) 586-0150
Fax (413) 584-5674
www.beer-winemaking.com
30th year! Fresh White Labs.

Modern Homebrew Emporium
2304 Massachusetts Ave.
Cambridge 02140
(617) 498-0400
Fax (617) 498-0444
www.modernbrewer.com
The Freshest Supplies, In Business for 13 Years!

NFG Homebrew Supplies
72 Summer St.
Leominster
(978) 840-1955
Toll Free: 1-866-559-1955
www.nfghomebrew.com
Email: nfgbrew@aol.com
Great prices! Personalized service! Secure on-line ordering.

Strange Brew Beer & Winemaking Supply
331 Boston Post Rd. E. (Rt. 20)
Marlboro
1-888-BREWING
e-mail: dash@Home-Brew.com
Website: www.Home-Brew.com
We put the dash back in Home-Brew!

West Boylston Homebrew Emporium
Causeway Mall, Rt. 12
West Boylston
(508) 835-3374
www.wbhomebrew.com
Service, variety, quality. Open 7 days.

The Witches Brew, Inc.
12 Maple Ave.
Foxborough
(508) 543-0433
thewitchesbrew@att.net
www.thewitchesbrew.com
You've Got the Notion, We've Got the Potion

MICHIGAN

Adventures in Homebrewing
23869 Van Born Rd.
Taylor
(313) 277-BREW
Visit us at www.homebrewing.org

Brewingworld
5919 Chicago Rd.
Warren 48092
(586) 264-2351
Brew on Premise, Microbrewery, Homebrewing Supplies
www.brewingworld.com
www.kbrewery.com

Cap'n' Cork Homebrew Supplies
16812 - 21 Mile Road
Macomb Twp.
(586) 286-5202
Fax (586) 286-5133
www.capncorkhomebrew.com
e-mail: cap_n_cork@netzero.net
Wyeast, White Labs, Hops & Bulk Grains!

Park Winery and Home Brew Supply
15320 Charlevoix
Grosse Pointe Park 48230
(313) 821-9463
Fax: (313) 821-5298
www.parkwinery.com
Beer & Wine making supplies, Wine on Premise

The Red Salamander
205 North Bridge St.
Grand Ledge
(517) 627-2012
Fax (517) 627-3167
Phone or fax your order.

Siciliano's Market
2840 Lake Michigan Dr. N.W.
Grand Rapids 49504
(616) 453-9674
Fax (616) 453-9687
www.sicilianosmkt.com
The largest selection of beer and wine making supplies in west Michigan.

things BEER
Webberville
1-800-765-9435
www.thingsbeer.com
Your Full-Service Homebrew Shop With A Home Town Feel!

MINNESOTA

Homebrewersupply.com
Minneapolis 55413
(612) 788-6160
info@homebrewersupply.com
www.homebrewersupply.com
Large Selection, low prices. Free shipping on orders over $60. Most orders shipped within 24 hours.*

Midwest Homebrewing and Winemaking Supplies
3440 Beltline Blvd.
St. Louis Park 55416
1-888-449-2739
www.midwestsupplies.com
FREE instructional video with any purchase

Northern Brewer, Ltd.
1150 Grand Ave.
St. Paul 55105
1-800-681-2739
www.northernbrewer.com
Call or write for a FREE CATALOG!

MISSOURI

The Home Brewery
205 West Bain (P.O. Box 730)
Ozark 65721
1-800-321-BREW (2739)
brewery@homebrewery.com
www.homebrewery.com
The original Home Brewery products.

Homebrew Pro Shoppe, Inc.
14 SW 3rd Street
Lee's Summit 64063
(816) 524-0808 or
Toll-Free 1-866-BYO-BREW
support@brewcat.com
www.brewcat.com
Secure On-line shopping - Complete line of beer & wine making supplies & equipment.

St. Louis Wine & Beermaking
251 Lamp & Lantern Village
St. Louis 63017
1-888-622-WINE (9463)
www.wineandbeermaking.com
The complete source for Beer, Wine & Mead makers!
Fax us at (636) 527-5413

MONTANA

Montana Home Brewing Supply
7220 Hwy 93 So.
PO Box 1142
Lakeside 59922
(406) 844-0407
e-mail: sales@mthbs.com
www.mthbs.com
Beer and wine making supplies

NEBRASKA

Fermenter's Supply & Equipment
8410 'K' Plaza, Suite #10
Omaha 68127
(402) 593-9171
Fax: (402) 593-9942
e-mail: FSE@tconl.com
www.fermenterssupply.com
Beer & winemaking supplies since 1971. Same day shipping on most orders.

NEW HAMPSHIRE

Kettle to Keg
161 Main Street
Pembroke 03275
(603) 485-2054
www.kettletokeg.com
Homebrewing supplies, tea and gifts

NEW JERSEY

Brewer's Apprentice
179 South Street
Freehold 07728
(732) 863-9411
www.brewapp.com
Online Homebrew Shopping.

Rubino's Homemade Wine & Beer Supply
2919 Route 206, Store# 405
(located at the Columbus Farmer's Market) Columbus 08022
(609) 261-8420
homebrewsupply@optonline.net
www.hamiltonhomebrew.com
Beer making equipment & ingredient kits including: Brew House, True Brew & Brewer's Best.

NEW YORK

Bottom of the Barrel
1736 Mt. Hope Ave.
Oneida 13421
(315) 366-0655
Fax (315) 363-0670
Best Little Homebrew Store Around.

E.J. Wren Homebrewer, Inc.
Ponderosa Plaza,
Old Liverpool Rd.
Liverpool 13088
1-800-724-6875
e-mail: ejwren@twcny.rr.com
www.ejwren.com
Largest homebrew shop in Central New York

Hennessy Homebrew Emporium
470 N. Greenbush Rd.
Rensselaer 12144
(800) 462-7397
www.beerbrew.com
Huge Selection, Open 7 days a week, Est. 1984

Niagara Tradition Homebrewing Supplies
1296 Sheridan Drive
Buffalo 14217
(800) 283-4418
Fax (716) 877-6274
On-line ordering. Next-day service. Huge Inventory.
www.nthomebrew.com

Party Creations
345 Rokeby Rd.
Red Hook 12571
(845) 758-0661
www.partycreations.net
Everything for making beer and wine

NORTH CAROLINA

Alternative Beverage
114 Freeland Lane
Charlotte
Advice Line: (704) 527-2337
Order Line: 1-800-365-2739
www.ebrew.com
29 years serving all home brewers' & winemakers' needs! One of the largest suppliers in the country

Asheville Brewers Supply
2 Wall Street #101
Asheville 28801
(828) 285-0515
www.ashevillebrewers.com
The South's Finest Since 1994!

OHIO

The Grape and Granary
915 Home Ave.
Akron 44310
(800) 695-9870
www.grapeandgranary.com
Complete Brewing & Winemaking Store.

Listermann Mfg. Co.
1621 Dana Ave.
Cincinnati 45207
(513) 731-1130
Fax (513) 731-3938
www.listermann.com
Beer, wine and cheesemaking equipment and supplies.

Main Squeeze
229 Xenia Ave.
Yellow Springs 45387
(937) 767-1607
www.mainsqueezeonline.com
Award Winning Brewers helping all Brewers!

The Pumphouse
336 Elm Street
Struthers 44471
1(800) 947-8677 or
(330) 755-3642
www.thepumphouse.cjb.net
Beer & winemaking supplies & more.

Titgemeier's Inc.
701 Western Ave.
Toledo 43609
Phone (419) 243-3731
Fax (419) 243-2097
e-mail: titgemeiers@hotmail.com
www.titgemeiers.com
An empty fermenter is a lost opportunity – Order Today!

The Winemakers Shop
3517 North High Street
Columbus 43214
(614) 263-1744
www.winemakersshop.com
Serving Beer and Winemakers since 1974

OKLAHOMA

High Gravity Homebrewing and Winemaking Supplies
7164 S. Memorial Drive
Tulsa 74133 (918) 461-2605
e-mail:store@highgravitybrew.com
www.highgravitybrew.com
Online ordering. Fast friendly service.

OREGON

Above the Rest Homebrewing Supplies
11945 SW Pacific Hwy, #235
Tigard 97223
(503) 968-2736
Serving Beer & Wine Makers since 1993

PENNSYLVANIA

Ben's Homebrew
327 E. 6th Ave.
Tarentum 15084
Ph & fax (724) 409-4101
e-mail: benshomebrew@gmail.com
www.benshomebrew.com
For all your home brewing and wine making needs.

Country Wines
3333 Babcock Blvd.
Pittsburgh 15237-2421
(412) 366-0151 or
Fax (412) 366-9809
Orders toll-free 866-880-7404
Online catalog at:
www.countrywines.com

Keystone Homebrew Supply
599 Main St.
Bethlehem 18018
(610) 997-0911
sales@keystonehomebrew.com
www.keystonehomebrew.com
Quality Ingredients and Expert Advice!

Keystone Homebrew Supply
779 Bethlehem Pike (Rt. 309)
Montgomeryville
(215) 855-0100
sales@keystonehomebrew.com
www.keystonehomebrew.com
Quality Ingredients and Expert Advice!

Triangle Homebrewing Supply
2100 Smallman St.
Pittsburgh (412) 261-4707
www.ralph.pair.com/triangle.html
Bringing you the BEST for less!

Wine, Barley & Hops Homebrew Supply
248 Bustleton Pike
Feasterville 19053
(215) 322-4780
winebarleyandhops@worldlynx.net
www.winebarleyandhops.com
Your source for premium beer & winemaking supplies

Wine & Beer Emporium
100 Ridge Rd. #27
Chadds Ford 19317
(610) 558-BEER (2337)
winebeeremporium@aol.com
www.winebeeremporium.com
We carry a complete line of beer & winemaking supplies, honeys, cigars and more!

RHODE ISLAND

Blackstone Valley Brewing Supplies
407 Park Ave.
Woonsocket (401) 765-3830
Quality Products and Personalized Service!

SOUTH CAROLINA

Bet-Mar Liquid Hobby Shop
736-F Saint Andrews Rd.
Columbia 29210
(803) 798-2033 or
1-800-882-7713
www.liquidhobby.com
Unmatched Value, Service & Quality Since 1968

TENNESSEE

All Seasons Gardening & Brewing Supply
3900 Hillsboro Pike, Ste. 16
Nashville 1-800-790-2188
www.allseasonsnashville.com
Shop online. Nashville's Largest Homebrew Supplier!

Brewers Corner
800 Park Ave., Suite E
Murfreesboro 37129
(615) 849-7797
www.brewerscorner.com
Middle Tennessee's source for homebrew supplies.

TEXAS

Austin Homebrew Supply
7951 Burnet Rd.
Austin 1-800-890-BREW
(512) 300-BREW
www.austinhomebrew.com
Huge online catalog!

DeFalco's Home Wine and Beer Supplies
8715 Stella Link
Houston 77025
(713) 668-9440
Fax (713) 668-8856
www.defalcos.com
Check us out on-line!

Homebrew Headquarters
300 N. Coit Rd., Suite 134
Richardson 75080
(972) 234-4411
1-800-966-4144
www.homebrewhq.com
Dallas' only home beer and wine making supply store!

The Winemaker Shop
3006 S.E. Loop 820
Fort Worth 1-800-482-7397 or
(817) 568-4700
brew@winemakershop.com
http://winemakershop.com
FREE catalog

UTAH

The Beer Nut
1200 S. State
Salt Lake City 84111
(888) 825-4697
Fax (801) 531-8605
www.beernut.com
"Make Beer not Bombs"™

VIRGINIA

HomeBrewUSA
5802 E. Virginia Beach Blvd., #115
Norfolk 23502
1-888-459-BREW
or (757) 459-2739
www.homebrewusa.com
Largest Selection of Beer & Wine Making Supplies & Equipment in Southeastern Virginia!

Weekend Brewer - Home Beer & Wine Supply
4205 West Hundred Road
Chester/Richmond area 23831
1-800-320-1456 or
(804) 796-9760
beerinfo@weekendbrewer.com
www.weekendbrewer.com
LARGEST variety of malts & hops in the area!

WASHINGTON

Bader Beer & Wine Supply, Inc.
711 Grand Blvd.
Vancouver, WA 98661
1-800-596-3610
Sign up for our free e-newsletter at www.baderbrewing.com

The Beer Essentials
2624 South 112th St., #E-1
Lakewood 98499
(253) 581-4288 or
1-877-557-BREW (2739)
www.thebeeressentials.com
Mail order and secure on-line ordering available

The Cellar Homebrew
Make your own beer & wine
14320 Greenwood Ave. N.
Seattle 98133
1-800-342-1871
FREE Catalog/Guidebook, FAST Reliable Service, 33 Years! Secure ordering online www.cellar-homebrew.com

Homebrew Heaven
9109 Evergreen Way
Everett 98204
1-800-850-BREW (2739)
Fax 425-290-8336
brewheaven@aol.com
www.homebrewheaven.com
Voted Best Online Web Site for Ordering

Larry's Brewing Supply
7405 S. 212th St., #103
Kent 1-800-441-2739
www.larrysbrewsupply.com
Products for Home and Craft Brewers!

Mountain Homebrew & Wine Supply
8520 122nd Ave. NE, B-6
Kirkland 98033
(425) 803-3996
info@mountainhomebrew.com
www.mountainhomebrew.com
The Northwest's premier home brewing & winemaking store!

Northwest Brewers Supply
1006 6th Street
Anacortes 98221
(800) 460-7095
www.nwbrewers.com
All Your Brewing Needs Since 1987

WISCONSIN

BrewCitySupplies.com The Market Basket
14835 W. Lisbon Road
Brookfield 53005-1510
1-800-824-5562
Fax (262) 783-5203
www.BrewCitySupplies.com
Secure On-Line Catalog, Superb Service, Superior Selection & Unbeatable Prices

Homebrew Market
1326 North Meade St.
Appleton 54911
1-800-261-BEER
www.homebrewmarket.com
Beer & Wine Supply Retail Store and Mail Order

House of Homebrew
415 Dousman St.
Green Bay 54303
(920)435-1007
Fax (920) 435-1008
staff@houseofhomebrew.com
www.houseofhomebrew.com
Beer, Wine, Cider, Mead, Soda, Coffee, Tea, Cheese Making.

Midstate Fermenters LLC
1425 Wisconsin Dells Pkwy, #3
Wisconsin Dells 53965
Phone or fax (608) 253-FERM
info@midstatefermenters.com
www.midstatefermenters.com
Home Brewing, Winemaking and Kegging Supplies.

Point Brew Supply
3041 A. Michigan Ave.
Stevens Point 54481
(715) 342-9535
marc@pointbrewsupply.com
www.pointbrewsupply.com
"The Feel Good Store"

WindRiver Brewing Co., Inc
861 10th Ave.
Barron 54812
1-800-266-4677
www.windriverbrew.com
FREE catalog. Fast nationwide shipping.

Wine & Hop Shop
1931 Monroe Street
Madison 53711
1-800-657-5199
www.wineandhop.com
Southern Wisconsin's largest selection of beer & winemaking supplies. 10 varieties of wine-making grapes from Mitchell Vineyard.

CANADA

SASKATCHEWAN

Paddock Wood Brewing Supplies
#B1-116 103rd Street
Saskatoon S7N 1Y7
1-888-539-3622
experts@paddockwood.com
www.paddockwood.com
Canada's largest mail order store - We've got what you need.


visit us online at www.byo.com

1776 Porter

An American Colonial-style ale

by John B. McKissack III • Vidor, Texas

If I could go back in time and brew a beer, I would go back to 1776. With what I have learned from the brewing technology of today and using what was available back then, could I brew a beer that would cause my American forefathers to raise a frothy mug of my brew and cheer? Well, I brewed just such a beer as if I had jumped into a time machine and gone back in time to 1776. I called it my "1776 Independence Porter" and I personally classify it as an "American Colonial ale" since there is no current style classification for the beers brewed by Colonial Americans in their homes.

The 1776 Independence Porter was made using ingredients, equipment and methods from the 18th Century.

I sure realized in a hurry how spoiled I am to modern conveniences. I did not have propane, a thermometer, digital scale, or my high-tech stainless brew system (which I now appreciate more than ever). It took much longer and entailed a lot more labor than what I have become accustomed to. I had to cut up a substantial pile of wood for roasting the grain, cereal mashing the ground corn, heating water and boiling the wort.

Roasting the grains

I burned down a pretty large pile of firewood to get a good bed of coals. I then took about 2 lbs. (0.9 kg) of American 6-row malted barley and put it in an iron pot, which was set on the bed of coals. I continually stirred the grains with a small wooden paddle. I did not measure time or temperature, but continued to roast the grains until they were the color I desired.

The mash

I used a small 3-gallon (11.4-L) pot and heated up about 2½ gallons (9.5 L) of water on the coals. I heated up the water until it was starting to steam just to the point of obscuring my reflection, then I poured the water into a large pail containing my grains and oats.

From my understanding, the way they judged the water temperature when brewing back then was by the amount of steam. I had read somewhere the process was to: "Bring your water to a boil and put it into the mash tun. When it has cooled enough that the steam has cleared and you can see your reflection in the water, add your malt to the tun." So, I basically used the same principle.

The cereal mash

After I had my grains mashing in, I gelatized the stone-ground corn before adding it to the main mash. I added 2 lbs. (0.9 kg) of stone-ground, all-natural corn, water and a handful of malt in the same iron pot in which I roasted the grain.

I set the pot on the coals and continually stirred the gruel until it had come to a boil and then boiled for about 20 minutes. You need to stir it continually to avoid scorching. I then poured the boiling corn mash into the pail with the main mash. I stirred it in and covered it and let it mash for another hour and a half.

The sparge

We all know that you will be leaving a lot of sugar in the grains if we don't at least rinse the grains. I guess that is why they could only expect about 40% efficiency. If I could have stayed longer I would have made a false bottom out of hammered copper and had a much better efficiency. Instead, I just strained and rinsed the grains. My efficiency was only 57%, but I am extremely happy with the resulting wort.

I ended up with about 5½ gallons (20.9 L) of wort in my brew pot before I started the boil. All the locals (back in 1776) laughed at me for making such a small batch of beer. They said they brew a barrel or two at a time. Before long the wort was boiling away and I started adding the hops. I added pure molasses the last 15 minutes of the boil. When the boil was done I removed the pot from the coals. I covered the pot and let it cool overnight.

The next morning I woke up in the here and now. I transferred the wort to my fermenter and pitched my yeast. I took a gravity reading for my record, which was 1.062 and then I added distilled water until it was 1.042. The wort really tasted great.

I fermented it at about 70 °F (21 °C) for one week in the primary and two weeks in the secondary. I must admit, it was an enjoyable experience, imagining I was brewing back in 1776 with and for our forefathers. Several members of my local brew club (Golden Triangle Homebrewers Club, in Texas) stopped by during the process, which always helps make a great day brewing even better. After the beer was in the carboy and starting to bubble, I went and hugged my stainless 3-tier brew system, then sat down with Captain Ron (my dog), rubbed his ears and told him about my adventure.

The final beer was malty with a crisp roasted coffee flavor that blended nicely with a hint of molasses. It was very rich and robust with just a hint of smoke flavor in the mix. Without diacetyl or fruity esters, the beer was very clean. Hop bitterness balanced the sweetness, leaving just enough sweetness to blend with the roasty flavor. I am sure ole George would have helped me put away a few pints of this brew.

BYO.COM bonus:
The recipe used for this 1776 Porter