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THE HOW-TO HOMEBREW BEER MAGAZINE

DECEMBER 2010, VOL.16, NO.8

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Kim Jordan, CEO of New Belgium Brewing Company, in the brewhouse on her fat tire bike

15TH BYO ANNIVERSARY

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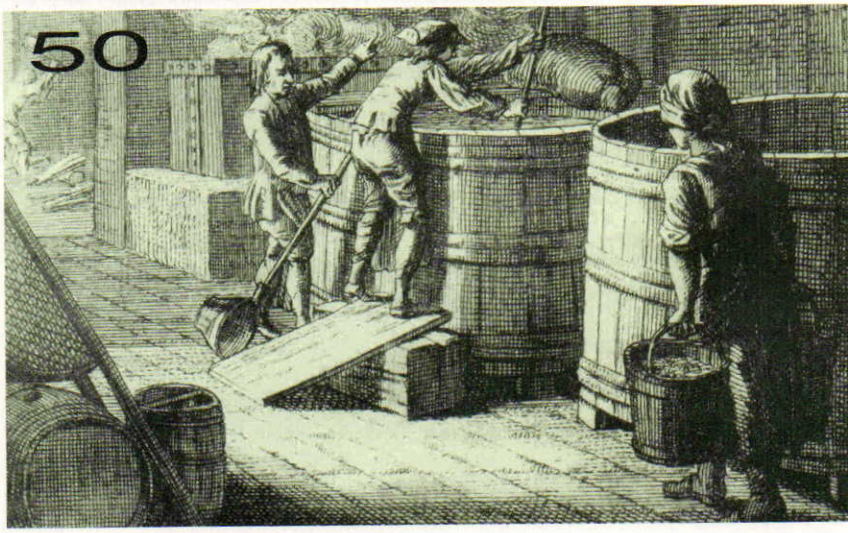

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BYO RECIPE STANDARDIZATION

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

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

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

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

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what's happening at BYO.COM

Spruce Bock

Here's a hearty holiday beer with an unusual spice — evergreen needles. Spruce tips, the new-growth of spruce trees, give a unique, characteristic flavor to beer. This flavor is not "piney" as many people suppose. Spruce tips can be found through an Internet search.
http://www.byo.com/component/resource/article/1437-spruce-bock

Video Tutorial: Specialty Grains

Learn how to use specialty grains to spruce up your favorite homebrew or brush up on what you already know. Specialty grains like black patent malt add flavor and color to your holiday homebrew recipes.
http://www.byo.com/videos/1801-using-specialty-grains

Label Galleries:

Each spring BYO offices are flooded with hundreds of homemade homebrew labels. Check out a gallery of the best of the best from our annual contest and get some ideas to enter your own label this spring.
http://www.byo.com/photos/category/1

Brew Your Own — The How-To Homebrew Beer Magazine

EDITOR
Chris Colby

ART DIRECTOR
Coleen Jewett Heingartner

ASSOCIATE EDITOR
Betsy Parks

TECHNICAL EDITOR
Ashton Lewis

INTERNS
Elizabeth Clare, Jeremy Perkins

CONTRIBUTING WRITERS
Jon Stika, John Palmer, Marc Martin, Terry Foster, Glenn BurnSilver, Kristin Grant, Forrest Whitesides, Jamil Zainasheff

CONTRIBUTING ARTISTS
Shawn Turner, Jim Woodward, Chris Champine

CONTRIBUTING PHOTOGRAPHERS
Charles A. Parker, Les Jörgensen

CANINE ASSOCIATES
Heidi, Louie

◆

PUBLISHER
Brad Ring

ASSOCIATE PUBLISHER & ADVERTISING DIRECTOR
Kiev Rattee

ADVERTISING SALES COORDINATOR
Dave Green

BOOKKEEPER
Faith Alberti

SUBSCRIPTION CUSTOMER SERVICE MANAGER
Linda Marlowe

NEWSSTAND DIRECTOR
Carl Kopf

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
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EDITORIAL & ADVERTISING OFFICE
Brew Your Own
5515 Main Street
Manchester Center, VT 05255
Tel: (802) 362-3981 Fax: (802) 362-2377
Email: BYO@byo.com

ADVERTISING CONTACT: Kiev Rattee (kiev@byo.com)
EDITORIAL CONTACT: Chris Colby (chris@byo.com)
FACEBOOK: www.facebook.com/BrewYourOwn
TWITTER: @BrewYourOwn

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Volume 16, Number 8: December 2010.

Anniversary Ale

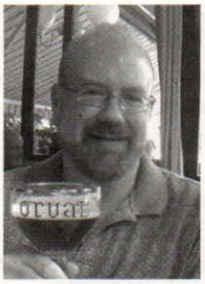
The recipe for *BYO*'s 15th Anniversary Ale (September 2010) says this is for 5 gallons. Is this 5 gallons of finished beer in the keg or 5 gallons at the end of the boil? If it is 5 gallons at the end of the boil, this would only yield about 4 gallons into the keg. Would I just boost the ingredients by multiplying them by 6/5. I usually try to brew 6 gallons at the end of the boil, leaving a half gallon in the kettle with the trub, leave a half gallon in the carboy at the end of fermentation. I am usually getting just about a full keg this way. I am planning to bottle this brew, how well does this age? Thanks for all of your help in advance.

Daniel Thompson
via email

Technically, all BYO *recipes are calculated such that the volume — which is almost always given as 5.0 gallons (19 L) — refers to the amount of wort in the fermenter. After fermentation, you would expect to lose some volume due to the yeast sediment. The total amount of volume lost would depend on a lot of variables — all the variables that determine the amount of yeast sediment and how compact it is. In addition, how much yeast sediment you transfer from the fermenter to the secondary fermenter, bottling bucket or keg will also effect your net volume.*

Knowing this, there are two approaches you can take towards brewing recipes in BYO *— you can follow the directions knowing that your final yield of finished beer will be less than 5.0 gallons (19 L), or you can make corrections to yield 5.0 gallons (19 L) of finished beer. Not sweating the fact that you've "lost" a bit of volume (compared to 5.0 gallons (19 L) being the final yield) to the yeast sediment is the simplest option.*

However, if you do want to yield 5.0 gallons (19 L) of finished beer, you have two options — a simple, less accurate method or a somewhat more complex, but more accurate method. The simple method can basically be summed up by saying, "just add a bit more water to yield approximately 5.25 gallons (19.9 L) in your fermenter, rather than the 5.00 gallons (18.9 L) called for in the recipe."



Gordon Strong is President of the Beer Judge Certification Program (BJCP), the organization that trains homebrew judges and sanctions homebrew contests that adopt the BJCP's rules. Strong led the development of the 2004 BJCP Style Guidelines and also the currently-used 2008 version. He has won numerous homebrewing awards, most notably the Ninkasi Award — the award for most points scored at the National Homebrew Competition — in 2008, 2009 and 2010.

On page 38 of this issue, Gordon gives homebrewers insight into brewing winter seasonal beers and the gift of 5 Best of Show winning recipes.

Horst Dornbusch is an international consultant to the brewing industry and writes for many beer-related publications. Horst was born in Germany, and most recently wrote about rauchbier — a smoked beer style associated with Bamberg, Germany — in our October 2010 issue. From 2002 through 2006, Horst was *Brew Your Own's* "Style Profile" columnist, combining brewing history with advice on how to brew each style.

On page 50 of this issue, Horst discusses the history of decoction mashing and the easy way to pull this technique off at home.

Michael Tonsmeire is a homebrewer and fermentation nerd living in Washington DC. He has been brewing beer for the last six years after getting his start by taking a student taught course his senior year of college. Michael is the blogger behind The Mad Fermentationist (www.TheMadFermentationist.com) where he posts about making beer as well as cheese, sake, vinegar, cider, and other fermentables. He is especially passionate about brewing sour beers, both in the tradition of classic European styles and in new directions that just might get his BJCP certification revoked. On page 28 of his issue, he discusses brewing kvass — a beer brewed from bread.

For extract brewers, just top up your fermenter to 5.25 gallons (19.9 L) instead of 5.00 gallons (18.9 L). Your beer will be slightly more dilute, but not so much that you would likely notice. For example, if you made a pale ale that would have had an OG of 1.048 and 37 IBUs of bitterness, you would actually yield a pale ale with an OG of 1.046 and 35 IBUs if you followed this method.

*If you feel you would really miss those two "gravity points" and IBUs — and really want to end up with 5.0 gallons of beer — multiply all the ingredients in the recipe by 5.25 gallons (19.9 L), then divide by 5.00 gallons (18.9 L). This includes the malts, sugars, hops, other spices and size of the yeast starter (if specified). For example, if the recipe called for 7.0 oz. (0.20 g) of chocolate malt, you would instead use [7 oz. *(5.25 gallons/5.00 gallons) =] 7.4 oz. (0.21 kg) of chocolate malt. (A spreadsheet would spare you the tedium of doing all these calculations.)*

For all-grain brewers set on obtaining 5.0 gallons (19 L) of finished beer, sparge enough so that — at the end of the boil — you end up with about 5.5 gallons (21 L) of wort. Then rack to the fermenter, aiming to yield about 5.25 gallons (20 L) of wort. (If you carry a little trub over to hit your fermenter volume, that's fine. Likewise, if you need to add a small volume of the water to the fermenter, that's fine, too.) This way, you can yield 5.0 gallons (19 L) of beer without making any alterations to the recipe. Note that your actual OG and bitterness (in IBUs) depend on your extract efficiency and hop utilization, respectively. So you can just adjust your extract efficiency to hit your OG with 5.5 gallons (21 L) of wort. Likewise, you can taste your beer and see if you need to make any adjustments based on the hop utilization to hit your target IBUs.

So, the simple method is to just add some water (knowing that your beer will be slightly more dilute). The slightly more complicated method is to multiply all your ingredients by your new fermenter volume, then divide by the old fermenter volume (for extract brewers) or fold the difference into your calculations for extract efficiency and hop utilization (for all-grain brewers).

Finally, you asked about how well our BYO *15th Anniversary Ale beer ages. All indications are that it conditions quickly, given its strength, and ages nicely for many months. Editor Chris Colby has posted one update to his blog (at byo.com) about how the beer tasted after 7 months and he will likely post about this beer again.*

Pitching in a pineapple recipe

I was reading in a recent issue of a homebrewer who was having difficulty finding a pineapple beer recipe ("Mr. Wizard," October 2010). I have an extract recipe

I've made that was pretty good. It's based on a fermented Mexican pineapple drink called Tepache, so that's what I call it. The actual beverage, if I remember, was fair, but had the unfortunate appearance of snot. I changed a few things by adding malt to the mix and came up with a decent recipe. The spices are required in the original recipe, but I offer them as an option; adding them changes it into an interesting Christmas beer. My notes are somewhat incomplete because I can't remember if I left the pineapple in the fermenter or strained them out, but I hope the homebrewer in Seattle can use the information.

Tepache
(3 gallons/11 L, extract)
OG = 1.050-1.055 FG = 1.022-1.011

Ingredients
1.4 lb. (0.64 kg) can Alexander Kicker extract
1.0 lb. (0.45 kg) amber dried malt extract
0.75 cup light brown sugar
1.0 lb. (0.45 kg) clover honey
3 AAU Cascade hops (60 minutes)
(0.5 oz./14 g of 6% alpha acids)
0.5 tsp Irish moss
6 whole cloves, (optional)
2 cinnamon sticks, about 3 in. (8 cm) long, (optional)
1 whole pineapple, peeled and chopped into large dices
1 packet of ale yeast
⅓ cup priming sugar

Step by Step
Add extracts, sugar and honey to a pot of 1.5 gallons (5.7 L) of water. Bring to a boil and add hops. Add Irish moss and spices (if using) 15 minutes before the end of the boil. After boil is over, remove pot from heat and allow temperature to drop to between 150–180 °F (66–82 °C). Add pineapple and steep for 20 minutes. Cool wort down further, transfer to carboy, top up to 3 gallons (11 L) with cool water and pitch yeast. Ferments quickly and begins to clear after three days.

J. J. Vallejo
Waukesha, Wisconsin

Thanks for sharing your recipe. Homebrew recipes containing pineapple are fairly rare, but not unheard of. (An imperial pineapple lambic won a medal at the 2003 Dixie Cup, the contest of the Foam Rangers homebrewing club of Houston.) It's good to see homebrewers coming up with interesting recipes. BYO

homebrew nation

BREWER PROFILE

Brewer: Lucas E. Szymonowski

Hometown/State: San Jose, California

Years brewing: Two

Type of brewer: All-grain

Homebrew setup: Setup includes a basic turkey fryer outdoor propane system including a 7-gallon (26-L) brew kettle, 100-quart (94-L) mash tun. Primary focus is one single-infusion, batch-sparged recipes, with an average efficiency of 70%.

Currently fermenting: Hibiscus Saison, Oktoberfest, Belgian Dark Strong Ale, Smoked Berry Wheat, Bavarian Hefeweizen

What's on tap/in the fridge: Spiced Dunkelweizen, American Amber, Belgian Dark Strong Ale and Smoked Berry Wheat.

About the brewer: It all started with Beverages and More . . . the Silicon Valley has many amazing beers. Belgian-style ales soon became a favorite, which at one point really started to add up in cost. Then The Food Network aired the infamous episode about making beer at home; one show from Good Eats with Alton Brown naturally turned into a feverish pace of extract brewing, all-grain brewing, and loads of homebrewing competitions.

Currently, I am in the process of opening a Pico-scale brewery in Sunnyvale. Tasting room should be open within the next few months! We will proudly donate 1% of all profits to help find the cure for epilepsy in addition to crafting excellent beer.

My blog/website:
www.shizmobrewery.com
shizmobrewery.blogspot.com
twitter.com/shizmobrewery

PROFILE RECIPE

Baltic Porter

(5 gallons/19 L, all-grain)
OG = 1.100 FG = 1.025
IBU = 21 SRM = 41 ABV = 9.8%

Ingredients
15 lbs. (6.8 kg) US 2-row malt
1 lb. 15 oz. (0.88 kg) Munich malt
1 lb. 8 oz. (0.68 kg) brown malt
17 oz. (0.49 kg) crystal malt (60 °L)
14 oz. (0.39 kg) crystal malt (120 °L)
14 oz. (0.39 kg) chocolate malt
3.5 oz. (99 g) Carafa® III malt
4.3 AAU Marynka hops (60 mins) (0.41 oz./12 g of 10.5% alpha acids)
4.5 AAU Marynka hops (10 mins) (0.43 oz./12 g of 10.5% alpha acids)
WLP838 (Southern German Lager) yeast

Step by Step
For better efficiency, try misting all grains prior to milling. Add 6.75 gallons (25.5 L) quarts of water to achieve a mash temperature of 150 °F (65.5 °C). Vorlauf (which is a German term for recirculation of wort through the grain bed), drain the mash tun and sparge with 2.5 gallons (9.5 L) of 168 °F (75.5 °C) water. Add water to achieve 6 gallon (23 L) boil volume.

Add Marynka hops at 60 and 10 minutes of boil. Cool to 68 °F (20 °C). Pitch 2-liter starter of yeast. Lower temps to 48 °F (9 °C) for three weeks. Lager at 38 °F (3 °C) for six weeks. Carbonate and enjoy.

The longer this beer sits, the better it gets, meaning the last glass will always be the best, which is the case for me.

byo.com brew polls

Do you brew a special beer for any of the fall or winter holiday?

No, but I would like to 40%
Yes, a few times 30%
No, I'm not interested 27%
Yes, many times 3%

what's new?

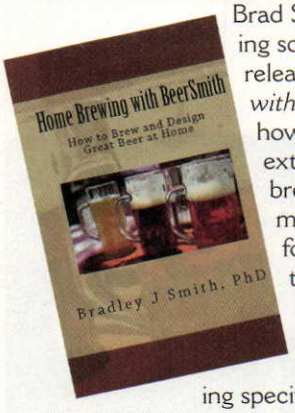
The Brewers Hardware Tri Clover RIMS Tube

Designed to maintain a constant mash temperature, the Tri Clover RIMS Tube can also be used for step mashing and also mash-out. Unlike any other RIMS tube on the market, it features all tri clover fittings for easy disassembly and cleaning.

When disassembled, you can pass a brush clean through the entire tube body. The inlet and outlet feature 1.5" tri clover ferrules which will accept barb or NPT tri clover fittings. A water heater element and temperature controller are required but not included. Your system will also require a pump.

www.brewershardware.com/Tri-Clover-RIMS-Tube.html

Home Brewing with BeerSmith



Brad Smith, author of the popular brewing software package BeerSmith, has released his new book. *Home Brewing with BeerSmith* covers everything from how to get started with a simple extract batch to the latest all-grain brewing methods, hop techniques, mashing, kegging, decoction and tips for making better beer. It also covers the most recent brewing techniques such as brew-in-a-bag, batch sparging, adjusting pH, growing hops and has three chapters on designing specific beer styles.

Brad Smith has written more than 125 articles on home brewing, wrote the top selling BeerSmith beer recipe software, and his weekly blog articles, podcast and newsletter at BeerSmith.com attract over 50,000 brewers each month.

http://BeerSmith.com

calendar

December 4
Biere de Rock - 2nd Runnings
Castle Rock, Colorado
The Rock Hopper's Brew Club presents this AHA sanctioned, Belgian and French Ale only competition open to any amateur homebrewer age 21 or older. Judging will take place at Elk Mountain Brewing.
Deadline: November 27
Entry Fee: $5
Phone: (303) 730-2151
Email: bierederock@rockhoppers-brewclub.com
Web: http://bierederock.rockhoppers brewclub.com/

December 4
Walk The Line On Barleywine Homebrew Competition
Tampa, Florida
Sponsored by the Dunedin Brewers Guild, this competition is for strong beers of all kinds, including barleywines, strong Scotch ales, imperial anything, double anything and more.
Note: Please enter your beer in the BJCP style of the base beer.
Entry Deadline: November 27
Entry Fee: $6
Phone: (727) 785-8689
Email: jimC@dunedinbrewersguild.com
Web: http://www.dunedinbrewers guild.com/

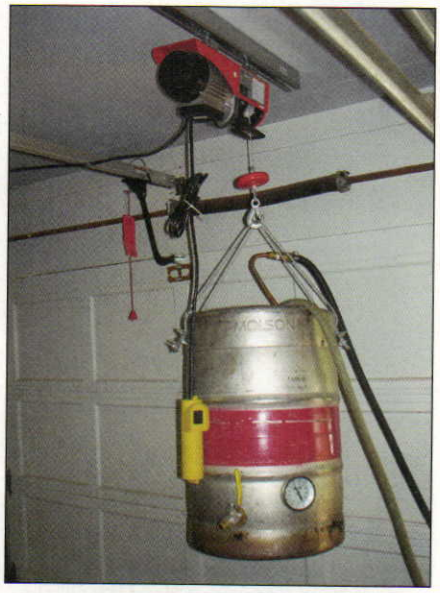
December 11
Fugetaboutit Homebrew Competition
Chattanooga, Tennessee
The Barley Mob Brewers of Chattanooga host their second annual homebrew competition. All entries will be judged according to the 2008 BJCP guidelines. Medals will be awarded to the 1st, 2nd and 3rd place beers in each category.
Entry Deadline: November 20
Entry Fee: $6
Phone Number: (423) 762-8741
Email: tony@barleymob.com
Web: http://www.barleymob.com/

> "I batch sparge so I elevate my mash tun so I can heat the wort as it's draining."

reader gadget

Kettle Lifter

Les Johnson • Eugene, Oregon



I built this setup to help move my kettles around without having to lift them. I batch sparge so I elevate my mash tun so I can heat the wort as it's draining. I can lift my kettle to the height of my mash tun to drain my mash water first so I can mash in.

Next, I lower it back down to the burner and start heating my sparge water. I then lift and drain part of the sparge water and do my first runoff. Then I move it back to burner until I am ready for the final runoff. When my wort is through boiling and I have cooled it I then lift it again to a table and drain it in to my fermenter.

To build this lift, I purchased the electric hoist from Harbor Freight Tools. I then purchased an 8-foot (2.4 m) length of barn door track and a couple of rollers. I mounted the barn door track to my garage ceiling. The rollers bolted right up to the hoist. I used some ¼-inch (0.6 cm) cable to make straps to lift my kettles with.

This has really been a back saver for me. I do lots of 10-gallon (19-L) batches so I have the keg kettles nearly full most the time.

grain profile

BLACK PATENT MALT

Black Patent Malt is the darkest of the common roasted malts. Used in low proportions, it lends a dark color without significantly impacting flavor. If used in significantly proportionate amounts it will contribute dark, roasted and sometimes harsh, astringent flavors. Overuse, however, can lead to an ashen taste. It has been often overlooked for its cousin, roasted barley, but Black Patent Malt is also used in many stouts, porters and other dark beers.

we WANT you

Share your tips, recipes, gadgets and stories with *Brew Your Own.* If we use it, we'll send you some *BYO* gear! Email our editors at **edit@byo.com**

beginner's block

DRY and LIQUID YEAST

by betsy parks

A question many brewers face when starting out is whether to use dry or liquid yeast. Some brewers prefer the convenience and variety of liquid yeast, while others prefer the shelf life and versatility of dry strains. The truth is, both types of yeasts will do a good job fermenting a batch of homebrew, as long as you know the basics.

Liquid yeast

Brewers who prefer liquid yeasts often do so because there are a greater variety of liquid strains available for sale, which allows brewers to brew more specific to a beer style. For instance, if you wanted to brew a Belgian-style wheat beer, you might choose something like Wyeast 3942 (Belgian Wheat) or White Labs WLP410 (Belgian Wit). Liquid yeast strains are most commonly sold three ways: vials that are ready to pitch (White Labs), "smackpacks" with activators (Wyeast) and slants, which are small tubes containing a small amount of yeast and some type of yeast food.

Liquid yeasts sometimes need to be prepared as starters before pitching them into a batch of wort, especially if you buy it as a slant, as they don't yet have a large enough cell count to fully ferment a full batch of beer. A yeast starter will build up the yeast cell count before adding the yeast to the wort. One of the most common mistakes homebrewers make is not pitching enough yeast, which can cause off flavors and other flaws, so it is always better to have a healthy population of yeast right from the start. This is especially important for higher gravity beers. For more information about making a yeast starter, go to www.byo.com/component/resource/article/1088.

Dry yeast

Dry yeast is great for brewers who don't mind a less beer style-specific strain or need a yeast with a specific flavor profile, such as the aforementioned Belgian-style wheat, or for high-gravity beers. Dry yeast can also be stored longer than liquid strains (if stored properly), and often contain more yeast cells than liquid packages.

The caveat with dry yeasts, however, is that they need to be rehydrated before pitching. Many new brewers, sometimes actually following the instructions given in a recipe or with a kit, sprinkle the dry yeast on top of the wort. Unfortunately, skipping rehydration can kill nearly half of the yeast cells, (according to Chris White and Jamil Zainasheff in their new book *Yeast: The Practical Guide to Fermentation*), which will result in beer that suffers from signs of underpitching, much the same as the problems with not pitching enough liquid yeast as mentioned above.

Most brand-name, brewing-specific dry yeasts will come with recommendations for rehydrating, but if for some reason yours didn't, the general procedure is to mix one or two packets of room-temperature yeast with warm water (95–105 °F/35–41 °C). Allow the mixture to sit for 15 minutes and then gently stir to form a cream. Let the yeast rest again for about five minutes, then slowly adjust the temperature to within 15 °F (8 °C) of the wort temperature and pitch.

Also, for the best rehydrating results, either pre-boil the water used to mix with the yeast, or use a sanitary-sourced water — such as distilled or reverse osmosis — when making starters, and be sure to cover the starter (plastic wrap works well) while letting it rest to keep air and microbes out while rehydrating.

by marc martin

DEAR REPLICATOR,

TWO YEARS AGO MY WIFE DECIDED TO PLAN AN ANNIVERSARY GETAWAY FOR US DRIVING THE BACK ROADS OF EASTERN PENNSYLVANIA. ONE OF MY FAVORITE TOWNS OF THE TRIP WAS SELINSGROVE WHERE WE STAYED AT THE SMALL SELINSGROVE INN. IT WAS RIGHT ACROSS THE STREET FROM THE SELIN'S GROVE BREWING CO. AND IT WAS HERE THAT I FOUND MY ALL-TIME FAVORITE BEER FOR WINTER: SHADE MOUNTAIN STOUT. I HAVEN'T HAD ANOTHER STOUT THAT COMPARES TO THAT ONE, AND WITH WINTER COMING I AM HOPING YOU CAN HELP ME WITH A RECIPE.

DAVID UBANICEK
SYRACUSE, NEW YORK

My call to the Selin's Grove Brewing Company was answered by Heather McNabb who, together with her husband, Steve Leason, make up the backbone of the business. This is one of those stories of grassroots homebrewers fulfilling their dream of brewing on a commercial scale. The first beer that they can recall brewing was in college in the mid 1980s, which was a lagered stout. Stout is one of their favorite styles and this could well have been the precursor to the present Shade Mountain Stout.

Their love of beer and a trip to Colorado landed them on the steps of the burgeoning New Belgium brewery. Looking for new adventure, they both accepted jobs at New Belgium. Steve held several positions and advanced from bottling all the way up to brewing. Meanwhile, Heather worked in both the final filtering and cellering departments.

In 1996, armed with more than just homebrewing experience, the opportunity to move back east and open a brewpub presented itself. Heather's parents owned a property in the heart of Selinsgrove. The almost 200-year-old stone building, which is on the National Historic Registry, had originally been the governor's mansion for Pennsylvania's third governor, Simon Snyder. The basement served as a perfect location for the original brewery and a tiny kitchen supplied a limited menu.

Steve produces his beers on a commercial 8.5 barrel system housed in a 1930s four bay block garage on the property. Sometimes he has to brew two times per week to satisfy the demand. He reports that total output this year should top 400 barrels.

Shade Mountain Stout, which is 100% organic, definitely meets the style guidelines for a true oatmeal stout. The aroma exhibits roasted grain characters followed by coffee and chocolate notes. A rich, light brown head tops the nearly opaque liquid and holds all the way to the bottom of the glass. The flavor exhibits a smooth roast grainy profile combined with chocolate and a slight nuttiness. The high percentage of oats contributes to a full bodied mouthfeel and silky smoothness. A higher temperature and somewhat thick mash produces a slightly sweet finish. The one hop addition serves to be just enough to balance the residual sugars.

Now David, you can satisfy your thirst for this excellent stout because you can "Brew Your Own." For further information about the brewery, visit the website www.selinsgrovebrewing.com or call them at 570-374-7308. BYO

Selin's Grove Brewing Shade Mountain Stout clone

(5 gallons/19 L, extract with grains)

OG = 1.054 FG = 1.015
IBU = 33 SRM = 39
ABV = 5.1%

Ingredients

3.3 lbs. (1.5 kg) Briess light, unhopped, malt extract
1.5 lbs. (.68 kg) light dried malt extract
5 oz. (.14 kg) crystal malt (60 °L)
7 oz. (.19 kg) chocolate malt (350 °L)
13 oz. (.36 kg) roast barley (450 °L)
1 lb.10 oz. (0.73 kg) flaked oats
11 oz. (.31 kg) crystal malt (20 °L)
3 oz. (85 g) Carapils® malt
9.9 AAU Challenger pellet hops (1.2 oz./34 g of 8.25% alpha acid) (60 min.)
½ tsp. yeast nutrient (last 15 minutes of the boil)
White Labs WLP 013 (London Ale) or Wyeast 1028 (London Ale) yeast
0.75 cup (150g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 1.5 gallons (5.6 L) of water at 156 °F (69 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the liquid and dry malt extracts and bring to a boil. While boiling, add the hops, yeast nutrient as per the schedule. Now add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

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

Winter Warmer

Cold weather seasonals

by Betsy Parks

WHILE NOT EVERYONE LIVES WHERE THE WEATHER GETS COLD, ALL BREWERS CAN APPRECIATE A BEER THAT CAN BE ENJOYED ON A CHILLY NIGHT BY THE FIRE. THIS TIME OF YEAR, WINTER WARMERS AND SEASONAL ALES COME OUT IN FORCE. IN THIS ISSUE, TWO SEASONAL-ALE LOVING BREWERS TALK ABOUT TIPS FOR MAKING A WINTER ALE.

K9, our winter seasonal ale, changes every year. This year we experimented with the new Cara Brown® malt from Briess, so the emphasis is more on malt character. Every year we try to keep it balanced, but this year it is definitely malt-focused. In addition to the Cara Brown®, we used three kinds of Munich malt, plus a little bit of crystal with our base 2-row. It's got a real nice graham cracker flavor to it. People who have tried it have asked if it was spiced, but it has no spice in it.

This year's K9 is a also little darker and a bit less hoppy — around 30 IBUs. It is around 7% alcohol, with a nice dark tan color — kind of like George Hamilton.

My preference in winter warmers has always run all over the board, but I have always liked Rogue's Mogul Ale, which is dark, malty and hoppy — very Pacific Northwest-style. I also like Sierra Nevada's Celebration, which is lighter with lots of hops.

Our beer changes recipes every season — some years we emphasize malt. We try and take advantage of the wealth of raw materials, but we play around with the malts the most, and I like to play with malt a lot with winter seasonals.

We try to keep our winter ales in the 6.5 to 7 percent ABV range and in the dark tan to a light amber color — this year's ale is more brown than red. We even change up the yeasts, which has a big impact on the beer. For instance, we've used lager yeast, English ale yeast and so on.

Hops are also a lot of fun — I usually try a new hop or mix different regions of hops that normally wouldn't get used together, such as mixing traditional German hops with English hops. With a winter warmer we have a tendency to mix and match. The one ingredient I don't play with much is spices. I tend not to use them much myself as a personal preference, although I've tasted many beers that are spiced that I like.

When brewing a winter seasonal, I think brewers make mistakes most often by going overboard on certain ingredients, which brings the beer out of balance. For example, I've had some beers that were way overspiced. I've also had some of these beers that have had such emphasis on malts that they were sticky sweet. You need to balance it out.

If you go heavy handed on something for emphasis, that's great, but remember to also go somewhat heavy handed on everything else in the beer to keep it in balance.

If you are thinking about brewing a winter warmer at home, try experimenting a little before committing to a full batch of winter brew. Make a 5-gallon (19-L) batch of wort and then separate it into five 1-gallon (3.8-L) containers. Then you can try something different in each of the small batches, such as dry spicing or spice additions when the wort is hot but not boiling, changing dry hops or yeast, or even add fruit in the secondary (a little fruit in a malty beer gives a nice layer of complexity). When you come up with a combination you like, you can then scale it up to 5 gallons (19 L).

"If you go heavy-handed on something for emphasis, that's great, but remember to also go somewhat heavy handed on everything else in the beer to keep it in balance."

Bob Malone, Brewmaster at Flying Dog Brewery in Frederick, Maryland. Bob has brewed professionally for seventeen and a half years. He is a graduate of the Siebel diploma course and a member of the Institute of Brewing & Distilling. He brewed in Japan for seven years and worked in the US from the Pacific Northwest to the Mid-Atlantic, with stops in between.

John Lyda, Brewmaster and Vice President at Highland Brewing Company in Asheville, North Carolina. John started his career with a homebrewing kit he purchased from a church rummage sale. A Siebel graduate and Asheville native, John has been with Highland since its inception.

Our winter seasonal, Cold Mountain Winter Ale, is roughly based on a brown ale with various spices and fruit flavors added. Without the spices and flavors, you would notice a hole in the overall profile of the base beer.

The hop rates in Cold Mountain are low in terms of bitterness as well as aroma with the spices filling in for them. We also intentionally leave in some diacetyl to help with the overall roundness of the beer.

I like winter seasonals that are malty with a slight warming effect from around 7–8% alcohol and with just a hint of spices. More importantly, I prefer to drink a winter seasonal that is balanced with subdued aromas and flavors that keep the drinker guessing what spices have been added.

I do not brew Cold Mountain to emulate a particular style. Instead, I formulate it with the balance of flavors between the malt, hops and spices in mind. The thought process was that particular grains would complement — or in some cases contrast — with certain spices. I also choose hops with spicy or piney characteristics to enhance particular spices. I brewed this by envisioning the beer I would like to drink sitting in front of a fire on a cold winter day.

In formulating a winter seasonal, my first suggestion would be to use darker grains with caramel notes and definitely some cinnamon, cranberry and some sort of nut flavor. For hops, I would include some Hallertau for spiciness and an American hop variety for a hint of pine aroma.

One way we experiment with this style in the brewery is to split up the base beer and add different types and amounts of flavors/spices to see which work well with one another.

Common mistakes I've noticed when brewing a winter seasonal include being too heavy handed with the spices or other flavors, thus creating an unbalanced beer. If you don't have to guess what flavor is in the beer, there's too much! BYO

Proper Priming

Brewing light lager, calculating ABV

by Ashton Lewis

Q I HAVE ALWAYS ADDED THE PRIMING SUGAR SYRUP TO THE BOTTLING BUCKET BEFORE I ADD THE BEER TO THE BUCKET CREATING A SWIRLING MOTION TO MIX THE PRIMING SUGAR TO THE BEER FILLING THE BUCKET. FELLOW BREWCLUB MEMBERS TELL ME THAT THEY ADD THE PRIMING SUGAR TO THE BEER IN THE BUCKET AFTER THE BEER HAS BEEN SIPHONED FROM THE SECONDARY FERMENTER. WHEN IS THE RIGHT TIME TO ADD THE PRIMING SUGAR AT THE TIME OF BOTTLING?

BRAD JOHNSON
BLAINE, MINNESOTA

A I think this is an example of "six of one, half dozen of the other." There is no "right" time to add priming sugar to the bottling bucket; both times work fine. The most important thing about handling beer after fermentation is complete is to minimize oxygen pick-up. Whatever method you choose, it is important to completely mix the priming sugar with your beer so that the sugar solution is uniformly distributed. If you don't, you can get inconsistent carbonation levels between bottles from the same batch.

You can also add the priming solution to each bottle before filling. While this takes a little extra effort it does permit a trouble-free method of getting the right amount into each individual bottle. If you have access to lab gadgets you can use a pipette to quickly and accurately measure and dispense the priming solution into your bottles before filling. If you are guessing that I am the type of guy to use lab gadgets for brewing and cooking, you're right. I've used this same method to add yeast to bottles before filling and have even used a pipette and graduated cylinder to mix large batches of bloody marys.

Since I am exposing my über geek side, I will continue on this path for a moment. The other really nice thing about using a pipette to add priming sugar to your bottles is that you can accurately and precisely do a mini-experiment to determine how much sugar is really the best amount for the beer you are carbonating. Experiments require replicates, and a 6-pack is a convenient sample for carbonation experiments . . . Why? Because beer is packaged in groups of six!

> "If you have access to lab gadgets you can use a pipette to quickly and accurately measure and dispense the priming solution into your bottles . . ."

Q IN PREPARATION FOR SPRING I WANT TO COME UP WITH A GOOD PLAN TO BREW A LIGHT LAGER BEER. WHEN I SAY LIGHT, I MEAN LOWER IN CALORIES AND ALCOHOL THAN THE AVERAGE 5% BEER. DO YOU HAVE ANY SUGGESTIONS THAT WILL HELP ME?

MIKE BROWN
VIA EMAIL

A Brewing light lagers that have very subtle flavors atop a stark white canvas is difficult. Little flaws in the recipe balance and off-flavors easily masked by bigger beers stick out like a fleck of pepper in a bowl of milk. There are a few basic tips that will help get you started and the first concerns water. The best thing to do for this style is buy reverse osmosis water from a local grocery store and add water salts to produce water with about 50 mg/L of calcium. I prefer to use calcium chloride for this type of beer

because chloride has a softer effect on flavor than sulfate. If you use calcium chloride and add 0.02 ounces per gallon (0.14 g/L) of mineral free water you will have the 50 mg/L of calcium I suggest.

The next ingredient you need to select is malt. If you are not an all-grain brewer, consider delaying this brew until you begin brewing using mashing as part of your routine. The type of malt you select is really up to you. Clearly pale-colored malt is required, but you have a pretty wide selection of pale lager malts to choose amongst. If you plan on using adjuncts you may want to use some 6-row malt in your grist bill, but many of today's 2-row malts produced from North American barley have enough enzymes to handle up to 15–20% adjunct with little problem. Light beer is not the style to start adding a bunch of special malts, but if you do want just a little color and malt flavor a dash of higher kilned pale malt, such as 10 °L Munich malt, or crystal malt can be used. Just don't get carried away with these ingredients because a little bit goes a long way.

Next is the most critical process to consider; mashing. The underlying principle to light beer brewing is the production of wort that is highly fermentable and there are two ways to achieve this goal. The easiest on paper is to add exogenous enzymes (enzymes from sources other than malt) to the mash. The best way to produce very fermentable wort, however, is by controlling the mash. Not only is this relatively easy, but it works very well. The main difference, however, is that extended mashes do not hydrolyze all of the malt starch into fermentable sugars so there is residual carbohydrate in beers using extended mashing. For this style of beer you want to have a wort gravity somewhere between 8–9 °Plato or 1.032–1.036.

The type of mash you need to use is a multi-temperature step mash. I suggest beginning your mash at about 122 °F (50 °C). This first step is used by some brewers to encourage proteolytic activity, but for this style it is just a good starting point to get your water and malt properly mixed together. A good ratio of water to malt for this style is about 3.5 parts water to 1 part malt by weight (3.5 liters water per kilogram malt or 0.42 gallons per pound). Hold the mash at your mash-in temperature for about 15 minutes and begin heating toward a target of 145 °F (63 °C). It is absolutely vital to this type of beer not to over-shoot the target temperature. A useful technique is to shut off the heating when you get to about 140 °F (60 °C) and let the mash temperature settle. Then slowly heat up to 145 °F (63 °C). Why is this so critical? Well the whole purpose of this method is to hit a temperature where both beta and alpha amylases are happy and to hold this temperature for at least two hours . . . that's right, two hours minimum! If you

want to go longer you can, but at some point the rate of change in an enzymatic reaction approaches zero as the concentration of substrate approaches zero.

This is all very easy for me to explain, but the execution is not easy because the mash cools off fairly quickly. In a commercial brewery things are controlled automatically and as the mash cools the heating jackets and mash agitator kick on and off to keep the mash temperature within a defined control range. You are going to have to do the same thing at home by carefully monitoring the mash. I think two to two and a half hours is a reasonable time to fuss over the mash.

After the long hold at 145 °F (63 °C) is over you need to heat the mash up to about 158 °F (70 °C) so that alpha amylase can reduce the size of any large starch molecules that may have survived. After a brief 10–15 minute hold, mash off at 168 °F (76 °C) and transfer to the lauter tun.

Things are pretty standard from here on out; boil for 60–90 minutes and use a modest hopping rate during the boil to target around 10–20 IBUs, depending on your personal preferences. Cool the wort down to around 50–55 °F (10–13 °C), aerate well and pitch a clean-fermenting lager yeast strain. If you pitch at a proper level (about 10–15 million cells per milliliter of wort) primary fermentation should be complete in seven to ten days. Carefully rack to your secondary and store as close to 32 °F (0 °C) as possible for about 3-4 weeks to allow the beer to naturally clear.

Q I HAVE A RASPBERRY WHEAT RECIPE WHERE I ADD RASPBERRY PUREE IN THE SECONDARY. THIS OF COURSE CHANGES THE GRAVITY OF THE BEER AND I AM NOT SURE HOW TO CALCULATE THE FINAL ALCOHOL CONTENT. CAN YOU PLEASE ADVISE?

JOHN CONRAD
RICHMOND, VIRGINIA

Unfortunately, the alcohol content of most fermented beverages cannot be calculated based on the change in specific gravity seen during fermentation for one very simple reason; not all contributors to specific gravity are fermentable. This means that it is incorrect to assume that the original gravity represents "potential alcohol" as indicated by many hydrometers. This is especially true when discussing beer because it is an absolute fact that not all sources of extract are fermentable.

If you had a solution of water and sucrose and nothing else you could indeed consider the specific gravity of the solution to be a good indicator of potential alcohol. If this solution is completely fermented the end result would be a solution of water, ethanol and a relatively insignificant amount of other fermentation by-products. Specific gravity could be used to fairly accurately determine the alcohol content of this solution of water and ethanol.

The problem with most fermented beverages is that there is more present than alcohol and water. Alcohol has a density less than water and a solution of water and alcohol has a density less than 1.000 . . . that is unless there are compounds that are denser than water, like sugars. What does this all mean? It means that you can have two beers with the same original gravity and the same final gravity that contain different amounts of alcohol. This is possible because the carbohydrate content of the beer is a third contributor to specific gravity and makes this possible, meaning that there is no real way of calculating the alcohol content of beer based on the hydrometer.

So the fact is if you want to calculate the alcohol content of beer you have to make a bunch of assumptions. For most beers that have a relatively "normal" mash you can multiply the change in °Plato by 0.4 to determine a decent approximation of alcohol by weight. If you want alcohol by volume you multiply the change in °Plato by 0.5. So for the fruitless beer you brewed the beer started at 13° Plato (1.054 SG) and finished at 3.50° Plato (1.014). That's a drop of 9.5° Plato and corresponds to about 4.75% by volume using this method.

Adding sugar (like fruit puree) after the beer is fermented gets a little messier because you are no longer measuring the specific gravity in the absence of alcohol. I would determine how much sugar by weight I am adding and convert this sugar weight to alcohol (1 gram of fermentable sugar yields 0.51 grams of alcohol), then add this alcohol yield to the weight of alcohol in my beer and then run another calculation to determine the blended alcohol concentration. BYO

German Pilsner

Clean, crisp and dry

by Jamil Zainasheff

German Pilsner recipes seem so simple, but brewing a perfect example is a challenge that many brewers never master. A big part of the challenge is getting a dry, crisp finish to the beer.

Historically, German Pilsner was an attempt to copy Bohemian Pilsener. German Pilsner is crisper and drier with a sharper bitterness that tends to linger in the finish. It is also more highly attenuated and lighter in body and color, having a medium-light body and ranging from pale straw to light gold in appearance. The malt character is evident as a light Pilsner grainy flavor and aroma. Hop character is a mix of floral and spicy noble hops, usually ranging from low to moderate. The fermentation character is clean, and very low in esters.

I would never attempt to make a German Pilsner without using continental Pilsner malt. You can use other pale malts if you have no other option, but the light, grainy taste of high quality Pilsner malt is right on target for this style and it is the only malt you need for a great German Pilsner. You can add head and body forming dextrin malts such as Carapils® or Carafoam®, but keep these between 0 and 10% of the grist.

Extract brewers should use a Pilsner-type extract that attenuates at least 75% or more. Most light colored extracts will attenuate fairly well and should be close enough. Those made from continental Pilsner malt would be the best choice, but there are several good domestic Pilsner or Pilsner-like extracts out there. Even if using an extract with a lower fermentability, the most important thing is to ferment it to the maximum extent possible.

Perhaps, historically, a brewer would use a decoction mash when brewing German Pilsner, but I find that high quality continental Pilsner malt and a single infusion mash will produce a beer every bit as good as the best commercial examples. It is more important to invest time and effort in fermentation, sanitation and post fermentation handling than decoction. To ensure alpha amylase has also completed its work, you can include a short additional rest at 154 to 158 °F (68 to 70 °C).

For a single infusion mash, target a mash temperature range of 147 to 150 °F (64 to 66 °C). If you are making a lower gravity beer, use the higher end of this temperature range to leave the beer with a bit more body. Keep in mind that lower mash temperatures need longer to convert than high mash temperatures. The first few times you make a beer like this, test your mash for conversion and extend your mash until you are confident conversion is complete.

In this style, hop flavor and aroma should always be present and can range from low to high. I really like using German grown Hallertau hops for flavor and aroma, though sometimes they are hard to source. Other German grown hops, such as Tettnang, Spalt, Perle or Tradition, work well also. These hops when grown outside of Germany can still work well, but you should check with your supplier first if you are not sure how closely they match the German grown hops. If you cannot get any of those hops, you do have some flexibility. The trick is to select hops with that same flowery or spicy noble hop character. You do not want to use anything fruity or citrusy. Some decent substitutions are Liberty and Mt. Hood. You can also try Crystal, Ultra and Vanguard. It is really the overall impression that matters. The big picture is that you want moderate hop character and a firm bitterness, but both should complement and integrate well with your malt and yeast choices. The balance of bittering versus malt sweetness should always be to the bitter side. You want a firm bittering presence, one that is obvious, maybe even sharp, but not harsh. The bitter-

Continued on page 21

german pilsner by the numbers

OG:	1.044–1.050 (11–12.4 °P)
FG:	1.008–1.013 (2.1–3.3 °P)
SRM:	2–5
IBU:	25–45
ABV:	4.4–5.2%

German Pilsner
(5 gallons/19 L, all-grain)

OG = 1.048 (11.9 °P)
FG = 1.009 (2.3 °P)
IBU = 37 SRM = 3 ABV = 5.1%

Ingredients

9.7 lb. (4.4 kg) Durst Continental Pilsner Malt 2 °L (or similar)
6.64 AAU Perle pellet hops (0.83 oz./24 g of 8% alpha acids) (60 min.)
1.68 AAU Hallertau pellet hops (0.42 oz./12 g of 4% alpha acids) (15 min.)
1.68 AAU Hallertau pellet hops (0.42 oz./12 g of 4% alpha acids) (1 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) yeast

Step by step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 147 °F (64 °C). Hold the mash at 147 °F (64 °C) until enzymatic conversion is complete, which may take 90 minutes or more at this low temperature. Infuse the mash with near boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 6.5 gallons (25 L) and the gravity is 1.037 (9.3 °P).

The total wort boil time is 90 minutes, which helps reduce the S-Methyl Methionine (SMM) present in the lightly kilned Pilsner malt and results in less Dimethyl sulfide (DMS) in the finished beer. Add the first hop addition with 60 minutes remaining in the boil. Add Irish moss or other kettle finings with 15 minutes left in the boil. The other hop additions are at 15 minutes and 1 minute left in the boil. Chill the wort to 50 °F (10 °C) and aerate thoroughly. The proper pitch rate is three packages of liquid yeast or one package of liquid yeast in a 6-liter starter.

Ferment around 50 °F (10 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but do not rush it. Cold fermented lagers take longer to ferment than ales or lagers fermented at warmer temperatures. If desired, perform a diacetyl rest during the last few days of active fermentation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes. A month or more of cold conditioning at near freezing temperatures will improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

German Pilsner
(5 gallons/19 L, extract only)

OG = 1.048 (11.9 °P)
FG = 1.009 (2.3 °P)
IBU = 37 SRM = 3 ABV = 5.1%

Ingredients

6.83 lb. (3.1 kg) Pilsner liquid malt extract 2 °L
6.64 AAU Perle pellet hops (0.83 oz./24 g of 8% alpha acids) (60 min.)
1.68 AAU Hallertau pellet hops (0.42 oz./12 g of 4% alpha acids) (15 min.)
1.68 AAU Hallertau pellet hops (0.42 oz./12 g of 4% alpha acids) (1 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) yeast

Step by Step

I have used a number of Pilsner-type extracts. Most do an admirable job of brewing a German Pilsner. If you cannot get fresh liquid malt extract, use an appropriate amount of dried extract instead. Using fresh extract is very important to this style.

Add enough water to the malt extract to make a pre-boil volume of 5.9 gallons (22.3 liters) and the gravity is 1.041 (10.2 °P). Stir thoroughly to help dissolve the extract and bring to a boil.

Once the wort is boiling, add the bittering hops. The total wort boil time is 1 hour after adding the first hops. Add Irish moss or other kettle finings with 15 minutes left in the boil. The other hop additions are at 15 minutes and 1 minute left in the boil. Chill the wort to 50 °F (10 °C) and aerate thoroughly. The proper pitch rate is three packages of liquid yeast or one package of liquid yeast in a 6-liter starter.

Ferment around 50 °F (10 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but do not rush it. Cold fermented lagers take longer to ferment than ales or lagers fermented at warmer temperatures. If desired, perform a diacetyl rest during the last few days of active fermentation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes. A month or more of cold conditioning at near freezing temperatures will improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

ness-to-starting gravity ratio (IBU divided by the decimal portion of the specific gravity) ranges from 0.5 to 1.0, but I like to target around 0.7 to 0.8.

You can make a fine example of this style with most water, but *BYO*'s "Mr. Wizard" columnist Ashton Lewis says that making excellent very clean lagers requires very low carbonate water. He prefers to start with reverse osmosis water and adds calcium chloride to adjust to 25 ppm calcium. While that is true, I personally feel it is also important to have at least a small amount of sulfate in the water. The sulfate content of brewing water affects the perception of hop bitterness to a significant degree. Very low sulfate content results in a "soft" or "flabby" bitterness, but bitterness in a German pilsner should be firm and sharp. Adding a small amount of gypsum results in a sharper, crisper hop bitterness. Most water only requires a small amount of gypsum. If you do not know the sulfate content of your water, start with one gram of gypsum per gallon. Generally, you should never need more than two or three grams per gallon. It is usually better to add less than to add more and it only takes a small amount to accentuate hop bitterness. You can add gypsum to the mash or, if you are brewing with extract, you can add it directly to your boil kettle water before you heat it.

You can ferment German Pilsner with almost any lager yeast. My favorites are White Labs WLP830 German Lager and Wyeast 2124 Bohemian Lager, and former "Style Profile" columnist Horst Dornbusch is fond of Wyeast Danish Lager 2042. You need around 340 billion clean, healthy cells to properly ferment 5 gallons (19 L) of this beer, which is double what you would use for an equivalent strength ale. For a simple, non-stirred starter, one package of liquid yeast in 1.5 gallons (6 L) will result in the right amount of yeast. If you are not making a starter, you will need about three packages of fresh liquid yeast. Even if you have three packages of yeast, it is still prudent to make a small starter from the packages about four to six hours before pitching. This ensures that the yeast is viable and gives them a chance to get started before fermentation.

A good German Pilsner is clean and crisp and a large part of that comes from excellent fermentation practices. You should be putting at least as much effort into fermentation as you do producing the wort. The BJCP style guide mentions the presence of sulfur from fermentation and DMS from the lightly kilned Pilsner malt, but you should still strive to eliminate these flavors and aromas from your German Pilsner.

When making lagers, I like to chill the wort down to 44 °F (7 °C), oxygenate, and then pitch my yeast. I let the beer slowly warm over the first 36 hours to 50 °F (10 °C) and then I hold this temperature for the remainder of fermentation. If fermentation seems sluggish at all after the

first 24 hours, I am not afraid to raise the temperature a couple degrees more. This is similar in theory to a Narziss fermentation, where the first two-thirds of the fermentation is done cold and the final third is done warmer. The idea is to reduce the diacetyl precursor alpha-acetolactate, which the yeast create during the early phase of fermentation. Once the growth phase of fermentation is complete, it is important that fermentation be as vigorous as possible. It may never be as robust as fermentation at ale temperatures, but it is important to have enough activity to blow off aromatic sulfurs and other unpleasant compounds. Vigorous yeast activity at the end of fermentation also improves reduction of compounds such as diacetyl.

Since diacetyl reduction is slower at colder temperatures, a cold-fermented lager may require a diacetyl rest. To perform a diacetyl rest, simply raise the temperature into the 65 to 68 °F (18 to 20 °C) range for a two-day period near the end of the fermentation. While you can do a diacetyl rest after the fermentation reaches terminal gravity, a good time for a diacetyl rest is when fermentation is 2 to 5 specific gravity points (0.5 to 1 °P) prior to reaching terminal gravity. Brewers ask how they should know when fermentation has reached that stage. My advice is to raise the fermentation temperature for a diacetyl rest as soon as you see fermentation activity significantly slowing. It will not hurt the beer and it should help the yeast reach complete attenuation as well.

It seems that every beer improves with some period of cold conditioning and German Pilsner is no exception. Traditional lager conditioning utilizes a slow temperature reduction before fermentation reaches terminal gravity. The purpose of the slow cooling rate is to avoid sending the yeast into dormancy. After a few days, the beer reaches a temperature close to 40 °F (4 °C) and the brewer transfers the beer into lagering tanks. If you want to use this technique, you will need precise temperature control so that fermentation slowly continues and the yeast remains active. Rapidly chilling the beer near the end of fermentation can cause yeast to excrete a greater amount of ester compounds instead of retaining them.

Personally, I prefer to wait until fermentation is complete, including any steps such as a diacetyl rest, before lowering the beer temperature. The yeast is far more active and able to reduce fermentation byproducts at higher temperatures. Once I am certain the yeast have completed every job needed, I use a period of cold storage near freezing. This time in storage allows very fine particulates to settle out and the beer flavors to mature. In any case, great lagers take time, so do not rush things. BYO

Jamil Zainasheff is the host of "Can You Brew It" and "Brew Strong," both found on The Brewing Network *(www.thebrewingnetwork.com).*

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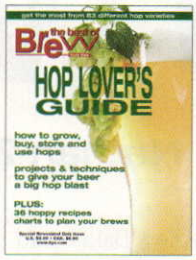

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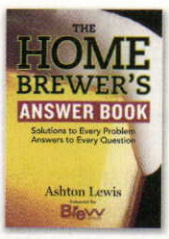

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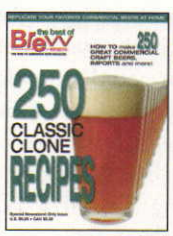

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The brew that (literally) puts the bread in "liquid bread"

INTEREST IN KVASS,

a staple of Russian life, is rising here in North America.

KVASS REVIVAL

Story and photos by **Michael Tonsmeire and Nathan Zeender**

"Can we brew something weird?" It was with those simple, prophetic words from Tom Baker, present brewer and owner of Earth Bread + Brewery in Philadelphia, to Scott Smith, brewer and owner of Pittsburgh's East End Brewing Co., that our current story of the brewing oddity that is kvass begins. In the summer of 2006 Baker was winding down his days at his cult label Heavyweight Brewing Co., where he gained a reputation for brewing unique and boundary pushing beers, when Smith made a pilgrimage to the last open house for the soon to be shuttered brewery. The two creative brewers share an admiration for arcane beer recipes and wordplay, which led Smith to cavalierly offer Baker the opportunity to travel to Pittsburgh to guest brew a batch at East End.

The ever daring Baker had gotten the inspiration for brewing a kvass from Randy Mosher's *Radical Brewing*, a literary exploration of archaic beer styles. The appropriately named Mr. Baker, a confirmed bread geek, to that point had only homebrewed a single 5-gallon (19-L) batch of kvass. Peggy, his wife, and Earth Bread partner, remembered this brew with no rosy adjectives.

So in the winter of 2006, Mr. Baker arrived at East End and instigated an enduring fascination with kvass in Smith. For the guest brew, Smith commissioned 30 loaves of stale rye bread from the nearby Wood Street Bread Co., and owner Bill Bartelme was only too happy to oblige. The resulting 3% ABV beer was fermented with East End's house ale strain.

Happy with the success of their initial effort, the two brewers collaborated on a second kvass, this time fermented with bread yeast on Baker's recommendation. This change added a welcome rustic charm to the finished beer. Smith has continued a regular series of kvasses employing bread yeast under his Session Ale line: an ambitious project to brew a vast array of flavorful beers at less than 4.5% ABV.

KVASS: A PRIMER

Kvass, from the Russian word meaning to leaven, is a millennium old, low alcohol (generally between 0.5 and 2.5% ABV) folk beer brewed from stale bread. An ingenious use for unpalatable leftover bread, the carbohydrate rich sustaining drink is widely touted as a probiotic health drink and vodka hangover cure. Traditional kvass is fermented either with bread yeast or spontaneously with wild yeast, and usually consumed within a matter of days, as bacteria quickly acidify the beer – a turn favored by some devotees.

Kvass is a staple of the traditional foodways of Russia and Eastern Europe that crosses cultural and class divides – a point of national pride. Pushkin rated Russians' need for kvass equal to their need of air for breathing, and the works of Tolstoy, Chekhov and Dostoevsky often cited kvass. As an alliteration and possible derivation, in Norse mythology, Kvasir was the all-wise poet-god whose blood was distilled and used to ferment honey into mead.

Traditional kvass is a true peasant beer that covers a genus of recipes that include stale bread, along with cereal grains, fruits, vegetables, various herbs and/or spices. For ages kvass was a strictly domestic product with endless local variants; for example beet kvass is common in the Ukraine and horseradish kvass is popular in the Urals.

It is important to make a clear distinction between traditional kvass and modern, commercial kvass. The kvass you might find today on the shelf at a Russian specialty store is an unfermented sweet soft drink, sharing little in common with its namesake. To find a true descendant of traditional kvass in America you need look no further than East End Brewing.

KVASS À LA EAST END

In the Summer of 2010, Scott Smith invited both of us to join him to brew and document his current batch of kvass. Smith was a longtime homebrewer before opening East End Brewing in 2004 and that spirit still pervades his operation. In addition to his year round beers, Smith is constantly brewing innovative and experimental beers with abandon, a sense of humor and not a trace of pretension.

The recipe for East End's Wood St. Kvass includes 60 loaves of stale rye bread, supplemented with a mash of Pilsner malt, brown malt for toasty bread crust flavor and rye malt for character. Smith also added enough caraway seeds (the dominant flavor in so many rye breads that it has become synonymous with the grain) to the boil to impart their distinct warm aroma into the beer. As with adding any spices to beer, it is a balancing act to get the spice to come through without trampling over the other beer flavors or the beverage's drinkability.

Brewing kvass on a production scale offers numerous challenges and impracticalities. Our work on the batch started the night before brew day with picking up stale rye bread from the Wood Street Bread Co. That night we sliced the bread into large chunks and then mixed it with roughly 1 gallon (3.8 L) of 190 °F (88 °C) water per loaf in a modified hopback where it sat undisturbed overnight to give time for the bread to hydrate.

On brew day morning we returned to the brewery for mash in. When the mash was converted, we turned our attention to the bread which had disintegrated into a thick doughy mass. We took turns forcing the liquefied bread through the metal grate at the bottom of the hopback and into the boil kettle. This thick, starchy substance is what brewers usually try to avoid getting into their boil, but we were watching gleefully as chunks of bread goo shot through the sight glass. Smith pumped the runnings from the mash in with the liquefied bread, creating a turbid kettle liquor.

If the bread wasn't enough of a clue that what we were brewing was out of the usual, the hop schedule was a dead giveaway — just 7 oz. (200 g) of low alpha-acid Styrian Goldings in 11 barrels — approximately a single IBU in 341 gallons (1,290 L) of beer.

Along with this meager hop addition, we added one pound of caraway seeds, pulverized in a coffee grinder. After a short 30 minute boil, followed by whirlpool and heat exchange, the wort was ready for fermentation.

Smith had discovered when he aged a previous batch of kvass, the brew took on an up-front and complementary lactic sourness. To replicate that character with a portion of the batch we helped on, he chose to pump 140 gallons (530 L) of the thick wort up to the attic of the brewery for fermentation and souring in two long-used oak barrels. A warm primary fermentation in porous oak encouraged a mixed fermentation with wild yeast and acid producing bacteria. Smith intends to age the barrel fermented portion for 6–12 months before releasing the beer under the name Debaser, a direct reference to the opening track on the Pixies 1989 album Doolittle and also, "a terrible pun about the incredible acidity of the beer."

The remainder of the wort was transferred into a standard cylindroconical tank for fermentation. A modest two tablespoons of Red Star active bread yeast was rehydrated in warm water and pitched for the entire batch – about the number of cells required to ferment 5 gallons (19 L) of barleywine.

KVASS AT HOME

With all the valuable knowledge gleaned from our time brewing at East End, we returned home with ideas of what kvass could be in the homebrew environment.

For our first kvass, we scaled the recipe directly from East End's brew sheet and used a loaf of home baked rye bread. Active fermentation was swift and complete in just a few days at warm temperatures to encourage lactic acid production. The result was a spritzy, lactic and thirst quenching beer with a hint of caraway.

For our second iteration, we took inspiration from the folk beers of Scandinavia to create a winter kvass, with smoked malt, fresh spruce clippings and dried elderberries. Whereas the East End's kvass is a perfect summer beer, we sought to make a kvass for the cooler months. As a baseline for this more robust brew, we used a dark pumpernickel bread, but again fermented warm with bread yeast.

We landed on a more accessible option for our third variation, a hybrid

brown porter-kvass fermented with beer yeast. English porters historically got their bread crust character from brown malt. By adding a loaf of pumpernickel bread as well, we aimed to enhance this character. We also increased the hopping rate and fermented this kvass with an ale yeast to prevent souring.

These three beers are just the beginning of the flavors we can play with in kvass. Let it be an arena of the imagination — think black bread, honey, juniper berries, ferment with a sourdough starter, etc...

(IM)PRACTICALITIES OF BREWING KVASS

Adding liquefied bread to a batch of beer brings its drawbacks and challenges. The flour tends to settle on the bottom of the kettle as the beer comes to a boil and can scorch if stirring is neglected for even a few minutes. Flour also adds starches which are unfermentable by beer yeast, but which can be consumed by wild yeast and bacteria.

Make sure the bread contains no added oil or fat. Whole rye and wheat add small amounts of fat to the bread but not enough to disrupt head stability. Bread yeast is the same species as ale yeast (*Saccharomyces cerevisiae*). The yeast strains marketed for bread are selected for their ability to ferment quickly. When used to produce a beer, active fermentation occurs just as rapidly with a small amount of bread yeast as it would with a standard pitch of ale yeast. Bread yeast, however, is not selected for its flocculation properties, so steel yourself for a hazy beer. Dried bread yeast is not produced under the same sanitary conditions as beer yeast, and often contains populations of both *Lactobacillus* and wild yeasts. These added microflora are not an issue when rising a loaf of bread, but when used to produce beer the odds that sour or funky flavors will develop are relatively high.

Michael Tonsmeire wrote about adding fruit to sour beers in the September 2010 issue of Brew Your Own.

bread RECIPES

No-Knead Sourdough Rye

Ingredients

7.5 oz. (213 g) bread flour
7.5 oz. (213 g) whole rye flour
1.5 tsp. table salt
1.5 tbls. whole caraway seeds
11 oz. (325 mL) filtered or bottled room temperature water
2 tbls. of sourdough starter (If you don't have a sourdough starter sub in 1 tsp. of distilled white vinegar and ¼ tsp of active dry bread yeast, avoid "Rapid Rise" or similar.)

Step by Step

Toast the caraway in a small pan over low heat until they become aromatic (2–3 min).

Whisk together the flour, salt, and caraway. In a separate bowl, dissolve the sourdough starter into the water. Combine the dry ingredients with the wet, mixing for 30 seconds or until there is no dry flour. The dough may seem a bit stiff now, but as the starch molecules hydrate the dough will become softer.

Set the dough aside in a bowl covered with plastic wrap and then a tea towel for 18–24 hours in a cool spot. You may need to adjust the rise time based on how quickly your starter (or yeast) works, the dough should double or triple in volume.

Turn out the shaggy mass of dough onto a clean, floured work surface, adding more bread flour on top. Fold the dough back onto itself a few times until it loosely resembles a ball. If the dough is too sticky to work with (it should be tacky) or if it won't hold its shape you can fold in a few additional tablespoons of flour. On a clean surface, roll the dough ball in a circle between your hands to form a smooth outer skin.

Place the loaf on a floured towel to prevent it from sticking. Cover and leave the loaf to rise until it doubles in size (1.5–2 hours). When the dough has risen, place a

cast iron Dutch oven in an oven and set it for 425 °F (220 °C). If you are using an enamel-coated Dutch oven, set the oven to 450 °F (230 °C) since the lighter/glossy surface will transfer heat at a slower rate. Once the oven is preheated, wait an additional 10–15 minutes until the Dutch oven is heated through.

Immediately before putting the loaf into the oven, you need to score the top to allow for oven spring to occur and for steam to escape. We like a few parallel cuts with a sharp knife or straight razor blade held at a 45 degree angle (⅛ inch or shallower). Place the loaf (as gently as possible) into the Dutch oven. Return to the oven to bake for 25 minutes with the lid on, then raise the temperature by 25 °F (14 °C) and remove the lid, bake until the crust is golden brown and crunchy (20–25 min). Remove from the oven to a cooling rack.

Pumpernickel Bread

Use the same ingredients and technique as for the rye, but also add:

2 tbls. light molasses
1 tbls. Carafa® Special II (ground to a fine powder in a coffee grinder)

beer RECIPES

East End Kvass
(5 gallons/19 L, all-grain with bread)

OG = 1.036 FG = 1.009
IBU = 1.5 SRM = 6.7 ABV = 3.5%
The negligible IBUs and bread yeast combine to give this beer a high chance of souring (as both we and East End have experienced). If you want to increase your chances of avoiding a sour beer you should increase the hop addition to 1 oz. (28 g) of Styrian Goldings.

Ingredients

5.5 lbs. (2.5 kg) Pilsner malt
1.0 lbs. (0.45 kg) rye malt
0.50 lbs. (0.23 kg) brown malt
0.47 AAU Styrian Goldings hops (30 mins) (0.1 oz./3 g of 4.5% alpha acids)
0.2 oz. (6 g) ground caraway (30 mins)
Bread yeast (Red Star or Fleischmann's)

Step by Step

Slice a loaf of stale rye bread and soak it in 1.0 gallon (3.8 L) of 190 °F (88 °C) water overnight. It is best to do this in a sealed cooler to retain as much heat as possible. On brew day, mash grains 60 minutes at 152 °F (67 °C).

Puree the loaf of rye bread and soaking water with a stick blender and add to the boil kettle along with the mash runnings. If you don't own a stick blender, do your best to break apart the bread with a whisk before adding it to the boil kettle. Due to the short (30-minute) boil and added bread water, make sure not to collect too much wort pre-boil.

Stir the beer as it comes to a boil to prevent scorching. Add the hops and caraway at the start of the boil. After the 30 minute boil is complete, chill to 75, aerate, and pitch ~¼ g of dried bread yeast rehydrated in a few tablespoons of warm (90–100 °F/32–38 °C) water for five minutes. Despite the small amount of yeast, visible fermentation should begin within 24 hours.

When fermentation is complete, bottle with 4.5 oz. (130 g) of sugar for medium-high carbonation.

Winter Kvass (Jul Kvass)
(5 gallons/19 L, all-grain with bread)

OG = 1.040 FG = 1.010
IBU = 0 SRM = 12 ABV = 3.8%
Fresh spruce clippings are used in place of hops for this batch. Make sure to use only the new growth spruce tips. Elderberries add a flavor similar to slightly tart raisins and can be purchased at many natural food stores.

Ingredients

3.5 lbs. (1.6 kg) Maris Otter pale malt
3.5 lbs. (1.6 kg) beechwood smoked malt
0.50 lbs. (0.23 kg) rye malt
0.50 lbs. (0.23 kg) brown malt
0.50 lbs. (0.23 kg) crystal rye
0.18 oz. (5 g) spruce tips (30 mins) (fresh new growth)
0.71 oz. (20 g) dried elderberries (0 mins) (lightly crushed)
Bread yeast (Red Star or Fleischmann's)

Step by Step

Slice a loaf of stale pumpernickel bread and soak it in 1.0 gallon (3.8 L) of 190 °F (88 °C) water overnight. On brew day, mash grains 60 minutes at 152 °F (67 °C). Puree the loaf of pumpernickel bread and soaking water with a stick blender and add to the boil kettle along with the mash runnings. Due to the short boil and added bread water make sure not to collect too much wort pre-boil.

Stir the beer as it comes to a boil to prevent scorching. Boil for 30 minutes with the spruce added at the start and the elderberries added at the end. Pitch 1 gram of bread yeast rehydrated in a few tablespoons of warm (90–100 °F/32–38 °C) water for 5 minutes.

Without the protection of hops this beer will likely develop a lactic acid character as it ages. It can be drunk young, but additional aging is recommended to give a chance for the disparate flavors to come together.

After fermentation is complete, rack to secondary and allow approximately 3 months for the beer to sour. When the gravity stabilizes bottle the beer with 3.5 oz. (99 g) of sugar for a moderate level of carbonation.

Pumpernickel Brown Porter
(5 gallons/19 L, all-grain with bread)

OG = 1.042 FG = 1.010
IBU = 15 SRM = 22 ABV = 4.1%
This recipe was brewed with a solid dose of hops and was fermented with American ale yeast to ensure that it did not sour. The grain bill echoes the recipe for the pumpernickel bread. If desired, caraway and/or molasses can be added for additional layers of flavor.

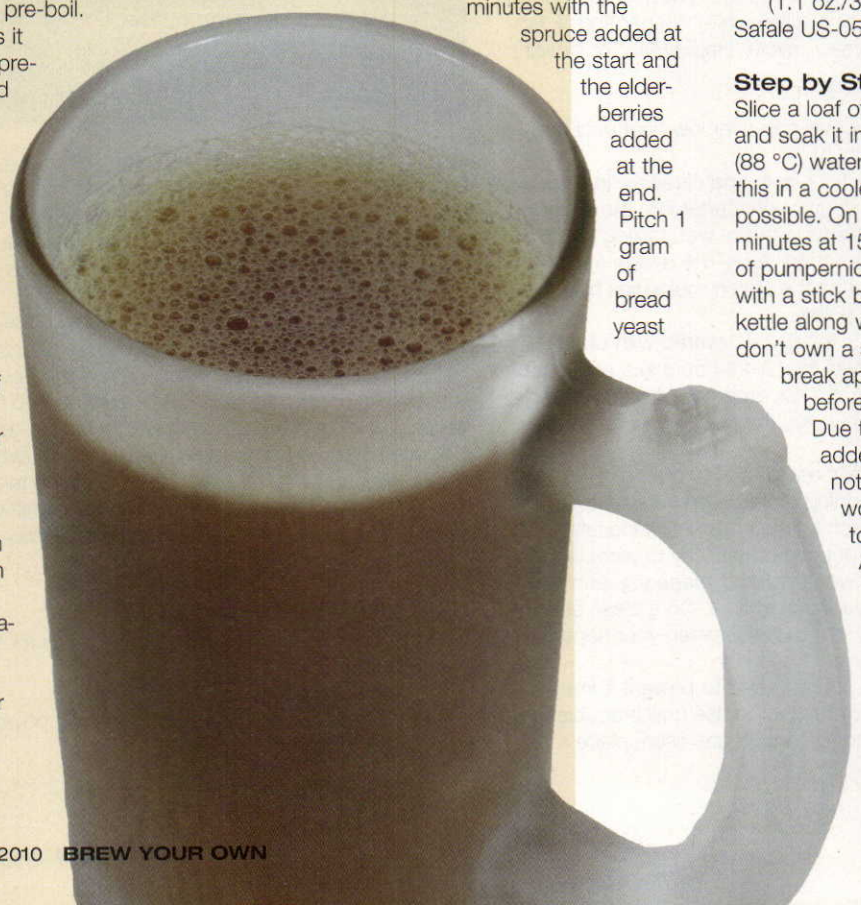
Ingredients

6.5 lbs. (3.0 kg) Maris Otter pale malt
1.38 lbs. (0.63 kg) rye malt
6 oz. (0.17 kg) brown malt
4 oz. (0.11 kg) Carafa® Special II malt
4 oz. (0.11 kg) chocolate rye
1 tablet Whirlfloc (10 mins)
5.3 AAU Fuggle hops (30 mins) (1.1 oz./32 g of 4.8% alpha acids)
Safale US-05 dried yeast

Step by Step

Slice a loaf of stale pumpernickel bread and soak it in 1 gallon (3.8 L) of 190 °F (88 °C) water overnight. It is best to do this in a cooler to retain as much heat as possible. On brew day, mash grains 60 minutes at 152 °F (67 °C). Puree the loaf of pumpernickel bread and soaking water with a stick blender and add to the boil kettle along with the mash runnings. If you don't own a stick blender, do your best to break apart the bread with a whisk before adding it to the boil kettle. Due to the 30-minute boil and added bread water, make sure not to collect too much pre-boil wort. Stir the beer as it comes to a boil to prevent scorching. Add the hops at the start of the boil. After the boil, chill to 65 °F (18 °C), aerate, and pitch the package of dried yeast directly into the wort.

After fermentation is complete bottle with 3.5 oz. (99 g) of sugar for moderate carbonation. BYO



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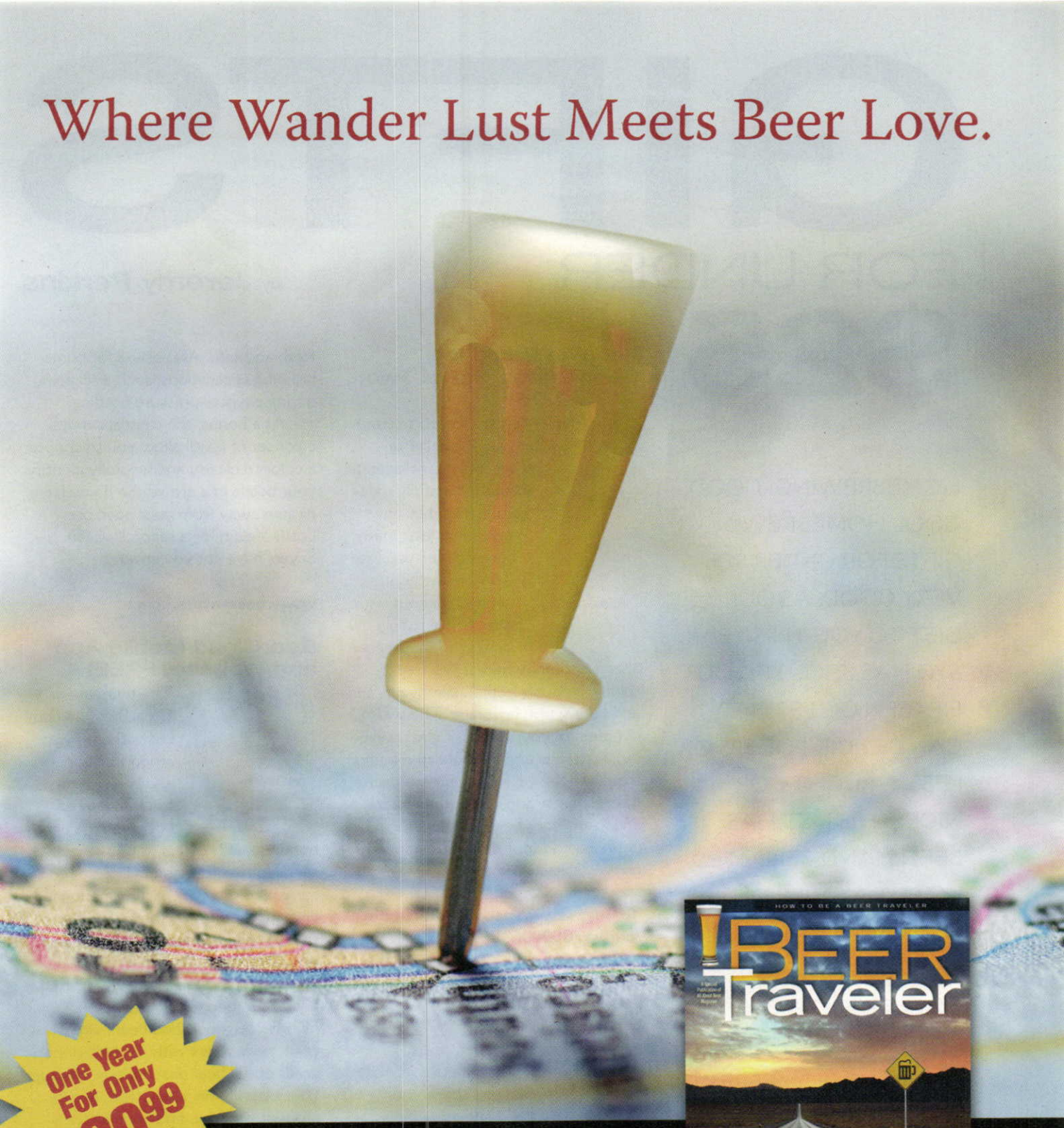

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Beer Savers, 6-pack, $12.99

Beer Savers are one of those products that may make you shake your head and ask, "Now, why didn't I think of that?" (Don't be too hard on yourself; we didn't think of it either.)

Beer Savers are durable, stretchy, molded bottle cap charms that are dishwasher safe and made of food-grade silicone. On the rare occasions where you just can't seem to find the bottom of that bottle, this product will keep your beer fresh and safe. Also useful for homebrewing applications, such as capping during counter-pressure bottling.

As a bonus, the standard multicolor set of 6 will allow you to choose a color to clearly and helpfully identify your bottle in a crowd. So if you have to step away from your open brew bottle - even for a second - Beer Savers have got you covered.

www.beersavers.com

BeerCloud Mobile App and Website, FREE!

The team at GreatBrewers.com has gathered vast amounts of beer and brewing data from dozens of beer wholesalers, hundreds of brewers, tens of thousands of retailers, and millions of consumers to provide the information juggernaut that is now the BeerCloud (found online and accessed through your smartphone).

BeerCloud tools help you pair beer with food, track down your favorite neighborhood beers, and discover new styles with the help of hundreds of full beer descriptions. Manage your beer life on The Cloud, peruse product catalogs, find popular brew spots, and even map your way to the nearest watering hole.

From educational opportunities to joining forums, the website and the app are full of information and interactive elements. And, best of all, site membership and app download are completely free!

To download:
Membership: http://

greatbrewers.com/beercloud
App: iPhone App Store;
Android Market

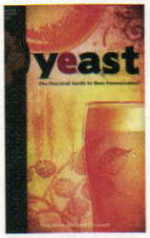
Self-Calibrating Digital Thermometer, $16.90

Digital thermometers for homebrewing have come a long way, and this model from CDN is an example. It is housed in a durable stainless steel case and takes 8 seconds or less to display the correct temperature.

In addition to being waterproof and self-calibrating, it also includes a maximum temperature function (so you can set it and forget it) and shuts off after ten minutes of non-use to conserve power. This model also measures a surprisingly broad range of temps — from -40° F. to 450° F — and comes with a manufacturer's 5-year limited guarantee.

Available at many homebrewing retailers. More info: www.cdn-timeandtemp.com

Yeast: The Practical Guide to Fermentation, $19.95



Authored by White Labs' Chris White (a *BYO* editorial review board member) and *BYO* columnist Jamil Zainasheff, this new book from Brewers Publications focuses on the brewer's perspectives about yeast and what it can contribute to beer. Also covers yeast selection, storage and handling, fermentation science, how to set up a yeast lab and a special guide to troubleshooting. An excellent a resource for brewers of all experience levels!

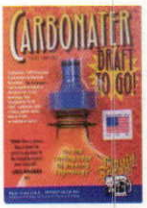
Available at many homebrewing retailers or visit http://shop.beertown.org/brewers/

Auto Siphon - 1/2" Racking Cane, $12.99

A classic homebrewing tool is the auto siphon. If the homebrewer in your life doesn't have one, the days of huffing and puffing when trying to transfer your beer from one container to another will be over. Get down to 6 inches (15 cm) of liquid with just one stroke. Plus, the removable diverter tip and plastic construction make cleaning a snap.

Available at many homebrewing retailers. More info: http://fermtech.ca

The Carbonater by Liquid Bread, $16



Have you ever been invited to a homebrew swap, excitedly rushed home to the garage after work to fill some sampling bottles from your refrigerated keg/CO_2 system, loaded up the car, and arrived at the meeting place only to find that your precious samples have all gone flat? Maybe the PSI wasn't up high enough, maybe the caps weren't on tight enough...

The Carbonator works with any standard CO_2 system (with quick disconnect) and fits any 1 or 2 Liter PET bottle. So, if there is a last minute party and you have no homebrew primed and bottled for holiday gifts, or a friend wants to take a sample of your premium lager that's not quite cold-aged to perfection you can easily whip out a clean soda bottle, fill it with beer, screw on the Carbonator, attach your CO_2 and carbonate to perfection.

Available at many homebrewing retailers or www.liquidbread.com/retail.html

The Brew Hauler, $13.50

If you've ever tried to move a full or even freshly washed, wet, slippery carboy you've probably staggered about, sworn a little (or a lot), done a fair amount of cleaning up, and desperately wished there was a better way. Many homebrewers use glass carboys, and the Brew Hauler makes transporting those precious potables easier (and more importantly, safer) than ever before.

Adjustable and constructed of sturdy polypropylene webbing, the harness can be easily moved from one carboy to another. Carry your beer with confidence up and down stairs, around tight corners and for long distances with The Brew Hauler.

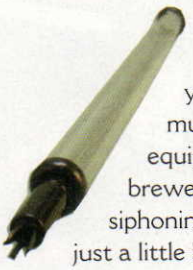
Available at many homebrewing retailers.

Escali Primo P115 Digital Kitchen Scale, $24.95

A digital multi-function food scale can be an invaluable tool for many homebrew recipes. With a capacity of 11 pounds (~5 kg), this Escali scale can weigh in ounces or grams.

To buy: www.americanweigh.com

Fermtech Wine Thief, $8.49



Don't let the word "wine" fool you, a wine thief is a must-have piece of equipment for homebrewers. Its easier than siphoning when you need just a little bit of beer, and if you're using carboys for fermenters, the 19-inch (48 cm) thief will make gathering samples a snap. Plus, the thief is wide enough to accommodate a hydrometer inside, making it a desirable multi-tasker.

Available at many homebrewing retailers. More info at http://fermtech.ca

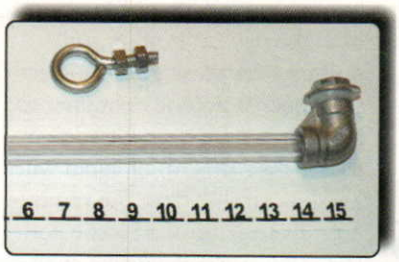
Blichmann Brewing Gloves, $11.99

Dive elbow-deep in scalding-hot wort and surface unharmed and smelling like a rose with these 28-mil gloves, standard in many commercial breweries. These gloves also protect your skin from splash-burns, chemicals and sanitizing agents.

A product of Blichmann Engineering, these gloves will prevent the cracked and bleeding skin often associated with excessive brewing. But be aware that even these gloves are not meant for "prolonged" exposure to hot liquid — any more than two minutes of exposure to hot liquid may result in a nasty burn.

More info:
www.blichmannengineering.com

Weldless Sight Tee - No Thermometer Kit, $24.95



If you already have a keg or brew pot and want to get more precise measurements, think about installing a weldless sight glass kit. And if you just don't trust the deep, dark depths of your 15-gallon (57-L) brew kettle, this product may be for you.

Precisely measure the contents of your brew pot and monitor color at the same time. Plus, you can add a glass thermometer after the initial installation (as shown above, some assembly is required).

To buy:
http://brewhardware.com/

Pin Lock Conversion Posts, $15.95

Finally, an easy way to convert pin lock kegs to ball lock keg posts! Simply unscrew your pin lock posts and screw on these ball lock posts. This conversion kit allows you to convert any Firestone, Spartansburg or Hoover pin lock Cornelius keg to a ball lock keg and contains a liquid and gas post fitting with poppets installed and tested for leaks. In addition, you get two o-rings for the fittings and two o-rings for the liquid and gas tubes in the keg. The fittings are made of precision aluminum and anodized to give a corrosion-proof, food grade

coating that is durable and will not chip or peel.

To buy: www.chicompany.net

Brew Belt, $23.99

Worry no more about stuck fermentations due to cold rooms. This electric heating belt helps to maintain minimum fermenting temperatures and fits 5-, 6-, or 7.5-gallon plastic buckets. It also fits 3-, 5-, and 6-gallon Better Bottles and 3-, 5-, 6- and 6.5-gallon glass carboys, although the manufacturer does not recommend using it with glass fermenters. Keep your ale cozy and warm this winter with the Brew Belt.

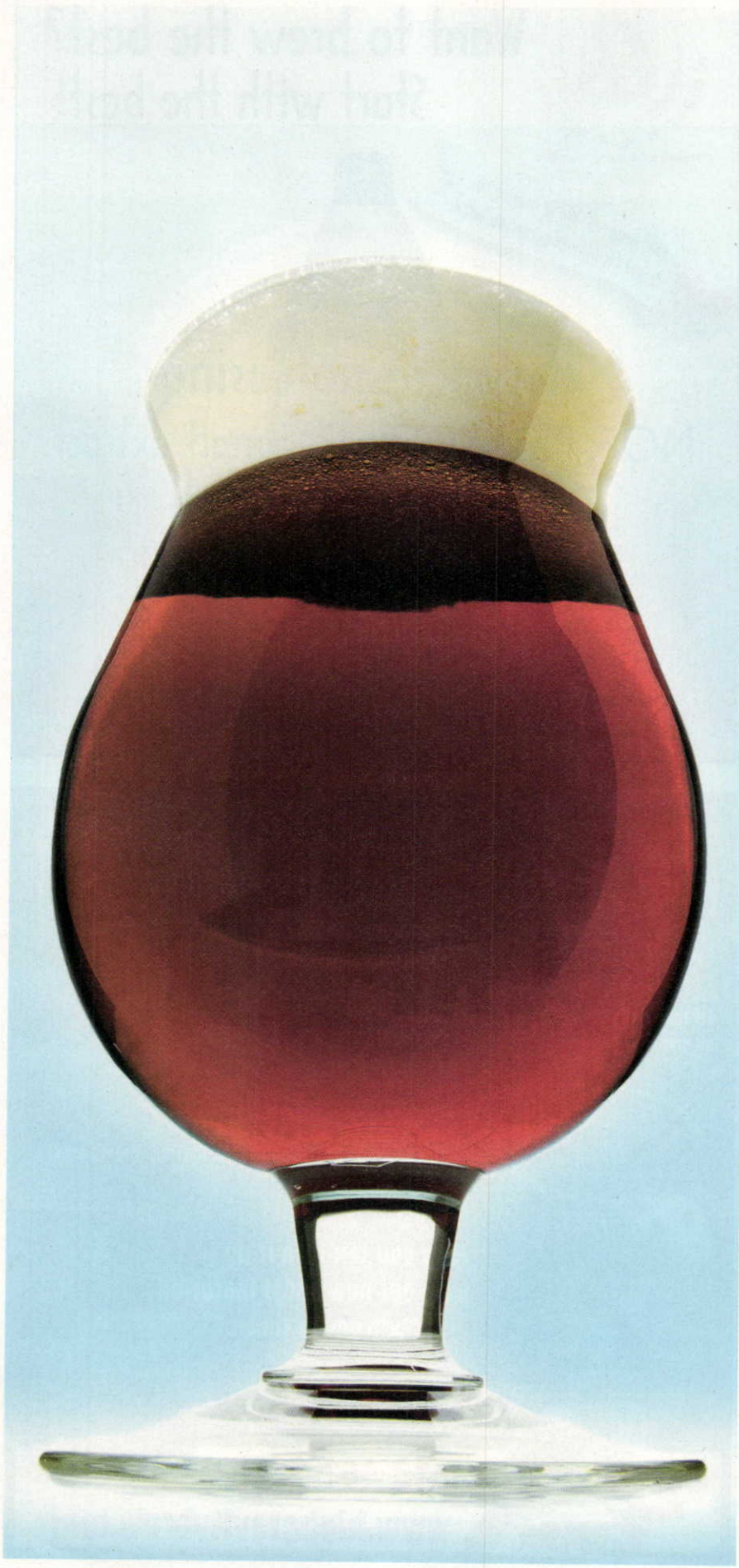
Available at many homebrewing retailers.

Bottle and Carboy Washer, $12.95

A useful tool for any homebrewer who has ever cleaned out a carboy. This bottle washer creates a jet-style stream that penetrates build-up in bottles or carboys. It is automatically activated when a bottle is pressed down onto the unit. Female hosed thread connection.

Available at many homebrewing retailers.

Hope this helps when it comes to selecting the lasting gift for the homebrewer — the kind of thing the gift-getter is going to appreciate for years to come. And there are a surprising number of quality homebrewing items out there for under $25 — if you know where to look. We hope you found something for the frugal homebrewer on your shopping list. A heartfelt holiday cheers! BYO



When the weather turns cold, it's time to seek out the king of all seasonal beers — winter ales. Brewed stronger, richer and more full-bodied, these beers taste great alongside a roaring fire or when hoisting the holiday cheer with friends.

Evocative of the season, winter ales have a tradition in the US, the UK, Belgium and elsewhere. English winter beers are normally called winter warmers, and tend to be dark, full in body, sweet and stronger than average (5.5% ABV and up). They are rarely spiced. American winter beers are usually called Christmas or holiday beers, and are almost always spiced. Belgian winter beers are often slightly stronger (by 1–2% ABV) versions of flagship beers. If they are spiced, the spicing is usually more subtle than American versions.

It's difficult to describe winter seasonal beers in traditional style terms, since it's always possible to find exceptions to any description. Perhaps it's best to just say they are seasonal offerings that have something "special" about them — stronger, darker, spiced, hoppier — basically whatever the brewer wants to do as a gift for customers and that is somehow suitable for the winter season.

I find most English winter warmers to be very malty with a full body and sweet finish. Flavors typical of English Christmas puddings are common — figs, molasses, toffee, caramel, raisins, prunes, dried fruit and so on. In general, they are not roasty but feature dark caramel and dark fruit flavors. As the name implies, a winter warmer should have some alcohol warmth. Beers of this profile are sippers — it's hard to drink them quickly. Some of my favorite examples are Young's Winter Warmer, Harvey's Christmas Ale, Hook Norton Twelve Days and Fuller's Old Winter Ale.

American Christmas beers can be based on a variety of styles, but are often an amber or darker-colored malt-focused beer. Spices that are associated with Christmas cookies, potpourri and mulled cider are common — cinnamon, nutmeg, allspice, ginger, clove, orange peel and others. Additional fermentables — molasses,

Story by **Gordon Strong**

WINTER SEASONAL BEERS

Award-Winning Beers That Came In From the Cold

honey, dark candi sugar, treacle, Lyle's Golden Syrup — are often used to add another flavor dimension. Anchor's Our Special Ale is a classic example, but is unusual in that it uses a different recipe every year. Many examples have a flavor similar to gingerbread cookies. Spices should be noticeable but not overpowering.

Belgian winter beers are often named Noël/Christmas or Hiver/Winter, and can be based on any style. Some are spiced, and orange seems to be a popular flavoring. I like the Dupont Avec les Bons Voeux (with the best wishes), DeKoninck Winter Koninck, Jenlain Bière de Noel, St. Bernardus Christmas and my personal favorite, De Dolle Stille Nacht (Silent Night, or Christmas Eve) which is primed with honey. They are all completely different beer styles, but all have that special holiday gift theme that makes them both rare and enjoyable.

Brewing Christmas Ales

To explore the style, I've found five Christmas ale recipes that have won best-of-show awards in sizeable competitions. The Beer Judge Certification Program (BJCP) database lists 1,161 best-of-show winners since these records have been kept. Of those, only eight beers were Christmas ales, and four of those were in winter beer competitions. The four brewers who won those open competitions are represented here; congratulations to them, and I thank them for their help in this article. One recipe is mine (my first best-of-show, incidentally), and the four others are from Ben VanderMeer, John Zelazny, Dean Priebe and Reed Vander Schaaf.

All the brewers agreed on using darker malty styles as the base for the recipe, several of them choosing stouts of some type. John Zelazny said "choose a beer style that is malt-oriented; hops are not the king here."

The brewers also agreed that residual sweetness is important to the character, and that the best examples often suggest desserts. Dean Priebe described his Sleigh Fuel as "thick on the tongue and sweet" and "resembling Christmas cookies." Ben VanderMeer credits his wife Elly with coming up with the idea for a hearty match for homemade mincemeat pies and gingerbread, and to be used as Christmas presents. He said "the FG can be high to balance the aggressive spicing; I used a lot more crystal malt than I normally would to add sweetness and depth."

The use of spices draws strong opinions, as expected. Again, there is near unanimous agreement that spices should be complementary, not dominant. John Zelazny said "too many spices overwhelm the taste buds and turn these beers into a train wreck." Dean Priebe uses spice extracts (vanilla, orange, cinnamon) and adds them to taste; he says "the base beer should stand on its own and the spices should add an extra dimension." Reed Vander Schaaf selected the unusual star anise to complement his strong stout, and toasted the spice to bring out the flavor. He isn't a fan of allspice or clove, so he was looking for something to stand out in competition. My selection of Christmas spices was straightforward, mirroring Christmas potpourri.

Stronger beers can age for years, so consider vintage dating them. I agree with Dean Priebe that these beers also make great cask ales. I have made mine several times to be served on hand pump at Christmas parties.

Gordon Strong is President of the Beer Judge Certification Program.

WINTER WARMER RECIPES

Holiday Prowler — Gordon Strong

(5 gallon/19 L, all-grain)

OG = 1.058 FG = 1.014
IBU = 19 ABV = 5.8%
Best of Show, Ohio State Fair 1997 (90 entries)

Ingredients

9.5 lbs. (4.3 kg) Crisp Maris Otter malt
0.75 lb. (0.34 kg) Scotmalt crystal malt (40 °L)
0.25 lb. (0.11 kg) Crisp chocolate malt
1.5 lbs. (0.68 kg) clover honey
½ can Lyle's Golden Syrup
¼ cup blackstrap molasses
6.1 AAU Goldings hops (60 mins) (1 oz./28 g of 6.1% alpha acids)
1.0 oz. (28 g) Fuggles hops (5 mins)
Spices: 4 cinnamon sticks, 1 nutmeg seed, 1 vanilla bean, 7 allspice berries, 1.5 tsp. whole cloves, 8 coriander seeds, 2 nectarine peels
White Labs WLP002 (English Ale) yeast

Step by Step

Old ale base. Mash grains at 158 °F (70 °C). 90 minute boil. Steep spices (chopped up) in tight mesh bag at knockout for 10 minutes, remove, then chill rapidly. Ferment at 68 °F (20 °C). Prime with muscavado sugar and cask-condition.

Holiday Prowler

(5 gallon/19 L, extract with grains)

OG = 1.058 FG = 1.014
IBU = 19 ABV = 5.8%

Ingredients

4.0 lbs. (1.8 kg) Muntons Light dried malt extract
1.0 lb. (0.45 kg) Crisp Maris Otter malt
0.75 lb. (0.34 kg) Scotmalt crystal malt (40 °L)
0.25 lb. (0.11 kg) Crisp chocolate malt
1.5 lbs. (0.68 kg) clover honey
½ can Lyle's Golden Syrup
¼ cup Blackstrap molasses
6.1 AAU Goldings hops (60 mins) (1 oz./28 g of 6.1% alpha acids)
1.0 oz. (28 g) Fuggles hops (5 mins)
Spices: 4 cinnamon sticks, 1 nutmeg seed, 1 vanilla bean, 7 allspice berries, 1.5 tsp. whole cloves, 8 coriander seeds, 2 nectarine peels
White Labs WLP002 (English Ale) yeast

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 158 °F (70 °C) for 45 minutes. Boil for 60 minutes, initially reserving half of the malt extract. Add remaining malt extract and other sugars with 15 minutes left in the boil. Steep spices (chopped up) in tight mesh bag at knockout for 10 minutes, remove, then chill rapidly. Ferment at 68 °F (20 °C).

Star Anise Stout — Reed Vander Schaaf

(5 gallon/19 L, all-grain)

OG = 1.093 FG = 1.028
IBU = 64 ABV = 8.5%
Best of Show, Santa Cruz County Fair 2008 (85 entries)

Ingredients

13 lbs. (5.9 kg) Gambrinus pale malt
4.0 lbs. (1.8 kg) Weyermann Pilsner malt
0.75 lbs. (0.34 kg) Briess Extra Special malt (140 °L)
0.5 lb. (0.23 kg) Briess roasted barley (300 °L)
0.5 lb. (0.23 kg) Briess chocolate malt (350 °L)
1.6 lbs. (0.72 kg) Weyermann Carafa® II malt (400 °L)
1.0 oz. (28 g) star anise
16 AAU New Zealand Pacific Gem hops (60 mins) (1.0 oz./28 g of 15.9% alpha acids)
6.8 AAU German Hallertauer Tradition hops (15 mins) (1.0 oz./28 g of 6.8% alpha acids)
1.0 oz. (28 g) Belgian Saaz hops (5 mins)
White Labs WLP013 (London Ale) yeast

Step by Step

Strong stout base. Mash for 60 minutes at 158 °F (70 °C). Boil for 60 minutes. Ferment at 68 °F (20 °C) for 2 weeks in primary, rack to secondary, and add star anise that has been toasted and broken up.

Bad Santa — John Zelazny

(5 gallon/19-L, all-grain)

OG = 1.085 FG = 1.018
IBU = 40 ABV = 8.6%
Best of Show, 2010 New York State Open (282 entries)

Ingredients

12 lbs. (5.4 kg) Canadian Pils malt
1.0 lb. (0.45 kg) Munich malt
0.50 lb. (0.45 kg) Carahell® malt (19 °L)
0.50 lb. (0.45 kg) CaraMunich® malt (30–40 °L)
1.0 oz. (28 g) black patent malt
1.0 lb. (0.45 kg) light dried malt extract
13 fl. oz. (384 mL) maple syrup
1.5 lbs. (0.68 kg) dried cherries
12 AAU US Northern Brewer hops (60 mins) (1 oz./28 g of 12% alpha acids)
Wyeast 1084 (Irish ale) yeast
1 vanilla bean (split)
3 cinnamon sticks (3 inches, broken into pieces)

Step by Step

Strong Scotch ale base. Mash all grains at 152 °F (67 °C) for 60 min. Mash out at 168 °F (76 °C) for 10 min. Add dried malt extract and maple syrup at boil. Steep cherries in 2 qts. (2 L) of first wort runnings for 30 min. Strain out cherries and add this wort at end of boil. Ferment at 62–64 °F (17–18 °C). Dry spice in secondary for 2–3 weeks.

Bad Santa

(5 gallon/19-L, extract with grains)

OG = 1.085 FG = 1.018
IBU = 40 ABV = 8.6%

Ingredients

7.5 lbs. (3.4 kg) light dried malt extract
1.0 lb. (0.45 kg) Munich malt
0.50 lb. (0.45 kg) Carahell® malt (19 °L)
0.50 lb. (0.45 kg) CaraMunich® malt (30–40 °L)
1.0 oz. (28 g) black patent malt
13 fl. oz. (384 mL) maple syrup
1.5 lbs. (0.68 kg) dried cherries
12 AAU US Northern Brewer hops (60 mins) (1 oz./28 g of 12% alpha acids)
Wyeast 1084 (Irish ale) yeast
1 vanilla bean (split)
3 cinnamon sticks (3 inches, broken into pieces)

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 152 °F (67 °C) for 45 minutes. Boil for 60 minutes, initially reserving half of the malt extract. Remove 2 qts. (2 L) of wort and steep cherries. Add remaining malt extract and maple syrup with 15 minutes left in the boil. Add cherry steeping wort at end of boil. Ferment at 62–64 °F (17–18 °C). Dry spice in secondary for 2–3 weeks.

Better Not Pout Stout — Ben VanderMeer

(5 gallons/19 L, all-grain)

OG = 1.068 FG = 1.020
IBU = 21 ABV = 6.1%
Best of Show, Great Arizona Homebrew Competition 2010 (151 entries)

Ingredients

10.5 lbs. (4.9 kg) US 2-row malt
1.75 lbs (0.79 kg) crystal malt (80 °L)
5.0 oz (0.14 kg) black patent malt
7.0 oz (0.20 kg) chocolate malt

4.0 oz (0.11 kg) roasted barley
6.0 oz (0.17 kg) flaked oats
5 AAU East Kent Goldings hop (60 mins) (1.0 oz./28 g of 5% alpha acids)
0.5 oz. (14 g) Cascade hops (15 mins)
1.0 lb. (0.45 kg) clover honey (15 mins)
1 tbsp. cinnamon (15 mins)
1 tbsp. nutmeg (15 mins)
2.0 oz. (57 g) freshly grated ginger (15 mins)
2 tsp allspice (15 mins)
0.75 tsp. cloves (15 mins)
orange zest (from 3 medium sweet oranges) (15 mins)
1 tsp. brewing salts (in brewing liquor)
1 tsp. Irish moss (10 mins)
2 packets of Danstar Nottingham dried yeast

Step by Step

Oatmeal stout base. Mash 60 minutes at 155 °F (68 °C). Collect 7.0 gallons (26 L). 90-minute boil. Ferment at 68 °F (20 °C) for 7 days, secondary at 68 °F (20 °C) for 7 days.

Better Not Pout Stout

(5 gallons/19 L, extract with grains)

OG = 1.068 FG = 1.020
IBU = 21 ABV = 6.1%

Ingredients

5.5 lbs. (2.5 kg) Coopers light dried malt extract
14 oz. (0.39 kg) US 2-row malt
1.75 lbs (0.79 kg) crystal malt (80 °L)
5.0 oz (0.14 kg) black patent malt
7.0 oz (0.20 kg) chocolate malt
4.0 oz (0.11 kg) roasted barley
6.0 oz (0.17 kg) flaked oats
5 AAU East Kent Goldings hops (60 mins) (1.0 oz./28 g of 5% alpha acids)
0.5 oz. (14 g) Cascade hops (15 mins)
1.0 lb. (0.45 kg) clover honey (15 mins)
1 tbsp. cinnamon (15 mins)
1 tbsp. nutmeg (15 mins)
2.0 oz. (57 g) freshly grated ginger (15 mins)
2 tsp. allspice (15 mins)
0.75 tsp. cloves (15 mins)
orange zest (from 3 medium sweet oranges) (15 mins)
1 tsp. brewing salts (in brewing liquor)
1 tsp. Irish moss (10 mins)
2 packets of Danstar Nottingham dried yeast

Step by Step

Steep grains in 5.5 qts. (5.2 L) of water at 155 °F (68 °C) for 45 minutes. Boil for 60 minutes, initially reserving half of the malt extract. Add remaining malt extract with 15 minutes left in the boil. Ferment at 68 °F (20 °C)

Sleigh Fuel — Dean Priebe

(5 gallons/19 L, partial mash)

OG = 1.060 FG = 1.018
IBU = 30 ABV = 7%
Best of Show, Novembeerfest 2007 (133 entries)

Ingredients

7.5 lbs. (3.4 kg) Briess CBW® Pilsen Light liquid malt extract
6.3 oz. (0.18 kg) ESB pale malt
9.4 oz. (0.27 kg) crystal malt (80 °L)
12 oz. (0.34 kg) black malt
5.6 oz. (0.16 kg) chocolate malt
5.6 oz. (0.16 kg) Carapils® malt
3.1 oz. (87 g) Munich malt (10 °L)
12 oz. (0.34 kg) lactose powder (15 mins)
10 AAU Fuggle hops (60 mins) (2.0 oz./57 g of 5% alpha acids)
Wyeast 1968 (London ESB) yeast
Vanilla extract
Orange extract
Cinnamon extract

Step by Step

Mash at 153 °F (67 °C). Ferment at 68 °F (20 °C). Add extract to 12 fl. oz. (355 mL) bottles — 7 drops vanilla, 3 drops orange and 7 drops cinnamon per bottle.

ROLLING with NEW BELGIUM BREWING

Colorado brewery rides FAT TIRE to success

Good microbreweries breed myth and New Belgium Brewing in Fort Collins, Colorado is no exception. In this case, there was a persistent rumor that floated about town that brewery co-founder Jeff Lebesch delivered the earliest batches of Fat Tire, the company's flagship beer, on his bicycle. The rumor fit well with the actual knowledge that Lebesch formulated his idea to open a brewery while on a bicycle and beer tasting tour of Belgium, and that the Fat Tire label features the old red cruiser bike now synonymous with the brewery. But that's where any hope that this rumor is true ends.

"No, that must be some kind of urban legend," clarifies New Belgium Brewing CEO and co-founder Kim Jordan. "I am sure there are times when Jeff was going somewhere to socialize that he put beer in his panniers, but it's not like when we started as a craft brewery that he delivered on his bike. In fact, I did the delivery in our station wagon at that point."

These days, New Belgium has a fleet of trucks handling that, and distribution in 26 states. The brewery has grown from a regional operation in 1991 to one of the nation's leading craft breweries. Fat Tire remains the company's best selling product, and one of the most recognizable labels in the craft brewing industry. Enough so, that the company now features the bicycle logo on almost all of its products — a move that was made five or so years back in an attempt to help consumers realize the company wasn't just "the Fat Tire Brewery," Jordan says, but one where a wide variety of Belgian-styled beers are made.

Jordan, however, adds that she is "wistful" for the original beer glass logo.

"For me the first thing we are is a brewery and beer enthusiasts, so I really liked that glass on the logo because it really spoke to that," she said.

The Beers

Like many craft breweries, New Belgium has a line of core beers supplemented with seasonal offerings. The brewery also has two specialty series as well — the Lips of Faith and Explorer series, designed to challenge drinkers to try something a little out of the ordinary.

"People were doing big beers and imperial beers and we thought we had a lot of things that could play in this category," Jordan said. "So that's when we started the Lips of Faith program."

But it wasn't always like that.

When New Belgium first began operating, they brewed Belgian-style exclusively. Was America was ready for these beers? Brewmaster Peter Bouckaert, who arrived from Belgium in 1996, recalls that the American craft brewing scene

Photos courtesy of New Belgium Brewing

at the time was really just starting to get its wings.

"Fat Tire had a bit of shock value. It was like Sierra Nevada Pale Ale when that came out. No one else did that," he said. "And Abbey, when it came out, was completely out of its time at that point too."

That trend of making beers before their time continued with New Belgium for years.

"Abbey and Trippel are from the very first line up (of beers made at New Belgium), from before people were making Belgian beers in the U.S.," Jordan says. "We made our first Saison in 1997, way before Saisons were something people really knew. Our first Brett (*Brettanomyces*) beer was Biere de Mars in 1998. We started making wood beer (La Folie) in 1996. So some of the things that are becoming more popular now we were already goofing around with."

Now, Bouckaert adds, "Pretty much anything goes. And people are educated enough now too to at least continue to try it and continue to drink it. It wasn't the case in (the beginning)."

Though Belgian-style beers remain the brewery's main focus, New Belgium has branched out into other areas with, among others, IPAs, Pilsner, lagers and German wheat. Having a beer like Fat Tire, one that is a consistent seller and money maker, allows Bouckaert a little more freedom to experiment with Belgian styles that might not be as familiar to the average beer drinker.

Transatlantique Kriek, which blends a golden lager with cherry lambic, the wood-aged beer La Folie and Biere de Mars, which uses *Brettanomyces* are examples.

"It was basically you bring something in from all these fishbowl bacteria that you have and you make something along those lines," he said of the latter two creations.

Continued on page 46

Story by **Glenn BurnSilver**

New Belgium Clone Recipes

New Belgium Brewing Fat Tire clone

(5 gallons/19 L, all-grain)

OG = 1.050 FG = 1.013
IBU = 19 SRM = 14 ABV = 4.7%

Ingredients

8 lb. 10 oz. (3.9 kg) pale malt
1.0 lb. (0.45 kg) Munich malt
6.0 oz. (0.17 kg) Victory® malt
8.0 oz. (0.23 kg) crystal malt (80 °L)
4.4 AAU Target hops (60 mins)
(0.4 oz./11 g of 11% alpha acids)
2.5 AAU Willamette hops (10 mins)
(0.5 oz./14 g of 5% alpha acids)
0.5 oz. (14 g) Goldings hops (0 mins)
Wyeast 1792 (Fat Tire Ale), Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast

Step by Step

Mash at 154 °F (68 °C). Boil for 90 minutes, adding hops at times indicated. Ferment at 68 °F (20 °C).

New Belgium Brewing Fat Tire clone

(5 gallons/19 L, extract with grains)

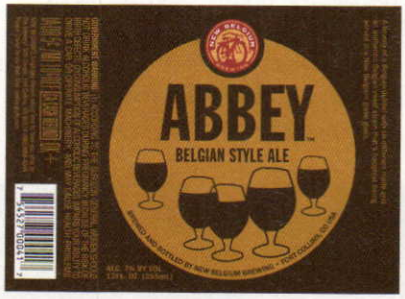
OG = 1.051 FG = 1.013
IBU = 19 SRM = 15 ABV = 4.8%

Ingredients

1.75 lb. (0.79 kg) Coopers Light dried malt extract
4.0 lb. (1.8 kg) Alexanders Pale liquid malt extract
2.0 oz. (56 g) pale malt
1.0 lb. (0.45 kg) Munich malt
6.0 oz. (0.17 kg) Victory® malt
8.0 oz. (0.23 kg) crystal malt (80 °L)
4.4 AAU Target hops (60 mins)
(0.4 oz./11 g of 11% alpha acids)
2.5 AAU Willamette hops (10 mins)
(0.5 oz./14 g of 5% alpha acids)
0.5 oz. (14 g) Goldings hops (0 mins)
Wyeast 1792 (Fat Tire Ale), Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 155 °F (68 °C) for 45 minutes. Add water to make 3.0 gallons (11 L) of wort and bring to a boil, adding hops at times indicated. Stir in dried malt extract and boil for 60 minutes. Add liquid malt extract for final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water, aerate and pitch yeast. Ferment at 68 °F (20 °C).



New Belgium Brewing Abbey clone

(5 gallons/19 L, all-grain)

OG = 1.065 FG = 1.011
IBU = 20 SRM = 24 ABV = 7.0%

Ingredients

7.5 lb. (3.4 kg) pale malt
2.0 lbs. (0.91 kg) cane sugar (15 mins)
1.5 lbs. (0.68 kg) Munich malt (20 °L)
0.25 lb. (0.11 kg) CaraPils® malt
0.50 lb. (0.23 kg) crystal malt (80 °L)
3.0 oz. (85 g) chocolate malt
5.0 AAU Target hops (60 mins)
(0.45 oz./13 g of 11% alpha acids)
1.3 AAU Willamette hops (10 mins)
(0.25 oz./7.1 g of 5% alpha acids)
1.1 AAU Liberty hops (5 mins)
(0.25 oz./7.1 g of 4.5% alpha acids)
Wyeast 1214 (Belgian Ale) or White Labs WLP500 (Trappist Ale) yeast

Step by Step

Mash at 150 °F (66 °C). Boil for 90 minutes, adding hops and sugar at times indicated. Ferment at 70 °F (21 °C).

New Belgium Brewing Abbey clone

(5 gallons/19 L, extract with grains)

OG = 1.064 FG = 1.011
IBU = 20 SRM = 24 ABV = 6.9%

Ingredients

1.5 lbs. (0.68 kg) Muntons Light dried malt extract
3.3 lb. (1.5 kg) Muntons Light liquid malt extract
2.0 lbs. (0.91 kg) cane sugar (15 mins)
1.5 lbs. (0.68 kg) Munich malt (20 °L)
0.25 lb. (0.11 kg) CaraPils® malt
0.50 lb. (0.23 kg) crystal malt (80 °L)
3.0 oz. (85 g) chocolate malt
5.0 AAU Target hops (60 mins)
(0.45 oz./13 g of 11% alpha acids)
1.3 AAU Willamette hops (10 mins)
(0.25 oz./7.1 g of 5% alpha acids)
1.1 AAU Liberty hops (5 mins)
(0.25 oz./7.1 g of 4.5% alpha acids)
Wyeast 1214 (Belgian Ale) or White Labs WLP500 (Trappist Ale) yeast

Step by Step

Steep grains in 3.5 qts. (3.3 L) of water at 150 °F (66 °C) for 45 minutes. Add water to make 3.0 gallons (11 L) of wort and bring to a boil. Stir in dried malt extract and boil for 60 minutes. Add liquid malt extract and sugar for final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water, aerate and pitch yeast. Ferment at 70 °F (21 °C).

New Belgium Brewing Trippel clone

(5 gallons/19 L, all-grain)

OG = 1.071 FG = 1.010
IBU = 25 SRM = 7 ABV = 7.9%

Ingredients

9.0 lb. (4.1 kg) pale malt
2.5 lbs. (1.1 kg) cane sugar (15 mins)
1.0 lb. (0.45 kg) Munich malt
2.0 oz. (57 g) Victory® malt
0.25 oz. (7.1 g) coriander (2 mins)
6.1 AAU Target hops (60 mins)
(0.56 oz./16 g of 11% alpha acids)
1.1 AAU Liberty hops (15 mins)
(0.25 oz./7.1 g of 4.5% alpha acids)
0.5 oz. (14 g) Saaz hops (0 mins)
Wyeast 1214 (Belgian Ale) or White Labs WLP500 (Trappist Ale) yeast

Step by Step

Mash at 149 °F (65 °C). Boil for 90 minutes, adding hops, sugar and spice at times indicated. Ferment at 68 °F (20 °C). (New Belgium ferments part of their Trippel with their Belgian yeast and part

with a neutral yeast, then blends the beers to get a beer in which the Belgian yeast characteristics are subdued.)

New Belgium Brewing Trippel clone

(5 gallons/19 L, extract with grains)

OG = 1.072 FG = 1.011
IBU = 25 SRM = 7 ABV = 7.9%

Ingredients

4.5 lb. (2.0 kg) Briess Light dried malt extract
14 oz. (0.40 kg) pale malt
2.5 lbs. (1.1 kg) cane sugar (15 mins)
1.0 lb. (0.45 kg) Munich malt
2.0 oz. (57 g) Victory® malt
0.25 oz. (7.1 g) coriander (2 mins)
6.1 AAU Target hops (60 mins) (0.56 oz./16 g of 11% alpha acids)
1.1 AAU Liberty hops (15 mins) (0.25 oz./7.1 g of 4.5% alpha acids)
0.5 oz. (14 g) Saaz hops (0 mins)
Wyeast 1214 (Belgian Ale) or White Labs WLP500 (Trappist Ale) yeast

Step by Step

Steep grains in 3.0 qts. (2.0 L) of water at 149 °F (65 °C) for 45 mintes. Add water to make 3.0 gallons (11 L) of wort and bring to a boil. Stir in roughly half of the dried malt extract and boil for 60 minutes, adding hops, sugar and spice at times indicated. Add remaining malt extract for final 15 minutes of the boil. Ferment at 68 °F (20 °C).

New Belgium Brewing 1554 clone

(5 gallons/19 L, all-grain)

OG = 1.059 FG = 1.015
IBU = 21 SRM = 35 ABV = 5.7%

Ingredients

7.5 lb. (3.4 kg) pale malt
0.50 lb. (0.23 kg) CaraPils® malt
4.0 lb. (1.8 kg) Munich malt (20 °L)
10 oz. (0.28 kg) chocolate malt
1.0 oz. (28 g) black malt
5.8 AAU Target hops (60 mins) (0.53 oz./15 g of 11% alpha acids)
Wyeast 2124 (Bohemian Lager) or White Labs WLP830 (German Lager) yeast

Step by Step

Mash at 154 °F (68 °C). Boil for 90 minutes, adding hops at times indicated. Ferment at 65 °F (18 °C), which is higher than usual for lagers.

New Belgium Brewing 1554 clone

(5 gallons/19 L, extract with grains)

OG = 1.059 FG = 1.015
IBU = 21 SRM = 32 ABV = 5.7%

Ingredients

3.0 lb. (1.4 kg) Briess Light dried malt extract
3.5 lbs. (1.6 kg) Munich liquid malt extract
8.0 oz. (0.23 kg) CaraPils® malt
13 oz. (0.37 kg) Munich malt (20 °L)
10 oz. (0.28 kg) chocolate malt
1.0 oz. (28 g) black malt
5.8 AAU Target hops (60 mins) (0.53 oz./15 g of 11% alpha acids)
Wyeast 2124 (Bohemian Lager) or White Labs WLP830 (German Lager) yeast

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 154 °F (68 °C) for 45 minutes. Add water to make 3.0 gallons (11 L) of wort and bring to a boil. Stir in dried malt extract and boil for 60 minutes, adding hops at times indicated. Add Munich malt extract for final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water, aerate and pitch yeast. Ferment at 65 °F (18 °C).

New Belgium Brewing Ranger IPA clone

(5 gallons/19 L, all-grain)

OG = 1.059 FG = 1.009
IBU = 70 SRM = 7 ABV = 6.4%

Ingredients

8.25 lbs. (3.7 kg) pale malt
2.0 lbs. (0.91 kg) cane sugar (15 mins)
3.0 oz. (85 g) crystal malt (120 °L)
12 AAU Chinook hops (60 mins) (1.0 oz./28 g of 12% alpha acids)
6.5 AAU Simcoe hops (30 mins) (0.50 oz./14 g of 13% alpha acids)
3.8 AAU Cascade hops (15 mins) (0.75 oz./21 g of 5% alpha acids)
0.5 oz. (14 g) Cascade hops (0 mins)
1.25 oz. (35 g) Cascade hops (dry hops)
Wyeast 1792 (Fat Tire Ale), Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast

Step by Step

Mash at 148 °F (64 °C). Boil for 90 minutes, adding hops and sugar at times indicated. Ferment at 68 °F (20 °C). Dry hop in secondary or keg for 1 week.

New Belgium Brewing Ranger IPA clone

(5 gallons/19 L, extract with grains)

OG = 1.059 FG = 1.009
IBU = 70 SRM = 7 ABV = 6.5%

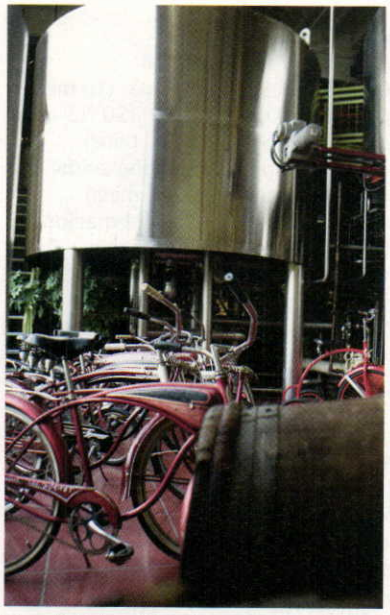
Ingredients

3.5 lbs. (1.6 kg) Briess Light dried malt extract
2.0 lbs. (0.91 kg) cane sugar (15 mins)
1 lb. 13 oz. (0.82 kg) pale malt
3.0 oz. (85 g) crystal malt (120 °L)
12 AAU Chinook hops (60 mins) (1.0 oz./28 g of 12% alpha acids)
6.5 AAU Simcoe hops (30 mins) (0.50 oz./14 g of 13% alpha acids)
3.8 AAU Cascade hops (15 mins) (0.75 oz./21 g of 5% alpha acids)
0.50 oz. (14 g) Cascade hops (0 mins)
1.25 oz. (35 g) Cascade hops (dry hops)
Wyeast 1792 (Fat Tire Ale), Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 148 °F (64 °C) for 45 minutes. Add water to make 4.0 gallons (15 L) of wort and bring to a boil. Stir in roughly half of the dried malt extract and boil for 60 minutes, adding hops at times indicated. Add remaining malt extract and sugar for final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water, aerate and pitch yeast. Ferment at 68 °F (20 °C). Dry hop in secondary or keg for 1 week.

Bikes make New Belgium Brewing go round



New Belgium Brewing was founded on a bicycle. Well . . . sort of. Founder Jeff Lebesch let his passion for cycling and beer, namely Belgian beer, run concurrently during a 1989 bike tour of Belgium, during which he spent a lot of time in breweries, tasting beer, talking with brewers and gathering ideas for his own operation.

When New Belgium opened in 1991, Fat Tire was an immediate hit and remains the company's most popular and recognizable brew. In fact, the red vintage cruiser bike logo was so well-known that many people referred to New Belgium as, "the Fat Tire Brewery," according to CEO and co-founder with Lebesch, Kim Jordan.

These days the bicycle logo is now found on most of the New Belgium products, pushing aside the ubiquitous beer glass.

"The reason we did it is because there are so many people who see us as the Fat Tire brewery and that bikes in large measure have become part of our culture, both as an environmental attribute — we believe in human powered transportation, spend a lot of our philanthropy dollars on encouraging alternative transportation — and sane policies for cyclists in urban areas," she said.

Stop by the brewery in bike-friendly Fort Collins, Colorado and there are usually a dozen or more bicycles parked out front. Employees are rewarded with a cruiser bike with the New Belgium name on the side after one year of service. Add in the Tour de Fat and donations to bike-worthy causes, and it's pretty clear that bikes and New Belgium are synonymous.

The Tour de Fat was founded in 2000 as a way to "give back to the bike community because the community has always supported the brewery," according to New Belgium spokesperson Bryan Simpson, the Tour de Fat is, in essence, a traveling bike circus.

The event features bicycle tours of up to 100-miles, but mostly it is fun and games, with all manner of bikes for people to try out — like one with old shoes for wheels, or another that only goes backwards. There is live music, magic, bikes for sale and trade, and usually a parade through town.

The Tour de Fat now reaches 13 cities a summer and has grown exponentially since its beginning.

"The show is leagues and fathoms above where it was (in the beginning)," Simpson says.

And there is plenty of beer too, though, as it says on the New Belgium website about Tour de Fat, "This is a bicycle event with beer, not the other way around."

Typically, a local cycling organization does all the pouring, and the money made is distributed among various bike charities or organizations that promote cycling over automobile use. Simpson said the company is "making about $1.5 million in funds now," over the many cities.

There are other bike and beer interactions as well, such as an "Urban Assault Ride" (aka treasure/scavenger hunt) and summers of bike-in movies — like a drive-in theater, remember those! — and Team Wonderbike, a "club" of sorts promoting the use of bikes over cars. The "team" boosts of 15,000 members.

"Team Wonderbike is a laughing war whoop, a social movement, an opening salvo in the campaign to greatly increase the use of one of mankind's greatest inventions, the bicycle," the Team Wonderbike webpage explains. "Human-powered, carbon-free, and more fun than walking, driving or running in place — the bicycle offers an elegant solution to so many issues. All that AND it's good for you."

Good for you, like finely crafted beers. Who'd have thought they'd go together so well?

Spice It Up

Another distinctive characteristic of many Belgian brews are the use of spices or alternative ingredients, and coming from Belgium where he worked at Rodenbach, Bouckaert has tried them all. He regularly imparts spices in New Belgium beers and champions experimentation, whether commercially or at home.

At New Belgium, he has crafted beers with grains of paradise, lemon peel, yerba matte, ginger, licorice, coffee, cherries, raspberries, peach, hibiscus, lemon verbena, Kaffir lime, dandelion greens and even endive.

"This is the creative beauty and freedom of brewing," he says. "We use it as salt and pepper; we will not overdose it, and they are essential." Bouckaert notes that spices are what make Belgian wheat beers, well, Belgian wits. He recommends coriander and orange peel as the most prominent options.

"In Sunshine Wheat, we go heavy on coriander; I think it's lovely at that high end. The beer also has orange peel," he says. "Mothership Wit is dominated with the yeast aroma, but has coriander, orange and lemon peel." How much of these spices to use is up to the brewer.

The Right Yeast

In Belgian beers, yeast can play as important a role in the flavor profile as the malt or spices used. New Belgium uses several primary yeasts over the wide range of its beers.

One strain is the proprietary Fat Tire strain, used in Sunshine Wheat, Fat Tire and Ranger. (This strain is sometimes available commercially as Wyeast 1792, part of their VSS series.) The company's lager yeast, used in beers including Skinny Dip, Blue Paddle and 1554 is similar to Weihenstephan 34/70 (a German yeast), while Bouckaert says White Labs WLP500 (Trappist Ale) is similar to what's used for Abbey. Though he didn't indicate which beers he uses it for, Bouckaert says he also keeps house yeast on hand that is low in "yeast aroma profile." He likens this to WLP001 (California Ale Yeast).

"Yeast strains are as important as any of your ingredients and the way you make your beer," Bouckaert says.

"You never treat an ingredient or, for instance, warm fermentation, as the criteria that you build your beer on. A beer development always will rely on multiple aspects of your recipe and the way you make the beer. That being said, in most Belgian beers, the yeast strain is an important building block."

Getting Wild

Then there are bacteria, those microorganisms that most brewers attempt to avoid. At New Belgium, Bouckaert uses various bacterial strains, including pure cultures of *Lactobacillus*, *Pediococcus*, *Acetobacter* and *Brettanomyces* in their sour beers. (See the sidebar on page 48 for more information.)

Anything Goes

These days, anything goes in the brewing world. Breweries are making giant hop monsters, quadruples, blurring styles, and the imperial stamp seems to apply to almost everything. While Bouckaert readily admits to some unusual experimentation — and even making an Imperial Berliner weiss — his guiding factor in any creation is concocting a drinkable beer. It is something he can't stress enough.

"For me, you can go extreme, but you always need to create good beauty in beer. You need to make a beautiful picture," he says. "If you go extreme you need to work within certain parameters to cover the extremities. But I don't see that happening as much anymore. Some brewers are getting so extreme they are making beers I cannot drink."

The brewery's latest move was into the American IPA market with Ranger. This beer came at the urging of the New Belgium Beer Rangers, the sales reps and delivery men with an ear to the street. They keep stressing a desire from customers for a hoppy American-style IPA, and eventually, Jordan and crew listened.

"We had been talking about a hoppy beer for probably three to four

When bacteria in beer is a good thing

The use of bacteria to sour beers and add other flavors and aromas, while not unique to Belgian beers, is perhaps much more common in styles from that country than anywhere else. New Belgium Brewing uses bacteria in several of its beers, most notably the wood-aged La Folie, as well as Biere de Mars and the recent Berliner Weiss. To get an idea of how to use bacteria in brewing, *Brew Your Own* tapped New Belgium Assistant Brewmaster Grady Hull for some information.

Do different bacterial species impart different characteristics, and if so, can you briefly explain the differences in each?
Yes they do. *Lactobacillus*, for example, produces lactic acid which imparts a fairly flavor-neutral sourness. *Acetobacter* produces acetic acid, which imparts a vinegar sourness. These types of sour flavors would be expected in a Belgian sour brown. Different yeast strains also have a huge impact on flavor. *Brettanomyces* imparts a fruity, pineapple-like flavor.

What should a homebrewer take into consideration when contemplating the use of bacteria?
If you add the bacteria and yeast simultaneously, there will be somewhat of a race. If the bacteria sours the beer too quickly, the fermentation will stall. If the yeast ferments the beer too quickly, the bacteria will become inhibited and the souring process will slow down considerably. If you are adding the bacteria to beer that has already fermented, be prepared to wait. Alcohol and hops both inhibit bacterial growth.

How should it be added to the wort? Does there need to be extra aeration or preparation for the wort?
The yeast will take up all of the oxygen very quickly at the start of fermentation no matter what you do, which is why people use wood for aging. After the fermentation is over, and the yeast goes dormant, the wood allows some oxygen into the beer, which in turn allows for the growth of aerobic organisms like *Acetobacter*.

How long does it take to begin providing results in the beer?
It depends on alcohol and hop content of the beer, temperature, amount and type of bacteria added, and oxygen level. For example, La Folie takes between 1 and 3 years to sour because the alcohol is already present at the start of souring. Berliner Weiss soured in a few days because the yeast and *Lactobacillus* were added at the same time so they did not have time to inhibit each other at first.

How should a homebrewer monitor the bacteria added to the beer?
We just use taste and monitor pH. When or how will a brewer know the beer is ready to bottle or keg? Are there certain flavors associated with bacteria use that indicate readiness? It really depends on what you are shooting for. If you're not sure what the expected outcome is supposed to taste like, buy a commercial example of the style you are trying to create so you know what the desired outcome is.

What are the risks with bacteria use?
If you have any equipment that has gaskets or moving parts like a bottle filler, take some extra care when cleaning after exposing it to high levels of beer spoiling bacterial infection. Use something that kills bacteria like bleach. For food safety reasons, yeast should be present and fermenting from the start of any fermentation to inhibit pathogens.

In reference to the above question, is there a risk of infecting other future batches, or even other batches in the brewing area?
Yes, the bacteria can survive in places where there might be moisture, like in an imperfection in the wall of a fermentation vessel or behind a gasket, which can infect a subsequent batch. As far as infecting existing batches in the room I think the basic rules of handling raw food and cooked food apply. Just be aware of where the bacteria is and don't cross contaminate.

What have we missed?
As beer sours it may go through phases that appear to be very undesirable. *Pediococcus*, for instance, can go through some very strange flavor and texture changes before it gets to a pleasant stage so if you have the patience don't give up too soon.

years before we actually did for the very reason that there were a lot of people who felt it was really straying from our roots," Jordan says.

"We struggled with it," Bouckaert admits. "We are New Belgium and creating Belgian-style beers, and the original inspiration came from Belgium, but . . . we need to come up with new things. The philosophy comes from Belgium, but we are an American company."

Both Jordan and Bouckaert agree that many of the IPAs on the market are over-the-top with hops, with many sacrificing overall flavor and balance for hop wallop. That's where Ranger is decidedly different. The beer has a fine hop character that meshes with the malt, fits the style parameters, but doesn't distract from other elements of the beer.

"Beer should have some level of balance. There is finesse in balance," Jordan says. "I think that is sometimes undersold by people. That is more our kind of thrust, to try and finesse a beer and have a balanced approach."

"You need a malt bill that will stand up to the hops, but complement them as well. You don't want them to compete," Bouckaert adds. "The malt is the backbone to what you are creating." Initially, "we played with a whole bunch of hops in it and we made it too complex in the aroma," he says. "We scaled it back and it has a beautiful aroma."

Bouckaert says his dry hops are added to the tank before the beer is added. The hops are not bagged and "are really well spread throughout the beer by doing so."

As far as how long to leave the dry hops on the beer, Bouckaert says he has tried various lengths of contact time, but found little difference in the final results.

"We have been trying from six hours to days of contact time and it does not make much difference in flavor," he says, adding that, "We prefer to take them out with a centrifuge as soon as possible so they do not clog up the pipes. This method gives a great but also a particular flavor."

Beer Culture And Beyond

At New Belgium Brewing, if the timing is right, one might find the accountant hovering over a brew kettle, cooking beer instead of books. It may seem strange, certainly it is unusual, but this is New Belgium Brewing at the core: A team operation where the culture surrounding the beer is as important as the beer itself.

To hear New Belgium spokesperson Bryan Simpson, who's been at the brewery for 13-years, tell it, you can't have one without the other.

"It's a good piece of the culture that gets to inform the beer," he explains of the quarterly Loose Lips drink-offs where any employee can take the challenge of deciphering three New Belgium beers mixed in a glass, and at what percentage of each. The winner gets to brew a batch of beer — any style they wish.

"The idea there is to play around and get new ideas from different venues; to get everybody thinking about beer. We've had HR folks and accountants brew beers and we've come up with some interesting stuff," Simpson adds.

Most of these beers end up on tap in the tasting room, though a few have found life in the commercial realm, including Eric's Ale and the recent release of Hagdorn's Helles.

"It was a huge surprise for me coming from Belgium, maybe coming from an older brewery and environment with an established brewing culture, but it was really different coming into a company like New Belgium," Bouckaert says of the company-wide involvement of the brewing process.

"It creates a huge fertile ground. People are very engaged. We have a common cause and we know what we need to do. People just get it. It's the pure DNA of the company. It's just what it is, what we are."

"Really, at New Belgium anything we do is a collaborative approach. Employees own part of the company. It is high-involvement culture and open-book management," Jordan says. BYO

Glenn BurnSilver is a frequent contributor to Brew Your Own.

“Double, Double, Toil and Trouble Fire Burn and Caldron Bubble”

HOMEBREW DECOCTION MADE EASY

To decoct or not to decoct? For many brewers, that seems to be the question, especially when they are preparing for an all-grain Märzen, bock or doppelbock — brews that have historically been associated with decoction mashing. Compared to modern single or multi-step infusion-mashing, decoction is a much more complicated method of wort production. It requires meticulous attention to process, a more complex brew house configuration, more thermal energy and more cleaning. It lengthens the brew day immensely. Many brewers argue that two otherwise identical beers (one brewed by decoction, the other by infusion) are indistinguishable. To them, decoction is not worth the increased effort. Modern commercial breweries, too, even in tradition-bound Bavaria, have largely given up on decoction-mashing. So why would any right-minded brewer want to decoct at all, nowadays? For homebrewers, one answer lies not in reason, but in emotion — because decoction is an ancient and venerable ritual of preparing the mash by fire, it is a way for the brewer to almost viscerally connect with beer-making's authentic past. With decoction, it may not be the destination that is the reward, but the journey itself.

Decoction, the Mash of Brewing's Past

For virtually all of brewing history, after mankind switched from making beer from moist bread loaves to making it from mashed extract, decoction mashing was one way of ensuring that enzymatic conversion of starches in the malt would take place. The workings of mash enzymes have been understood only for about 120 years. The first work about enzymatic conversion was published by the chemist Cornelius O'Sullivan, in 1890. Before O'Sullivan, brewers knew what they had to do to get good wort, but not why.

Also, enzymatic conversion, as we all know, occurs only within a fairly narrow temperature band (148–162 °F/64–72 °C), which means the brewer must control the temperature of the mash. However, the first practical thermometer was invented only in 1714 by the German instrument-maker Gabriel Fahrenheit. Before Fahrenheit, the only sure instrument for brewers to regulate the mash temperature was — the bucket!

By mixing varying quantities of the mash — each at different but predictable temperatures, and measured by the buckets-full — brewers could dependably replicate the required mash temperature. The most obvious mash temperatures for them to work with were the ambient temperature and the boiling temperature. Once brewers learned to vary the relative quantities of mash portions at these temperatures for a hot summer day as opposed to a frigid winter

Story by **Horst Dornbusch**

For homebrewers, just as historical commercial brewers, decoction mashing is labor-intensive. You must stir the grains thoroughly as the decoction is heated.

day, they had arrived at a fool-proof and repeatable mashing process. And that's essentially what decoction is.

Decoction Pros and Cons

I have made beers by both infusion and decoction, in large and small batches, and they were usually good either way. To me, the selection of a mash method is a matter of artisanal preference, not of ideological dogma. There are advantages and disadvantages to either method and, yes, there are indeed differences in the result. For instance, it is true that decoction promotes the Maillard reaction, which produces melanoidins from a combination of sugars, amino acids (the building blocks of proteins), water and heat. Melanoidins darken the beer slightly and add malty, bready, caramel aromas to the brew. But everything is relative. For me, that increase in maltiness, which many proponents of decoction claim is the key benefit of boiling the mash, is not that significant, because you could get the same or a similar effect by just adding commercial melanoidin malt to the grain bill or by extending the wort boil by an extra half-hour, say from 60 to 90 minutes.

There is another reason why the "enhanced maltiness" argument for decoction is spurious, in my view: I can decoct a beer from crappy malt, and the result won't taste malty; and I can infusion-mash a beer made with great malt, and the result will taste extremely malty. In modern grains, maltiness is one of the key variables grain breeders select for when they develop new brewing barley varieties. Thus, if you brew with the best of modern brewing grains, your beer will taste much maltier than any beer brewed during the late Middle Ages, when decoction was *de rigueur*. (Modern brewing grains differ in other ways from their historical counterparts, including differences in levels of modification and, of course, agronomic properties.)

The quality of the raw material has a much greater effect on beer flavor, including maltiness, than does the mashing technique. The surest way, therefore, to make a malty beer is to make it with "malty malt."

To me, the real advantage of decoction as opposed to infusion is not necessarily better beer flavor — and yes, you have a Constitutional right to disagree with me! — but better extract efficiency. This is because the cooking process does an extremely good job of dissolving certain cytolytic cell structures of the endosperm. These struc-

tures are mostly beta-glucans. As these viscous gums dissolve, they make the malt starches more easily accessible for gelatinization, which occurs — under laboratory conditions using barley starch — at about 147 °F to 153 °F (64–67 °C).

Gelatinization is a necessary precondition for enzymatic starch-to-sugar conversion by alpha-amylase and beta-amylase. In infusion mashing (as well as in malting), beta-glucans are broken down, too. This happens enzymatically, via beta-glucanase. The added effect of dissolving the gums by cooking in decoction mashing leads to better extract efficiency. For commercial brewers, who make thousands, even millions, of barrels of beer a year, even a small gain in extract efficiency may be of economic importance, but this gain must be related also to the cost of the extra energy that the decoction process consumes. For homebrewers, of course, such economic considerations ought not to matter.

Today, decoction is still a necessity in enzyme-poor mashes and in those with practically no enzymes at all. Recipes for certain American-style beers such as light lager, malt liquor or cream ale, which may call for corn or rice as part of the grist, definitely benefit from adjunct decoction in a separate cooker. In whiskey-making, too, adjunct cooking is still standard. The base grist of a typical bourbon mash, for instance, is milled corn, which has no enzymes. That mash is first boiled for all the reasons mentioned above. It is then allowed to cool off for the optional addition of some milled rye and/or wheat for more depth of flavor. As the mash cools down further, enzyme-rich barley malt or, in modern operations, more likely, synthetic enzymes are added. The amylase in the barley (or the synthetic enzymes) converts all the grain starches in the mash, including the gelatinized corn starches, into fermentable sugars. When cooled completely, the entire mash is inoculated with yeast and fermented. There is no lautering in bourbon-making. Once fermentation is finished, the mash — grain solids and all — is distilled, and the condensed evaporant is whiskey.

A secondary advantage of decoction is the improved coagulation of unconverted, large-molecular proteins during the mash boil. This early coagulation allows for these proteins to be trapped in the mash, especially during recirculation, so that they do not end up in the kettle. This usually results in less hot break and a clearer, more filterable beer. But this factor is probably also more relevant to the commercial brewer than the homebrewer.

Perhaps the most serious disadvantage of decoction to the homebrewer is the long and arduous brew day. But, if you are prepared to spend the extra time and effort, I have a Bavarian Märzen recipe for you to try. I selected this 1841 Bavarian original, because in Bavaria, more than anywhere else in the world, many brewers are still dedicated to the traditional decoction method. Note that all, as with all *BYO* recipes, quantities are calculated for a system with a nominal extract efficiency rating of 65%.

The Decoction Process

Because decoction requires the separation of a portion of the mash from the main mash, commercial breweries use slurry pumps. Depending on the specific brew house configuration, the decoction is either drawn into a cooking vessel and then processed there, or the main mash is removed to a standby vessel, while the decoction is cooked in the mash-kettle. In either case, the two mashes are re-combined after one of them has been boiled. In the old days, before mechanical pumps, a brewer would draw a decoction simply by ladling it into a separate, direct-fired vessel. Given the quantities involved in homebrewing, a two-quart pot or measuring cup will suffice as a transfer implement. For a cooker, use a pot that is at least two-thirds the size of your mash tun.

Decoction mashes tend to be fairly thin compared to infusion mashes. Depending on a brewer's preferences and the size of the mash tun, use about 2.5 to 3.5 quarts of brewing liquor per pound of grist (roughly 5 to 7 liters per kilogram). In constrast, in homebrewing, most infusion mashes are carried out at around 1.25 qts. per pound of grain (2.6 L/kg). In commercial breweries, it is not uncommon for decoction mashes to contain as much as 80 percent of the kettle volume in mash liquor. Therefore, they have more the consistency of grain porridge than of a grain bed. While heat is applied to the cooker, commercial breweries use mechanical agitators to avoid scorching of the decoction. In the homebrew environment, where the decoction is likely to be heated on a stove or a propane burner, stir the pot frequently!

During the decoction temperature rise, rest the mash at the conventional temperature stops for protease and amylase to let the respective enzymes do their work. These rests usually last no longer than 10 to 20 minutes each. Alternatively, you can increase the temperature very slowly but continuously, at perhaps 2 °F (1 °C) per minute. This should allow for enough time to achieve all necessary conversions even without rests. Once the decoction reaches the boiling point, it is cooked for about 10 to 20 minutes, rarely longer. Finally the hot decoction is blended back into the main mash to raise the main-mash temperature.

The main mash, of course, has to go through the same conversion steps as the decoction mash in the cooker. When returning the decoction to the main mash, do so in increments. Stir each increment into the main mash and check the main mash temperature, to make sure it does not exceed the target temperature for the next rest. If the main mash reaches its next rest target temperature before the entire decoction has been mixed in, just cool off the remaining decoction with some cold water before adding it. If the decoction was too small to achieve the desired temperature increase, add some boiling water to the main mash to supply the missing thermal energy.

In theory, a main mash can be decocted as often as the brewer desires — from a phytase acid and beta-glucanase rest at about 105 °F (approx. 40 °C) to the mash-out at about 170 °F (77 °C). In practice, however, most decoctions nowadays are single-step, from a protein rest at 122

Decoction Recipe

Märzen

(5 gallon/19 L, all-grain)

OG = 1.056 (14 °P) FG = 1.014 (3.5 °P)
IBU = 23 SRM = 9.5 ABV = 5.6%

The recipe below uses a double decoction. Up front, hop bitterness in this beer takes a second seat to the maltiness, while in the lingering finish, the hop aroma is noticeable. Any noble hop variety (Saaz, Hallertauer Mittelfrüh, Hersbrucker, Tettnanger, Spalt, Northern Brewer or Strisselspalt) is suitable. I selected a few recently developed noble hop varieties to achieve some good aromatic effect.

Ingredients

8.5 lb. (3.9 kg) Weyermann® Vienna malt
2.5 lb. (1.1 kg) Weyermann® Munich II malt
0.50 lb. (0.23 kg) Weyermann® Carahell® malt
0.50 lb. (0.23 kg) Weyermann® Melanoidin malt
4.4 AAU Taurus hops (60 mins) (0.34 oz./10 g of 13% alpha acids)
5.5 AAU Hallertauer Tradition hops (15 mins) (1.4 oz./39 g of 4% alpha acids)
5 AAU Smaragd/Emerald hops (5 mins) (0.63 oz./18 g of 8% alpha acids)
Bavarian-style lager yeast (such as Wyeast 2206 (Bavarian Lager) or White Labs WLP820 (Octoberfest Lager) yeast

Step by Step

Mash in the main mash as thin as your mash-tun size allows, at 105 °F (approx. 40 °C); rest 30 minutes to ensure proper grist hydration, activation of phytase for some mash acidification, and activation of beta-glucanase for some gum degradation.

Assess the main mash volume and calculate the first decoction volume to raise the main mash temperature to 149 °F (65 °C). Draw the decoction into a pot and heat it in 10 to 15 minutes to 149 °F (65 °C). Rest the decoction for 15 minutes. Heat the decoction in 10 minutes to 162 °F (72 °C). Rest it for 10 min. Heat the decoction in 10 minutes to 212 °F (100 °C). Boil it for 10 min. Reintroduce decoction to main mash. Rest the main mash at 149 °F (65 °C) for 10 minutes.

Calculate the second decoction volume to raise the main mash temperature to 162 °F (72 °C). Draw the decoction into a pot and heat it in 5 to 10 minutes to 162 °F (72 °C). Rest the decoction for 10 min. Heat the decoction in 10 minutes to 212 °F (100 °C). Boil it for 10 minutes. Reintroduce the decoction to the main mash. Rest the main mash at 162 °F (72 °C) for 10 minutes. Raise the temperature of the main mash to 171 °F (77 °C) by applying external heat. Rest the main mash for 15 minutes. Recirculate the run-off for 5 minutes. Start lautering and sparging slowly (!) until the kettle is full. (In a commercial brewery, lautering may last as much as 3 hours.)

Boil the wort for 90 minutes. Add the first hop at 30 minutes into the boil, the second hop at 75 minutes into the boil, and the third hop at 85 minutes into the oil. Whirlpool for 30 minutes. Heat-exchange the wort to fermentation temperature. Ferment at 50 °F (10 °C) for 3 weeks. Rack for lagering. Lager for 5 weeks as close to the freezing point as possible. Rack again, prime or condition, and package.

°F (50 °C) to a single saccharification rest at 152 °F (67 °C). The main mash reaches the mash-out temperature either through the application of external heat or — rarely in a Continental European brewery — through hot-liquor sparging. When double decoctions are employed, they usually occur between a protein rest at 122 °F (50 °C) and a single saccharification rest at 152 °F (67 °C); and then between the saccharification rest and the mash-out at 170 °F (77 °C). A triple decoction usually involves steps from a phytase/beta-glucanase rest at 105 °F/40 °C) to a protein rest (122 °F/50 °C); then from a protein rest to a single saccharification rest at 152 °F (67 °C); and finally from the saccharification rest to the mash-out at 170 °F (77 °C). A more involved, but rare scheme would be a quadruple decoction with an additional split of the saccharification phase into a beta-amylase rest at 148 °F (64 °C) and an alpha-amylase rest at 156 °F (69 °F). Obviously, it is also possible to infusion-step-mash a brew part of the way; and to decoction-step-mash it the rest of the way.

The amount of temperature increase generated in the main mash by the decoction depends, of course, on the volume of the decoction drawn for the boil. As a rule of thumb, this volume is between one-quarter and one-half of the main mash. There is an easy formula in the metric system (using liters and the Celsius scale) for calculating the volume for a desired temperature increase. (For a more rigorous equation, see "Mash Temperatures," by Bill Pierce, in the November 2010 issue of *BYO*.)

$$V_{decoction} = (T_{difference} * V_{main})/(84 - T_{main})$$

Where:

$V_{decoction}$ = the volume in liters of the mash that needs to be decocted

$T_{difference}$ = the desired increase in temperature in the main mash, in °C

V_{main} = the volume in liters of the main mash

T_{main} = the starting temperature of the main mash before the decoction

The number 84 is a calculation constant. (This value can be raised or lowered if the equation returns values that don't work in your brewery.)

Here is an example for raising the temperature of a 4-gallon (15-L) mash from the protein rest temperature 122 °F (50 °C) to a saccharification rest of 152 °F (67 °C):

$V_{decoction} = (17 * 15)/(84 - 50)$

$V_{decoction} = 255/34$

$V_{decoction} = 7.5$ L

Converted to the U.S. system of measurements (using quarts and the Fahrenheit scale), the equation is:

$$V_{decoction} = (T_{difference} * V_{main})/(182 - T_{main})$$ (BYO)

Horst Dornbusch is a frequent contributor to BYO.

Calculating Conversions

From all-grain to extract — and back

by Terry Foster

You had a great beer at a brewpub — so good that you want to recreate it at home. If the brewer was obliging enough to give you his all-grain recipe and you brew only from extract, how do you convert it? Or perhaps you wanted to try all-grain brewing, and where better to start than with your own favorite extract brew? How you make these conversions is generally straightforward, but does require a little number manipulation and some understanding of the nature of various malts.

A simple start

The first problem is that of "extract equivalency." In other words how do you ensure that the converted recipe will match the original gravity of the starting recipe. Well, the first thing you do is to look at *BYO*'s recipe standardization insert (in every issue on page 2), and use the numbers given there. Let's take a simple example first, say an all-grain 5-gallon (19 L) brew using 9.5 pounds (4 kg) of 2-row pale malt. *BYO* gives this as yielding an OG of 1.024 (or 24 "gravity points") when 1 pound is extracted into 1 gallon of water. So how much pale malt extract do we need to replace this grain? *BYO* says 1 pound of liquid malt extract (LME) in 1 gallon of water will give a gravity of 1.033–1.037; you probably won't know the exact figure, since manufacturers rarely give it. Let's assume it is 1.035 (or 35 gravity points) to minimize any error, and then, doing the gravity point calculation:

$$9.5 \times 24 = W \times 35 \ldots (i)$$

Where W is the weight of LME in pounds, then $W = (9.5 \times 24) \div 35 = 6.5$ lbs. of LME.

But often it is more convenient to take the whole number weight of LME, and make the rest up with dried malt extract (DME). *BYO* tells us that 1 pound of DME in 1 gallon of water gives a gravity of 1.045, so if in the above we assume we have only 6 pounds of LME, equation (i) is now written as follows:

$$9.5 \times 24 = (6 \times 35) + (WD \times 45) \ldots (ii)$$

Where WD is the weight of DME required. Then $((9.5 \times 24) - (6 \times 35)) \div 45 = 0.4$ lb = 6.4 oz. DME

At the risk of being obvious, if you had a recipe requiring 6 pounds of pale extract syrup, and 6 ounces (0.375 lb.) DME, the equivalent amount of 2-row pale malt (WM) would be given by: $WM = ((6 \times 35) + (0.375 \times 45)) \div 24 = 9.45$ lbs. pale malt.

The real world (I)

But the above was a very simple recipe, and generally we want to convert more complicated recipes involving perhaps several malts and adjuncts. So I am going to take such a recipe and go through the approach, starting with all-grain to extract. And the first point to consider is what you can and can't do with specialty malts and adjuncts (other than base malts such as pale 2- and 6-row, Pilsner, mild ale and wheat malts, which are the main source of fermentables). In other words, you need to decide whether you can get what you want by a simple steeping procedure, or whether a partial-mash will be required. Anything containing starch will require mashing, usually along with a proportion of pale malt to ensure the presence of sufficient enzymes to convert the starch into fermentables. These include amber, brown, special roast, Victory® and peat-smoked malts, as well as Munich, Vienna and rye malts (the last three can be mashed directly without added pale malt). Flaked cereals such as barley, oats, rice and so on also need to be utilized in a partial-mash, but I'll leave them out of this discussion since they are used for fairly specific purposes, and I don't want to complicate things too much.

More highly-roasted malts and grains that do not contain starch (or enzymes) can be treated by steeping in hot water to obtain both flavor and extract. Notable among these are crystal and caramel malts, chocolate and black malts, the darker cara malts, Caravienne®, Special B®, and roast barley. Consider the malt bill for this all-grain recipe for a dry stout:

> "If the brewer was obliging enough to give you his all-grain recipe and you brew only from extract, how do you convert it?"

Portly Stout

(5 gallons/19 L, all-grain)

OG = 1.063 FG = 1.015
ABV = 6.3% IBU = 50 SRM = 100

Malt ingredients

11.5 lb. (5.2 kg) 2-row pale malt (2 °L)
0.5 lb. (0.23 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) chocolate malt (400 °L)
0.5 lb. (0.23 kg) brown malt (65 °L)
0.25 lb. (0.11 kg) black malt (550 °L)

The first thing to notice is that we have four specialty malts, three of which can be steeped, but brown malt needs to be mashed. None of the specialty malts contain enzymes, so we have to add in some pale malt to the partial mash; an amount equivalent to the brown malt, 0.5 lb. will do the job. So, using the *BYO* recipe standardization numbers, the gravity points we shall get from the partial mash are as follows:

2-row Pale malt = 0.5 x 24 = 12
Crystal malt = 0.5 x (34 x 0.65) = 11
Chocolate malt = 0.5 x (34 x 0.65) = 11
Brown malt = 0.5 x (35 x 0.65) = 11
Black malt = 0.25 x (25 x 0.65) = 4
Total points = 49

Now the total gravity points required are 5 x 63 = 315, so points required from extract = 315 – 49 = 266. If we use only LME, then we should need 266 ÷ 34 = 7.6 lbs. But let's assume we want to use just 7 lbs. of LME, which gives us in points 7 x 34 = 238. Then points from DME = 266 – 238 = 28 and the weight of DME required = 28 ÷ 45 = 0.62 lb = 10 oz. Summing all this up we have our new recipe, which I have given in complete form:

Converted Portly Stout

(5 gallons/19 L, extract plus partial mash)

OG = 1.063 FG = 1.015
ABV = 6.3% IBU = 50 SRM = 100

Ingredients

7 lb. (3.2 kg) pale LME
10 oz. (0.3 kg) pale DME
0.5 lb. (0.23 kg) 2-row pale malt (2 °L)
0.5 lb. (0.23 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) chocolate malt (400 °L)
0.5 lb. (0.23 kg) brown malt (65 °L)
0.25 lb. (0.11 kg) black malt (550 °L)
13.6 AAU Northern Brewer pellet hops (1.7 oz./47 g) at 8% alpha-acid (at start)
Wyeast 1084 Irish Ale yeast or White Labs WLP004 Irish Stout yeast

Step by Step

Add pale and specialty malts to 3 quarts (2.8 L) water at 160 °F (71 °C), stir well, and heat if necessary to bring to 150–152 °F (65.6–66.7 °C). Let stand 30-45 minutes and strain liquid into boiling pot, wash the grains with 1 gallon (3.8 L) hot water, and strain again into pot. Stir in liquid extract, making sure it is fully dissolved, then do the same with the DME. Make up to 5 gallons (19 L) with hot water, bring to a boil and add the hops. Boil 60 minutes, cool, add yeast and allow the wort to ferment. When secondary fermentation is complete (one to two weeks) bottle or keg, conditioning in the normal way. Note that this assumes an extract efficiency of 65% in the partial mash.

The real world (II)

It should be obvious that if you had started with the converted version of Portly Stout, you could simply backtrack on the above calculations to produce an all-grain recipe for this beer. One of the reasons why this is easy is that you are swapping pale malt for pale LME and DME. With darker extracts you have to allow for whatever specialty malts may be present in the extract. This presents a great difficulty, since we do not often know exactly what has been used to make the extract, and even when we do, we seldom know in what proportion the specialty malt has been employed. And I am talking about straight extracts here; hopped extracts present a further problem if we don't know what level of bitterness they may contain.

We do have some help here, because the *BYO* October 2006 issue offers the "Ultimate Extract Chart." Using this and our experience of the parameters expected for the style of beer being brewed, it is possible to make a shot at such conversions. From the chart, amber, unhopped malt extracts generally have a similar color level which comes from incorporation of crystal malt in the original extract mash. It's a reasonable guess that they will contain around 10–15% of crystal, which will probably have a color level of 60 °L. So assume your recipe uses only extract, with no steep or partial mash, and you've used 6 lbs. of amber extract to make 5 gallons (19 L) of an English Bitter at OG 1.042. Then total points = 5 x 42 = 210. If we replace this with 90% pale malt and 10% 600 °L crystal malt then: (0.9W x 24) + (0.1W x 22) = 210, where W is the total weight of replacement grain or 23.8W= 210, so W = 8.8 lb (4.0 kg). Then weight of pale malt = 8.8 x 0.9 = 7.9 lb (3.6 kg), and of crystal = 8.8 x 0.1 = 0.88 lb. (0.4 kg), which can be usefully rounded to 8 lbs. (3.6 kg) of pale, and 1 lb. (0.45 kg) of crystal, and these will be mashed at 150–152 °F (65.6–66.7 °C).

You can do a similar thing for dark amber extracts, except that there is more guesswork as to the constituents of these. Most of these again contain crystal/caramel (60 °L) probably at 10–15%, along with chocolate malt or black malt or roasted barley, these latter probably being at a maximum of 5% of the total original grist. Your choice of the high-roasted malts will depend on the style of beer (and its taste!); use only chocolate for a brown porter, black for a robust porter, and black and roast barley for a

dry stout, for instance. Some of these are also made using some Munich malt in the mash, and if you want a rather fuller flavor in your beer, instead of just pale malt use a 60:40 mixture of Munich and pale malts along with the roasted malts.

Don't forget the hops!

If the recipe you wanted to convert to brew as an all-grain beer was made with a hopped extract we have a different problem, as we have to allow for these hops. Of course, we may have problems here if we don't know the hop rates or hop varieties used in the extract. Well, the latter should be relatively easy, using our taste buds and our knowledge of the beer style in question. And we are helped in the former by *BYO*'s extract chart, which for many such extracts gives us the range of IBU's to be expected from a given weight made up to a given volume of beer. Let's take for an example a Bavarian Pilsner kit weighing 6.6 lbs. (3 kg) and giving 6 gallons (23 L) with 25 IBU (average from the chart). We can replace this with W lb. of Pilsner malt as discussed earlier: W x 24 = 6.6 x 35, so W = (6.6 x 35) ÷ 24 = 9.6 lbs. Pilsner malt.

But suppose we want to make only 5 gallons (19 L) of our all-grain beer, we would need: 9.6 x 5/6 = 8 lbs. Pilsner malt.
Now the hops; for a Pilsner a noble hop, such as Czech Saaz or German Tettnang would be good choices, and I'll opt for the latter. So let's suppose we've got Tettnang pellets at 4% alpha-acid, and we want 25 IBU, how much will we need for our 5-gallon (19-L) brew? Well there is a simple equation for this:

$$IBU = (W \times A \times U \times 0.7489) \div V$$

Where W is weight of hops in ounces; A is alpha acid percent, U is the utilization factor, representing how much of the alpha-acid content finishes up in your beer as iso-alpha-acid; and V is the volume in gallons; 0.7489 is simply a conversion factor to allow for ounces and gallons in place of grams and liters.

Note that this equation is simply the definition of IBU, and while it is accurate as it stands, it will only ever give approximate answers for us, because we shall never exactly know U, or even A. It is a good practical guide, but these limitations mean you might need to tweak the hop rate in subsequent beers, if you don't quite have the bitterness you want. *BYO* assumes that U = 25%, so that in this case we have: 25 = (W x 4 x 25 x 0.7489) ÷ 5, and W = (25 x 5) ÷ (4 x 25 x 0.7489) = 1.7 oz (48g) [6.8 AAU].

So our 5-gallon (19-L) brew uses 8 lbs. (3.6 kg) Pilsner malt, mashed in the usual way, and the collected wort is boiled for 60 to 90 minutes with 1.7 oz. 4% alpha German Tettnang pellet hops.

Summary

I have given you essentially an overview of recipe conversion, which can obviously be more difficult with more complicated recipes, but will help you convert your favorites. However, never let numbers overrule your own taste and judgment! BYO

Terry Foster writes "Techniques" in every issue of BYO.

Get Control

Control systems in the brewing process

by Chris Bible

Brewing is a complex activity. When a brewer makes beer, there are many variables that must be specified and controlled in order to ensure that the characteristics of the finished product are aligned with the brewer's original intention. Key variables in the brewing process are often related to temperature. Examples of this are mash temperature and temperature profile, sparge water temperature, fermentation temperature and lagering temperature. Proper control of these key temperature variables is critical to brewing good beer.

A home brewer can control these temperature variables manually, but a more precise degree of control may be achieved by using an automated control system.

Functions of a control system

A control system is used to regulate a control variable, like temperature, by measuring the variable that is to be controlled, comparing this measurement to the desired value (called the variable "setpoint"), and then providing an output signal to an appropriate device in order to bring about change to the value of the measured variable. The overall control process requires measurement, comparison, computation and correction.

Measurement This is a measurement of the process variable being controlled by the system. For temperature measurement in a brewery, a thermometer, thermocouple or thermistor is often used.

Comparison This is a comparison of how close the measured value for the process variable is to the desired value (setpoint). This is done by the brewer in a manually controlled system. In an automated system, this is done either mechanically or electronically by a component in the control system.

Computation This is a calculation that uses the comparison of the difference between the measured value and the setpoint value, and determines how large and in what direction something needs to happen in order to cause change to the measured value. In a manual system, the brewer might think, "Wow, the mash temperature is much lower than it should be...". In an automated system a calculation is performed to compare the magnitude of the difference between the measured value to the setpoint value for the variable.

Correction A correction is made to the system based on the value of the difference between the measured value and the setpoint value of the variable that is being controlled. In a manual system, the brewer might turn up the mash heater to a high setting if the mash temperature is much lower than desired. In an automated system, a mechanical or electrical component will send a signal to the heater in order to make the correction.

Hardware of a control system

Any control system, whether manual or automatic, is made up of three distinct pieces of hardware: A sensor, a controller and a control element.

A sensor is a piece of equipment that measures a system variable. It serves as the signal source in automatic control.

A controller is a piece of equipment that performs the functions of comparison and computation (this is "the brewer" in the case of a manual control system).

A control element is a piece of equipment that performs the control action or exerts direct influence on the process.

This element receives signals from the controller and performs some type of operation on the process (e.g. turns on the mash heater).

"Any control system, whether manual or automatic, is made up of three distinct pieces of hardware: A sensor, a controller and a control element."

Automated controllers can make decisions in a home brewery that bring about constant mash or fermentation temperatures.

Software of a control system

Software, in this context, refers to the "brains" of the control system. The software is responsible for making the decisions associated with the "Compare" and "Computation" functions. In the case of a manual control system, the software is the decision-making abilities in the brewer's brain. In the case of an automated controller, the software refers to the programming logic and response outputs that are included within the controller. An automatic controller might use very simple logic, or a more complex algorithm might be used.

TYPES OF AUTOMATIC CONTROLLERS

On-off controllers

The simplest type of automatic controller is the on-off controller. It simply turns a control element on or off based on the relationship between the control variable value and setpoint. A good example of this is the thermostat in most homes. It responds to the measured temperature within the home by turning the heat-pump on or off. If the temperature is below the setpoint, the heat is turned on. When the temperature in the home exceeds the setpoint by a prescribed amount, the heat is turned off. With an on-off controller, the control element (the heater in this example) is either on or off, 100% or 0%, all or nothing. There is nothing in between.

Simple on–off feedback control systems like these are cheap and effective. In many cases, they represent a good trade-off between cost and control precision, and are more than adequate for most processes that might be controlled in a home brewery.

Proportional-integral-derivative (PID) controllers

A Proportional-Integral-Derivative (PID) controller uses a more complicated algorithm to determine how to respond to input signals. PID controllers calculate an "error" value as the difference between a measured process variable and a desired setpoint. The controller then attempts to minimize the error by adjusting the control elements in accordance with its programmed algorithm.

The PID controller algorithm uses three separate parameters in the control algorithm: the proportional, the integral and derivative values. The proportional value determines the controller's reaction to the current error, the integral value determines the controller's reaction based on the sum of recent errors and the derivative value determines the controller's reaction based on the rate at which the error has been changing. The weighted sum of these three actions is used to adjust the process. For best performance, the PID parameters must be tuned according to the nature of the specific system that is being controlled.

For example, after measuring the process variable (e.g. temperature) and then calculating the error, the controller decides when to change the control element output (e.g. heater) and by how much. When the controller first turns the heater on, it may turn the heater on only slightly if the temperature difference between the measured value and setpoint is small, or higher if the temperature difference is large. This is an example of proportional control. The heater output is proportional to the difference between the measured value and the setpoint value.

If the temperature does not increase quickly enough, the controller may try to speed-up the process by turning up the heater output more-and-more as time goes by. This is an example of an integral control. By using only the proportional and integral control methods, it is possible that in some systems the temperature may oscillate more quickly than desired between hot and cold, because the controller is adjusting the heater too quickly and over-compensating or overshooting the setpoint.

In order to achieve a gradual convergence at the desired temperature setpoint, the controller may wish to damp the anticipated future oscillations. In order to compensate for this effect, the controller may use logic associated with the observed rate of change of the temperature to alter the adjustments. This can be thought of as derivative control.

PID control parameters

The PID control parameters that are used in many controller algorithms are:

Proportional:

$$P_{out} = K_p e(t)$$

Where:
P_{out} = Proportional term of output
K_p = Proportional gain, a tuning parameter
e = Error = Variable Setpoint Value – Variable Measured Value
t = Time or instantaneous time (the present)

Integral:

$$I_{out} = K_i \int_0^t e(\tau)d\tau$$

Where:
I_{out} = Integral term of output
K_i = Integral gain, a tuning parameter
e = Error = Variable Setpoint Value – Variable Measured Value
t = Time or instantaneous time (the present)
τ = a dummy integration variable

Derivative:

$$D_{out} = K_d \frac{de(t)}{dt}$$

Where:
D_{out} = Derivative term of output
K_d = Derivative gain, a tuning parameter
e = Error = Variable Setpoint Value – Variable Measured Value
t = Time or instantaneous time (the present)
de(t)/dt = time derivative of error

Fuzzy logic controllers

A fuzzy logic controller works similar to a PID controller: it receives a measured input value, compares this to the desired variable setpoint, performs some calculations and generates an output value to manipulate a control element. The difference between a PID controller and a fuzzy logic controller is primarily in the algorithm that is used.

In a PID controller, the algorithm logic assumes that there is no uncertainty or overlap between states of a system. Using the example of temperature, a PID controller sees the system as either "too hot" or "too cold." A fuzzy logic control algorithm does not look at the system this way. Instead, the temperature variable in a fuzzy logic system might be divided into a range of different "states,' such as "cold," "cool," "moderate," "warm," "hot" or "very hot." These different states are then mapped to "membership functions" in which the true state (or "truth value") of the system at any one time will almost always be to some degree part of two membership functions, for example. 0.6 moderate and 0.4 warm, or 0.7 moderate and 0.3 cool.

Control logic response is then developed around the variable's truth states. By using this fundamentally different control approach, fuzzy logic controllers can generally control process variables much better than PID controllers. There is generally less overshoot when using a fuzzy logic controller, and the response time to reach setpoint is almost always quicker than with a PID controller.

Conclusions

So which type of control system should you use in your home brewery? Select a system based on your budget and required control precision. If you prefer to do things the "old fashioned way," then manual control may serve you well, but at the cost of increased involvement by the brewer. However you choose to do it, by controlling the important variables in the brewing process you will ensure that your beer is as good as it can be. BYO

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

Motorize A Grain Mill

Step up from hand cranks

by Steve Van Tassell

Apparently, I must have been a very good brewer in 2008 because on Christmas morning I found a brand new Crankandstein 3D grain mill under the tree. I guess Santa must have heard all of the cursing coming from the garage while I struggled with my previous mill and took pity on a deserving homebrewer.

Like many quality mills, the Crankandstein comes fully assembled but without a base, which gives the user considerable flexibility in how they'll mount and power the unit. For my old mill, I used a 20ish-year-old Skil hand drill that put out all of ⅛ horsepower (HP) with a variable speed trigger that was very difficult to control causing the milling process to run very slowly to not at all, or wildly fast. Clearly this was not going to be the solution going forward.

I'd seen some pictures of motorized mills over the years and decided this was the time to take the plunge. Wanting to be as frugal as possible, but also end up with a solid working mill, I settled on what I thought was a reasonable concept — the end product of which is shown in the photo below. Getting there from a blank piece of paper with only a general concept in mind was actually quite fun. (OK — beer gear nerd. Guilty!)

I had two overriding principles in designing my mill. As mentioned, I wanted to be as economical as possible. The second was, it had to fit under my work bench when not in use. Unlike almost everyone else on our street, we can actually park two cars in our garage, which doubles as my brewery, making efficient use of space critical. That gave me a maximum width, depth, and height of 24 inches (61 cm), 20 inches (51 cm), and 34 inches (86 cm) respectively. Width was the one factor that was going to be the challenge.

"I'd seen some pictures of motorized mills over the years and decided this was the time to take the plunge."

Parts and tools list

Motor and assembly

- Crankandstein model 3D 3-roller grain mill
- Crankandstein ⅜-inch to ½-inch driveshaft adapter
- Crankandstein base and hopper that fits the 3D model (base isn't used, just hopper)
- Grainger Belt-Drive motor, item #6K778
- Grainger Fixed Bore Sheave, item # 3X893 (small sheave)
- Grainger Fixed Bore Sheave, item # 3X934 (large sheave)
- Grainger Drive Belt, item #3L440 (44 inches/112 cm)

Base wood

- 8 feet of 2-inch x 2-inch lumber (2.5 m of 5 cm x 5 cm)
- 8 feet of 1-inch x 4-inch lumber (2.5 m of 2.5 cm x10 cm)
- 4 feet of 1-inch x 2-inch lumber (1.2 m of 2.4 cm x 5 cm)
- 1-foot x 2-foot-thick piece of ¼-inch-thick plywood (30 cm x 60 cm of 0.6 cm-thick)
- 2-feet x 2-feet-thick piece of ¼-inch-thick plywood (60 cm x 60 cm of 0.6 cm thick)

Other materials

- 3-feet x 5-feet piece of ¼-inch-thick polypropylene for the mill sides
- wood screws
- casters
- power cord
- switch housing
- switch housing cover
- switch

Tools

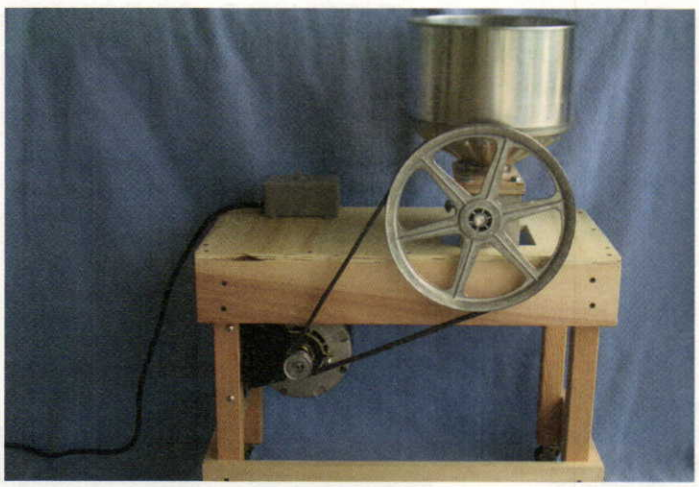
- table saw
- jig saw
- drill
- miscellaneous wrenches and screwdrivers
- a good supply of band-aids

With a few modifications, a Crankandstein grain mill can be converted from hand-crank to motorized.

1. THE MOTOR

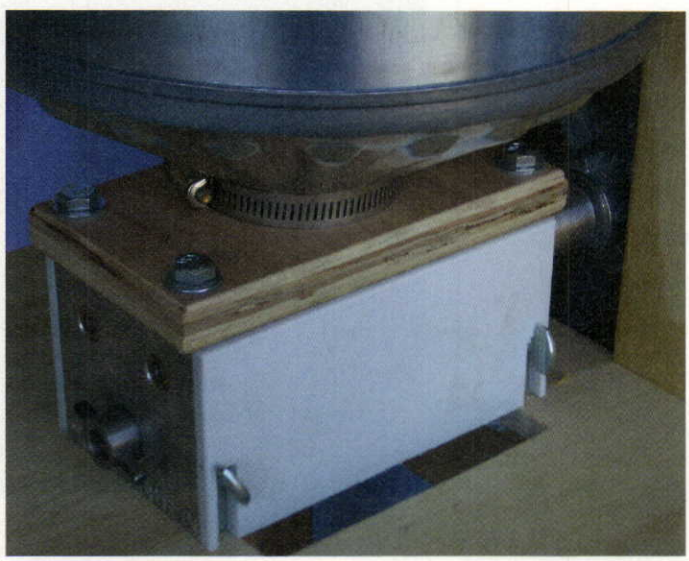
Crankandstein recommends 200 rpm at ¼ HP as the ideal operating speed and power for their mill. I'd seen lots of discussion on various beer forums on mill speeds and powers and these both seemed to fit. From the start I intended to use a motor and belt drive concept which gave me a lot of flexibility on what motor I'd use. I struck gold at a local motor repair store. They'd had a customer cancel an order and were stuck with a ½ HP, 1725 rpm, ⅝-inch shaft, capacitance start motor that was perfect for my project. At $50, the price was right.

To reduce 1725 rpm down to ~200 rpm, I went with a 1.5-inch (3.8 cm) sheave on the motor and a 10-inch (25 cm) sheave on the mill ($26 for both from Grainger). Crankandstein makes a shaft adapter that extends the drive shaft of the mill and makes it ½-inch (1.2 cm) wide to fit commonly available sheaves including the one I obtained. Using a 3L-type belt, which sits 0.45 inch (1.1 cm) down into the sheaves, the resulting mill speed is ~ 190 rpm.



2. THE BELT

Next step was the belt. I knew where the motor was going to be mounted (see photo, left). I didn't want it too close to the mill sheave so as to maximize the amount of belt in contact with the drive sheave avoiding slippage. The result was a centerline distance of 13 inches (33 cm) between the two sheaves. With the drive engineered, it was on to construction. Height was relatively easy. I made the unit tall enough so that it had just enough clearance for my grain bucket to slide underneath while clearing the mill mounting bolts on the underside of the deck. I added some casters to make the whole unit easily portable.



3. MILL OPENING

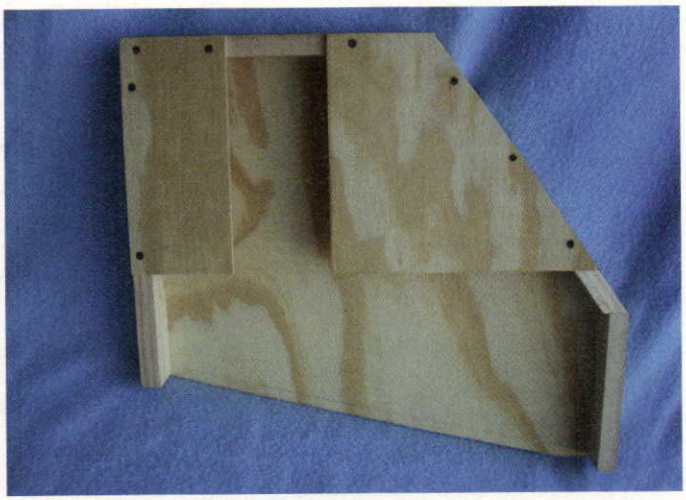
From the side, the opening for the mill was positioned such that it centered the mill over the bucket with the bucket completely inserted and touching the side and back braces. This ended up being a nice feature as I can simply shove the bucket in as far as it will go and it ends up being perfectly positioned to collect the milled grain. From the back, the mill opening was positioned as far in as possible while allowing ~¼-inch (0.6 cm) clearance for the mill sheave. I made the mill opening wider than the mill to allow it to better catch the grain coming out of the mill which doesn't come with sides. Ultimately, this didn't work that great as a small portion of the milled grain still missed the opening. To solve this I made some simple plastic sides for the mill which did the trick. These are precisely sized so they just push into place and stay put.

4. ASSEMBLING THE UNIT

With the legs and top done, assembly of the overall unit was pretty straightforward. I pre-drilled all the screw holes to avoid splitting, and countersunk for a nice finished appearance. All pieces are also glued as well as screwed. The motor is mounted on an 8-inch- (20-cm)-wide piece of scrap board. The only critical aspect here was aligning the mounting surface of the board with the interior surface of the legs so the motor mount had sufficient clearance. Going with the motor under the deck did save me some size and gives the unit an overall neater appearance, but it did make construction a bit more challenging. The cat is optional.

5. BELT GUARD

The last consideration was a guard for the belt and sheaves. (I haven't brewed any beers with fingertips as an ingredient yet, and didn't want to start here.) I wanted a cover that blocked the major pinch points where the belt enters the sheave, as well as the moving sheaves and belt themselves. In addition, I wanted a cover that could be easily removed to allow the belt to be replaced or adjusted. It covers almost all of the belt and sheaves from both the front and back, and is easily removed being held in place by only two screws that mount on two small blocks I added to the back brace (see photo, right).



6. WIRING THE MOTOR

Wiring the motor was fairly simple with a wiring diagram that was printed right on the information plate of the motor. Adding a switch made for easy operation and an immediate shutoff in case of a problem. That said, if you don't feel comfortable wiring for any reason, have a professional do the electrical wiring. Mistakes can cause serious injury or an electrical fire.

I used the optional hopper Crankandstein supplies. It holds 10 pounds (4.5 kg) of grain and had the advantage of being a drop-in component easily mounted by a few bolts. And at $35 it was quite reasonable. In keeping with the "no hand crank" concept, I copied a picture of the optional hand crank from the Crankandstein website (thanks guys!) made it into the now widely recognized international symbol for "No Cranks" and proudly slapped it right on the hopper (see photo, right). BYO

Steve Van Tassell first homebrewed in 1985. He's a BJCP certified judge who brews in Livermore, California with his incredibly supportive and lovely wife Denise.

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Back to School

Homebrewing in the classroom

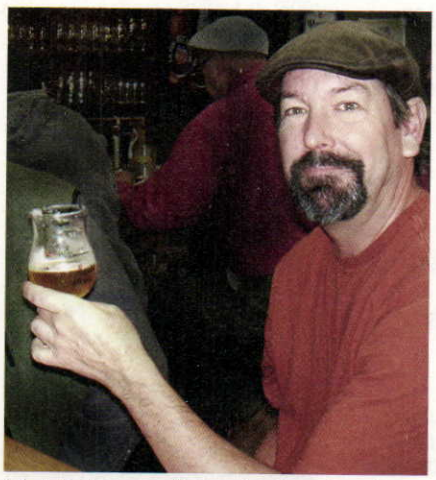
by Mark Taylor • Aptos, California

Ten years ago I caught the homebrewing bug after attending an afternoon demonstration at the local homebrew supply-store here in Santa Cruz, California. A small clutch of us gathered around a modest brew rig, asking simple questions and taking in the aroma of malt and hops.

Soon after, I bought a beginner's kit and the basic equipment to brew up an extract batch of beer. I haven't stopped brewing since, expanding on my knowledge and abilities from one batch to the next. Most of what I've learned over the subsequent years has come from getting involved in my local homebrew club, the Zymurgeeks, reading lots of brewing literature, participating in online forums and diligently practicing.

A couple of years ago it occurred to me what a benefit it had been to get introduced to this great hobby in such a hands-on way, and that others, like myself, could benefit from the structure of a hands-on classroom environment so that they could learn as I had. I noticed a gap between schools for the professional brewer, such as Siebel Institute and UC-Davis, and the occasional local store homebrew demonstrations. It seemed like the community (and the average brewer) would be well served by a narrowing of this gap, and my knowledge and passion for homebrewing, I hoped, could provide just that.

> "I noticed a gap between schools for the professional brewer, such as Siebel Institute and UC-Davis and the occasional local store homebrew demonstrations."



Mark Taylor currently teaches homebrewing at Cabrillo College in Soquel, California.

Based on this lofty plan, I developed a curriculum for a comprehensive yet practical five-day course for teaching homebrewing. I worked it out so that the lessons could be offered through community college extension classes.

Once my idea was developed, I mailed out application letters with my proposal to half a dozen nearby schools, and, low and behold, Cabrillo College in nearby Soquel showed some interest. At first Cabrillo worried about filling seats, but the class soon filled with eager students and I scheduled the first series.

Lessons are designed to be cumulative, taking the students from the basics of brewing with dried malt extract and steeping grains on through the more advanced knowledge of partial mash brewing and brewing 10-gallon (38-L), all-grain batches. All participants get the chance to have hands-on experience with the equipment and materials used in brewing, chilling, fermenting, bottling and kegging, along with the more academic calculations and tests for efficiencies, attenuation, alcohol content, etc. In addition, consideration of the malt bill, hop utilization and yeast selection for developing recipes beyond introductory brewing kits is discussed.

As a class we also sample beer styles — both homebrew and commercial examples — with an emphasis on sensory evaluation techniques. And on the fifth and final day of class the students bring in food to pair with three of the four beers that they brewed in class.

I have been teaching this class for three years now and it continues to be popular and well received. I believe that this is in part due to the fact that the class gives them an opportunity to directly experience the brewing process, a chance to test the wort, so to speak, without an initial commitment to the hobby.

Many students continue with the hobby and become actively involved in the local brewing community, and I feel proud to be able to offer this class through an organization that recognizes the value of homebrewing. And hopefully my experience will inspire other homebrewers to teach students about brewing in their own hometowns!

For more information on Mark or his classes please visit: www.backyardbrewer.blogspot.com BYO

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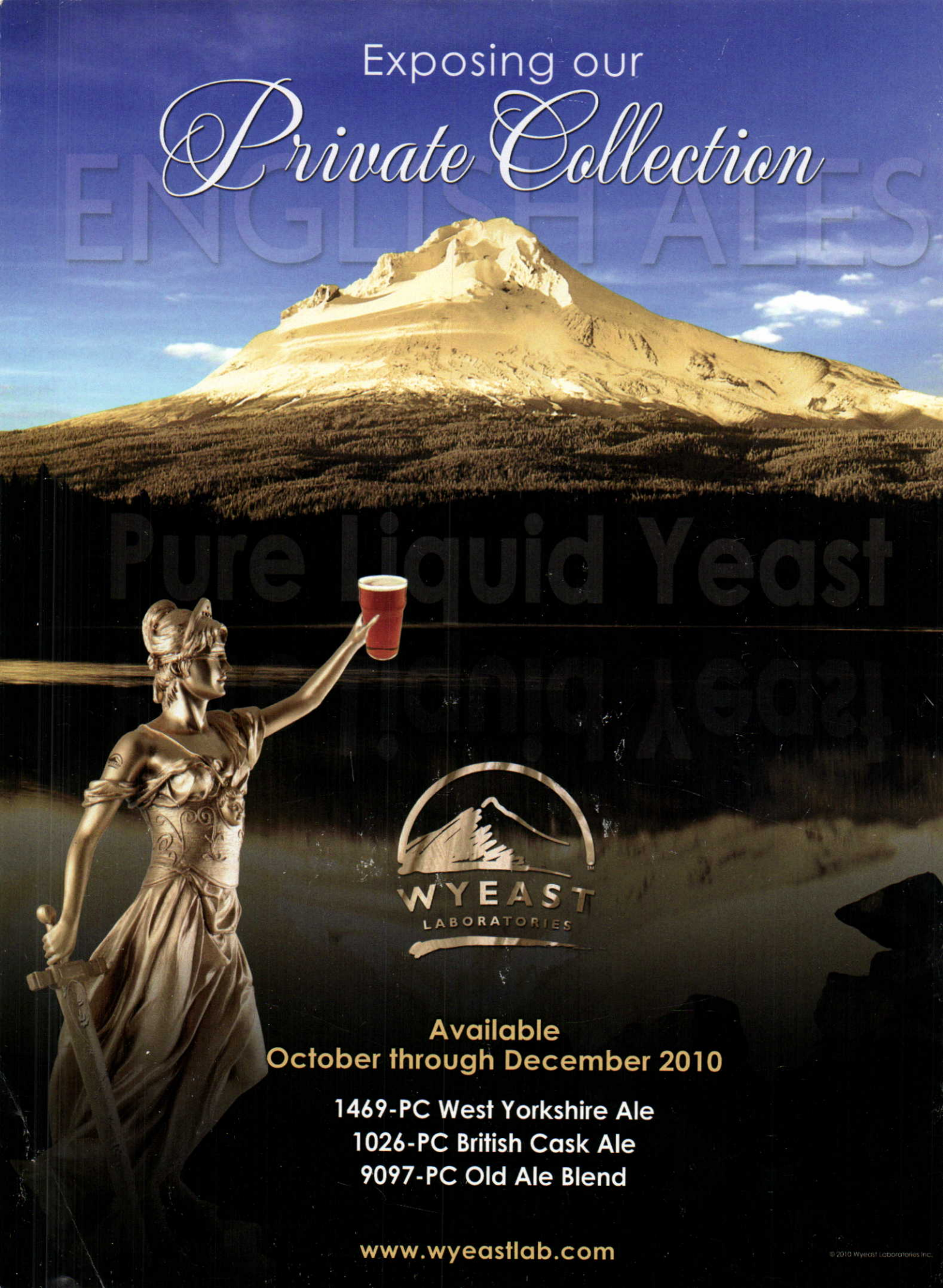
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