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BrewYour Own

THE HOW-TO HOMEBREW BEER MAGAZINE

JANUARY-FEBRUARY 2013, VOL.19, NO.1

TALL, DARK & AWESOME: RECIPES AND TECHNIQUES FOR DARK LAGERS

Build Your Own Mash Tun

Malting Grains at Home

Cloning Craft Beer History

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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.

THE LATEST FROM BSG HANDCRAFT (FORMERLY CROSBY&BAKER) 2013

BOLD MOVES INDEED.

We are pleased to announce that Crosby&Baker will now officially be known as BSG HandCraft. A change that's been waiting patiently in the wings. Some of the other things you'll immediately notice will be our constant, unyielding drive and increased dedication to make great things happen.

The bigger question, we imagine, is how will all of this affect you? Besides rethinking and refining ways to make everything easier and more intuitive for you, we've also committed to approaching the industry with a more innovative and forward-thinking approach.

However, we want you to realize that this is only the beginning... the pregame, if you will.

We encourage you to come grow with us - and enjoy the ride that we are about to embark upon.

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HandCraft

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for more BSG news follow us @thenewBSG

what's happening at **BYO.COM**

The Lowdown on Lagering

Some brewers think that lagers are so difficult to brew that only the most advanced brewers should attempt them. In reality, this is far from the truth. If you like the clean quality of lager styles, there is no reason not to begin brewing them at home.

www.byo.com/component/resource/article/1520

Base Malt Basics

The choice of a particular pale-colored malt — or "base" malt, as we sometimes call it — is a crucial decision when designing a beer in which the "malt" flavor is important. Read more about the biggest building block in your homebrews.

www.byo.com/component/resource/article/174

Delve into Dark Beers

Any beer that is not see-through can be called dark and that includes a variety of styles. In addition to the dark lagers in this issue, check out a collection of ten clone recipes for other dark styles, including stouts, porters, brown ales, a Scotch ale, an abbey ale and a dark ESB. Includes clones from Ommegang, Dogfish Head, Avery, Lagunitas, Minneapolis Town Hall, Tommyknocker, Grand Teton, Dominion, Capital and Alaskan.

www.byo.com/component/resource/article/ 5-10-clones-from-the-dark-side

Cover Photo: **Charles A. Parker**

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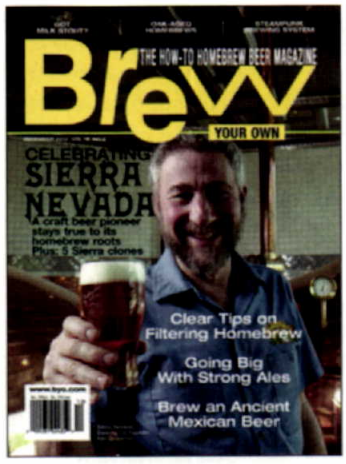


Celebration formulation

The December 2012 *BYO* Celebration Ale clone recipe lists a mash temp of 157.5 °F (70 °C). Is this a typo or just to make up for the simple grain bill? I've never mashed anything that high and never would have considered it for an IPA. Thanks.

Ron Tornese
via Facebook

That's the information we got from Sierra Nevada. Sierra Nevada Brewing Company's Celebration Ale was one of the first American IPAs (along with Anchor Liberty) and doesn't quite fit the modern "formula" that most American IPAs have settled in to. Celebration is darker in color and has more caramel flavor than most American IPAs, which tend to be brewed with smaller amounts of crystal malt and are usually much lighter in color. Likewise, it is fuller-bodied compared to most IPAs, which are frequently brewed employing a low temperature mash (148–150 °F/64–65 °C) meant to produce a highly-fermentable wort.

Celebration is, of course, very hoppy — as are all American IPAs — it's just balanced more towards an amber-colored, malty, full-bodied beer compared to most contemporary American IPAs. Brew the recipe as printed and be prepared to celebrate. (Or, if you prefer paler, drier IPAs, see the clone of Sierra Nevada Torpedo Extra IPA in our 250 Classic Clone Recipes *special issue.)*

Article arrives at the right time

How timely the feature article by John Blichmann "Home Brewery Design," November 2012. As an avid homebrewer, I was somewhat perplexed when our family moved to a new house and it did not have a walkout basement for a brewery like our old house. With family approval, I embarked upon building my own ultimate homebrewery, better known as Drane Brothers Brewery. Then my *BYO* arrived and there was John's expert guidance. I was comforted in learning I had made some good choices in size and layout, and gained some great ideas to help me finish. I have several Blichmann products and

contributors

Michael Tonsmeire is a Washington-D.C.-area homebrewer who is fascinated with funky fermentations. After discovering that beer could taste "good," he set his sights on homebrewing. He took a student taught course during his senior year at Carnegie Mellon University in 2005 called "Beer Brewing and Appreciation." After two extract batches as part of the class, he moved onto all-grain, which is when he really got hooked. Mike has written several stories for *Brew Your Own*, including a very thorough primer on brewing sour beers in the November 2011 issue. His blog, The Mad Fermentationist, chronicles his homebrewing experiments and can be found at www.themadfermentationist.com. On page 38 of this issue, he discusses three interesting dark lagers.

Horst Dornbusch is the founder and owner of Cerevisia Communications, a consulting firm that deals with all aspects of the brewing industry. His website is www.cerevisiacommunications.com. Horst is the author of several books on beer and brewing and was *BYO*'s "Style Profile" columnist for several years. Most recently, he was an Associate Editor for "The Oxford Companion to Beer" (Ed. Garret Oliver, 2012 Oxford University Press).

Horst lives in Massachusetts, but was born in Düsseldorf, Germany and visits there frequently, On a recent trip, he toured Brauhaus Faust and — on page 48 — reports on a "shady" beer they produce.

In 2010, Graham Anderson's girlfriend's New Year's resolution was to learn more about beer. The two of them began taking tasting notes and brewing together, and now they're engaged. Graham likes to make beer because it's sort of like his real job, investigating the timing of cell divisions in an academic lab, except experimental brewing results in beer almost every time.

He decided instead to take a step back and learn how to grow and malt barley. Crystal malt he made has been featured in Almanac Beer Company's 2012 California Fresh Hop Ale (www.almanacbeer.com/ourbeer/california-fresh-hop-beer/).

On page 26 of this issue, he explains how to make your own malt at home, something you probably already have the equipment to do.

always enjoy seeing what John comes up with next.

John Dane
via email

Glad the article was helpful to you and best of luck building your new homebrewery.

Captured by Porches Punctured by Corpses clone "by" wording queried by quizzical reader

I was interested in brewing this libation (Captured by Porches Brewing Co.'s Punctured by Corpses Undead Porter clone, November 2012). I'm an all-grain brewer and some things in the recipe caught my eye. It says to increase all the flaked additives "by" a certain amount. For example, it says to "increase the flaked wheat by 24 oz." This would make a total of 34 oz. of flaked wheat. Should this not be, increase "to" instead? Looking forward to the clarification.

Mark Pugh
via email

Author Marc Martin responds: "Thanks for the inquiry. The way it is worded in the article is correct. A total of 34 oz. of flaked wheat is the correct amount. The same is true for the flaked rye and flaked oats, both at 17 oz. total. That is the same scaled down percentage of grains from the brewer's original 9-barrel batches. This is a somewhat bizarre recipe from a bizarre brewery. This beer actually is almost like a weizen porter. Lots of body and mouthfeel.

Thanks for writing to the Replicator."

Starter stuff

Maybe it's just me, but it seems like *BYO* is emphasizing the benefits of making a yeast starter more often. I like that many recipes give a suggested starter size and I'm glad that you occasionally mention the yeast starter calculator at mrmalty.com. I think that is a wonderful tool that is a great resource for homebrewers. I have a question, though — should yeast starters be hopped? And if so, at what rate?

Mark Susco
via email

Yeast starters do not need to be hopped, but conversely there is no harm to it. If you are making a hoppy beer, you may wish to hop your starter at roughly the same rate as your full batch. For more information about making a yeast starter, check out a past "Techniques" column by Jon Stika at www.byo.com/component/resource/article/1088. BYO

homebrew nation

READER PROFILE

Brewer: Gary Fortin

Hometown, State: Biddeford, Maine

Years brewing: 4

Type of brewer: All-grain

Homebrew setup (volume, style, efficiency): Self-built HERIM (heat exchange recirculating infusion mash) system, two-tier brewhouse efficiency: 76%, mash efficiency: 80.1%

What's on tap/in the fridge: On tap is a Belgian strong ale and an American Pilsner. In the fridge is my version of Jamil's Evil Twin called Insidious Twin (which I hopped up to an IPA), English Extra Special Bitter (really a mild bitter), Black Rye IPA and my staple beer, Amarillo Pale Ale.

How I started brewing: When I was deployed to Iraq for the first time I picked up Charlie Papazian's *The Joy of Home Brewing*. Prior to reading that I always thought I would like to try brewing beer at home, but was too busy with life (so I thought). The lack of any alcoholic products while being deployed definitely added to the desire to have a beer, so that led to my next book by Sam Calagione — *Extreme Brewing* —and my mouth watered for more. The last book I read was *Brew Ware* by Karl Lutzen and Mark Stevens, and I thought, "Ok, I can do this." When I returned home from Iraq I purchased a brew kit from my local homebrew supply shop and began to brew extract on the stove. I then expanded to partial grains, brew-in-a-bag then finally all-grain and never looked back. After returning from my latest deployment I built a HERIM system. I also found YouTube extremely helpful, which led me to start a YouTube channel myself devoted to brewing.

My blog/website: www.youtube.com/user/Mainebrewguy?ob=0

reader recipe

Black Rye IPA
(5 gallons/19 L, all-grain)

OG = 1.066 FG = 1.015
IBU = 71 SRM = 35 ABV = 6.5%

Ingredients

11.5 lbs. (5.2 kg) Belgian 2-row malt
15 oz. (0.41 kg) rye malt
7.2 oz. (0.21 kg) caramel crystal malt (40 °L)
7.2 oz. (0.21 kg) flaked oats
6.8 oz. (0.19 kg) Carafa® II malt
5.0 oz. (0.14 kg) chocolate malt
1 tsp. Irish moss (10 min)
gypsum (per your water profile)
9.1 AAU Centennial hops (60 min)(0.91 oz./26 g at 10% alpha acids)
14 AAU Centennial hops (30 min)(1.4 oz./40 g at 10% alpha acids)
0.45 oz. (13 g) Centennial hops (0 mins)
1.4 oz. (39 g) Simcoe® hops
Safale US-05 yeast

Step by Step

Mash with a liquor-to-grist ratio of 1.25 qts./lb. (2.6 L/kg). Single step infusion mash at 154 °F (68 °C) for 60 minutes. Two-batch sparge at 168 °F (76 °C). The total preboil wort is 6.4 gallons (24 L). Boil for 75 minutes. Ferment until airlock activity has dropped off but not stopped, ~7–10 days, as you want the fermentation to produce enough CO_2 in the secondary to blow off the oxygen in the headspace. Rack to a secondary fermenter along with 1.4 oz. (39 g) of Simcoe® whole hops (no bag) for 14 days. Let the beer condition for another week in the secondary. Bottle or keg to 2.5 volumes CO_2. *Recipe scaled from 11 gallons (41 L) and adjusted to 65% extract efficiency.*

byo.com brew polls

Do you like to brew dark lagers?

No, but I would like to: 37%
Yes, sometimes: 33%
No, I'm not interested: 20%
Yes, all the time: 10%

what's new?

Electric Brewery Control Panel

The Electric Brewery Control Panel is now available completely assembled or in kit form. Custom designed and built to exacting specifications using industrial-grade components. Almost two years of work have gone into the design and development of this control panel to ensure that it works well ergonomically, is safe to use, and includes all the features a brewer could possible need.

www.TheElectricBrewery.com

Ruby Street Domed False Bottom

Ruby Street's new universal false bottoms will convert any 10-gallon (19-L) water cooler, converted keg or stock pot with 12-inch or greater diameter into a highly efficient mash tun. Stainless steel stop collars above and below the stainless steel false bottom allow for easy and secure depth adjustment with provided hex key. Also includes ⅜-inch ID silicone tubing for attachment to any ⅜-inch barbed fitting.

www.rubystreetbrewing.com

Better Dryer

Better than a bottle tree, the Better Dryer is less awkward and easier to store than a tree. Sanitize it the same way you sanitize bottles, then place the Better Dryer on the counter, drain the bottles into the bottling bucket and place the bottles upside down in the Better Dryer, letting the Better Dryer do all the work. Works for regular crown-cap bottles as well as swing tops.

www.betterdryer.com

calendar

January 11
Big Beers, Belgians & Barleywines Homebrew Competition
Vail, Colorado
The grand prize winner of this year's Big Beers, Belgians & Barleywines Homebrew Competition will have a batch of his or her recipe brewed, kegged and poured at The Falling Rock Taphouse in Denver, Colorado and also Dry Dock Brewing in Aurora, Colorado. The competition is restricted to specific AHA/BJCP beer styles.
Entry Fee: $5
Deadline: December 15
Contact: Laura Lodge, bigbeersfestival@hotmail.com
Web: www.bigbeersfestival.com

February 9
Great Northern Brew-Ha-Ha!
Duluth, Minnesota
Enter your homebrews in this second event on the Midwest Homebrewer of the Year circuit. Organized by the Northern Ale Stars homebrew club, this competition is open to any homebrewer in the US. There will be medals awarded for first, second, and third place in all BJCP categories. A minimum of 25 points must be obtained to receive a medal.
Entry Fee: $6
Deadline: January 28
Contact: Steve Daiken, brewmaster@northernalestars.org
Web: www.northernalestars.org/greatnorthernbrewhaha.html

February 9
Homebrew Alley 7
New York, New York
The New York City Homebrewer's Guild invites homebrewers to compete in their seventh-annual BJCP-sanctioned homebrew competition. All entrants will receive score sheets and commentary prepared by judges recognized by the BJCP. Prizes will be awarded to best of show 1st, 2nd and 3rd place, as well as a "Brewmaster's Choice" award.
Entry Fee: $7
Deadline: January 31
Contact: Chris Cuzme, cuzme@cuzme.com
Web: www.homebrewalley.org

homebrew nation

homebrew drool systems

Boise Homebrewery

Tom Figura • Boise, Idaho

I have been homebrewing for about seven years. I started out with just a few extract batches then caught the bug and went right to all-grain. I started brewing in my kitchen then progressed to my outside patio. Eventually, I set up a gravity tier system in my shop. I brewed this way until 2007 when my wife wanted to add on to our house. Part of the deal I struck with her was that I got a brew room out of the deal.

My hot liquor tank and mash tun are old kegs. The boil kettle is a 15-gallon (57-L) Polar Ware with false bottom. My HLT has a 4500W 240V element for heating the water, and my mash tun has no heat so I heat my strike water in a separate tank and pump it into the insulated mash tun.

I usually brew at least twice a month. I enjoy almost all styles of beer. House favorites are my American hefeweizen and dunkel. I also make a darn good IPA — I won 1st place in the wheat beer category at the Western Idaho State Fair in 2008.

social homebrews

Like *BYO* on Facebook: www.facebook.com/BrewYourOwn

Follow *BYO* on Twitter at: @BrewYourOwn

BYO asked on National Homebrew Day (Nov. 1): "So who out there is teaching someone to homebrew today and introducing them to the greatest hobby in the world?"

David Gunter • Los Alamos, New Mexico: "I taught my good friend how to brew his favorite American IPA, a clone of Bell's Two Hearted."

beginner's block

STUCK FERMENTATIONS

by betsy parks

At some point every homebrewer faces the dilemma of a dreaded stuck fermentation, which is when the yeast ceases activity before all of the fermentable sugars are converted into alcohol. If you are careful and take steps to keep your yeast happy and healthy, however, you can avoid getting "stuck."

Why fermentations stop

A stuck fermentation is often the result of one of three common conditions: improper fermentation temperature conditions, unhealthy yeast (or not enough healthy yeast cells) or a lack of oxygen.

Temperature

Yeast can be fickle under the wrong temperature conditions, and more specifically they don't like to be too cold or too hot. Yeast suppliers provide temperature guidelines for each of their yeast strains, which are ranges that they have determined in their laboratories as the temperatures that the yeast are able to grow and thrive without going dormant or dying, while producing the best beer. When you're brewing a batch of homebrew, be sure your fermenter is kept in an area that doesn't get too cold, which is a common reason for a stuck fermentation. When brewing beer styles that need to be kept on the cooler side, such as lagers, keep a close eye on the temperature inside your fermenter. If your fermentation starts to slow or stop, you can try warming things up a few degrees by moving your fermenter to a warmer area or with an electric heat wrap around the fermenter to get things moving again.

Unhealthy yeast

One of the most important steps for brewing any beer should always be pitching enough healthy yeast. Without enough healthy cells, the yeast can struggle and even decide to quit. If you are brewing anything with a higher-than-normal gravity, or anything that needs to ferment at a cool temperature, it's a good idea to build up a healthy population of yeast a day ahead of pitching with a yeast starter, or at least pitch more liquid or dried yeast than the recipe might call for. For more information about yeast starters, check out *BYO*'s video at www.byo.com/videos/24-videos/1799-making-a-yeast-starter.

If you have experienced a stuck fermentation, depending on where you are in your fermentation (take measurements with your hydrometer), you can try repitching more yeast. If fermentation stops near the beginning or middle of fermentation, you can pitch another full dose of yeast. If the fermentation stops near the end, try pitching a smaller amount of yeast — about a pint of yeast as a starter. You can also try adding yeast nutrient to be sure the yeast is healthy. Another "trick" is to kräusen the beer by adding some beer that is in the high kräusen stage of fermentation (36-48 hours after pitching for most beers). The rule for kräusening is to add 10% of the fermenter volume, or 0.1 part kräusen to 1 part beer.

Oxygen

In addition to temperature constraints, yeast need oxygen. Aerate your wort well before pitching the yeast, which many beginner brewers do by letting the wort splash when transferring it into the fermenter followed by vigorously shaking their fermenter. A more failsafe method of aeration, however, is to invest in a simple aeration stone setup, which releases consistent oxygen throughout primary fermentation via an air pump and stainless steel stone with tiny perforations. For more information about proper aeration, check out another *BYO* video at www.byo.com/videos/24-videos/1796-proper-aeration.

by marc martin

DEAR REPLICATOR, THANKS FOR SHOWING ME AND DAVE AROUND PORTLAND, OREGON LAST SPRING ON YOUR TOUR. YOU HAD SAID THAT IF WE EVER CAME ACROSS A BEER THAT WE WANT TO TRY TO DUPLICATE TO LET YOU KNOW. AFTER PORTLAND WE WENT SOUTH TO DO SOME ROCK CLIMBING IN UTAH. WE TRIED THE BEERS FROM EPIC BREWING COMPANY WHILE WE WERE THERE, AND BY FAR OUR FAVORITE WAS THEIR IMPERIAL RED ALE. CAN YOU HELP US WITH A RECIPE?

THOMAS BRIGHTON
DALLAS, TEXAS

Epic Brewing Company founders David Cole and Peter Erickson moved from the San Francisco Bay area to Salt Lake City, Utah in 1992 to open an aquaculture business selling brine shrimp eggs. Soon they were longing for the great styles and strength of the beers that they had enjoyed back in California, so David took up homebrewing. In 2008 when Utah passed a law allowing the production of beers stronger than 4% ABV, the pair decided to develop a business plan to open their own brewery.

David and Peter brewed their first batch of Epic in March 2010 and it was an immediate hit. Since then business has grown at a phenomenal rate. In 2011 they produced 4,200 barrels and this quickly doubled to 8,500 barrels for 2012. They are planning for double-digit growth in 2013.

Epic Head Brewer Kevin Crompton agreed to help David and Peter get their new brewery off the ground and has been with them ever since. Kevin began homebrewing in 1991 and started at Uinta Brewery in 1994. By 1997 he had worked his way up to head brewer and stayed with them until 2002. Since then he spent two years brewing in Kona, Hawaii and six years brewing for two other Utah breweries.

Epic's Imperial Red Ale has a white, creamy head that tops a darker-than-expected beer displaying bright ruby highlights. Slightly balanced toward the malt side, the hops come through more in the nose than the flavor.

Thomas, you won't have to rock climb to get your favorite imperial red ale because now you can "Brew Your Own." For further information about Epic Brewing Company and their other fine beers visit the website www.epicbrewing.com or call the brewery at 801-906-0123. BYO

EPIC BREWING COMPANY IMPERIAL RED ALE CLONE

(5 gallons/19 L, extract with grains)

OG = 1.072 FG = 1.015 IBU = 52 SRM = 27 ABV = 7.5%

Ingredients

6.6 lbs. (3 kg) Muntons Maris Otter light unhopped liquid malt extract
1.0 lb. 6.0 oz. (0.62 kg) light, dried malt extract
1.0 lb. (0.45 kg) Briess 2-row pale malt
17 oz. (0.48 kg) crystal malt (60 °L)
17 oz. (0.48 kg) Weyermann Caramunich® malt (140 °L)
7.0 oz. (0.19 kg) Weyermann Caraaroma® malt (130 °L)
2.0 oz. (56 g) roast barley (450 °L)
12 AAU Columbus hop pellets (0.85 oz./24 g at 14.2 % alpha acids) (60 min.)
3.25 AAU Mt. Hood hop pellets (0.5 oz./14 g at 6.5 % alpha acids) (40 min.)
1.44 AAU Cascade hop pellets (0.25 oz./7 g at 5.75% alpha acids) (10 min.)
5.25 AAU Centennial hop pellets (0.5 oz./14 g at 10.5% alpha acids) (0 min.)
1.0 oz. (28 g) Centennial hop pellets (dry hop)
½ tsp. Irish moss (last 30 min.)
½ tsp. yeast nutrient (last 15 min.)
White Labs WLP001 (American Ale), Wyeast 1056 (American Ale) or Safale 05 (American Ale) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 2 gallons (7.6 L) of water at 152 °F (66 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the liquid and dried malt extracts and boil for 60 minutes. While boiling, add the hops, Irish moss and yeast nutrient as per the schedule. Now add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

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

All-grain option:

This is a single step infusion mash using 9.0 lbs. (4.1 kg) Maris Otter 2-row pale malt and an additional 3 lbs. 2 oz. (1.4 kg) Briess 2-row pale malt to replace the liquid and dried malt extracts. Mix all of the crushed grains with 6 gallons (23 L) of 173 °F (78 °C) water to stabilize at 152 °F (67 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil for 60 minutes. Reduce the 60-minute Columbus hop addition to 0.75 oz. (21.3 g) (10.65 AAU) to allow for the higher utilization factor of a full wort boil. The remainder of this recipe and procedures are the same as the extract with grains recipe.

Lager Fermentations

Keep it clean and cool

by Betsy Parks

WE ALL LOVE TO DRINK TASTY, COOL-FERMENTED LAGERS, BUT WHEN IT COMES TO FERMENTING THEM IT IS SOMETIMES EASIER SAID THAN DONE. IN THIS ISSUE, TWO LAGER EXPERTS DISCUSS SOME ADVICE FOR RUNNING YOUR BEST LAGER FERMENTATION.

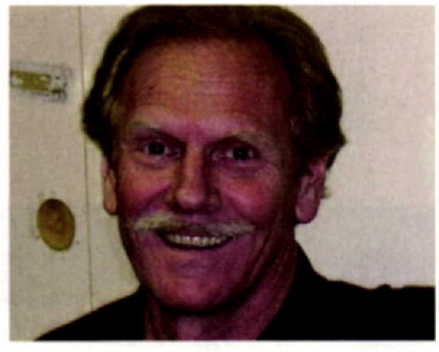
The styles of lager we brew at Sprecher tend to be German/Southern Bavarian styles, which are my first love. I spent 18 months in Germany while I was in the military and lagers are the principal beers there. Our Black Bavarian is a true Kulmbacher lager (although it is now usually categorized under the dark lager category). Some of the other lagers we also brew include a Vienna style lager, which is our biggest seller. We also make an Oktoberfest, a maibock and a Munich dunkelbock, and last year for summer we softened our Lake Michigan water to brew a proper Czech Pils.

Sprecher's lager yeast is a Weihenstephan lager culture, and we use that for most of our lagers (although not all). I started as a homebrewer back in 1971, and back then I brewed with a yeast strain that I had brought back to the US from my time in Germany. When I went to UC-Davis later on, I learned a lot about yeast culturing. After that, when we opened the brewery, I used to maintain our in-house cultures. That grew more difficult as time went on, so we found a yeast supplier to maintain our strains for us.

If you want to run a good lager fermentation it is absolutely paramount that you pitch enough yeast. You cannot get the right profile at the lower fermentation temperatures if you don't have enough yeast. The percent of daughter cells in your culture — which are young budded cells — is the most important thing to have in order to create the right character and bouquet. You want to have about 20 to 30 million cells per milliliter. You can't really know how many cells you have in your culture without a microscope, however. I used to do a lot of lab work as a homebrewer, but that may not be something that every homebrewer can do. If you can't perform the extra lab work, however, always start any lager fermentation with a well-oxygenated starter culture.

This is true for all fermentations, but temperature control is the other most important part of a successful lager fermentation. If you really had the right thing going in your homebrewery you'd be lagering in the low 40s Fahrenheit (4–6 °C), but that would be pretty slow going. Fermenting in the mid 50s (11–12 °C) is more realistic. It is very difficult at home maintaining a plus or minus one degree, which is what commercial brewers do. If you live in the right environment you can try to find an area of your house to keep the temperature constant, such as the basement. For example, here in Wisconsin we are lucky to hit 45 °F (7 °C) on some days. If you can afford it, you can also use temperature control devices to help maintain fermentation temperatures. For example, you can put on/off devices in the circuit of the plug to a refrigerator dedicated to fermenting beer to keep the fridge in the right temperature range.

Beyond yeast and temperature control, however, when you brew lagers it is also important to make sure to get a good break of the wort after the boil to get as much of the trub away from the yeast as possible in order for the yeast to do a proper job. Also, try to rack off the clear wort on the top of the fermenter as it gets down to your pitching temperature. Get rid of as much of that protein as you can before pitching because it does get in the way of a good clean fermentation.



Randal Sprecher, Owner and Founder of Sprecher Brewing Company in Glendale, Wisconsin. Randy founded his brewery in 1985 after working as a brewing supervisor at Pabst Brewing Company in Milwaukee, Wisconsin.

David Berg, Assistant Brewmaster at August Schell Brewing Co. in New Ulm, Minnesota. David graduated from the American Brewers Guild Craft Brewer's Apprenticeship Program in 1996.

At August-Schell we brew several lagers, including Pils, Vienna (Firebrick), bock, Maibock, Oktoberfest, a hoppy rye lager (Emerald Rye), and a smoked black lager (Chimney Sweep).

We have two primary in-house lager strains, one that dates back to the Christian Schmidt Brewery and the other to the Schaefer Brewery. We also occasionally use additional strains for limited-release beers.

It's very important to have an adequate amount of healthy yeast for brewing any style of beer. When brewing lagers, you need a higher pitch rate than for ales. Whereas an ale may have a pitch rate of 0.5-1 million cells per mL per degree Plato, we pitch our lagers between 1.5-2 million cells per mL per degree Plato.

Fermenting lagers is really no different than fermenting ales; to be successful you need a wort that has the adequate nutrients and oxygen, an appropriate amount of healthy yeast, and a way to control the temperature.

Modern breweries have tanks with cooling jackets that allow flow through the jacket based on beer temperature. This was not always the case, however. You can control fermentation temperature fairly well by controlling the room temperature. Another option is fermenting in a modified refrigerator or freezer.

The two most common mistakes brewers make when making lagers are not pitching enough yeast and fermenting too warm. The former is easily avoided; the latter can be solved by either equipment (a converted freezer, for instance) or by fermenting in a cold room during the winter.

There is no reason to be intimidated by brewing lagers. While the nature of the styles make them less forgiving to errors in pitch rates and temperature control, these problems can be overcome with planning. BYO

Blending Beers

Mashing malts, brewing with fruit

by Ashton Lewis

Q CAN YOU BLEND AN ALREADY CARBONATED SOUR WITH A FRESH BREWED NON-CARBONATED BEER WITHOUT ANY ISSUES?

SCOTT MEAD
VIA FACEBOOK

A There are many ways to blend, and for numerous reasons. It sounds like you may have a sour beer that is maybe a bit too much and perhaps could be improved by blending with a young beer. There is no problem in the fact that one beer is carbonated and the second beer is not. The real question that comes to mind is whether the carbonated beer is in a keg or if it was bottled?

Blending two bulk beers into a single keg is the way to go about any blending endeavor. Attempting to improve bottled beer by moving from bottle to a keg has oxidation written all over the plan and is something I would avoid doing. Perhaps that sentence is a little too mild . . . don't even think about moving beer from bottle to keg unless you are prepared to reverse, counter-pressure fill your bottles to protect your beer. This is a major pain in the neck.

The easiest way to do this is to first determine your blend ratio through blending trials. Once you settle on a blend, go ahead and rack the two beers into one keg. Assuming one beer is better suited for blending than the other, I would attempt to use all of one beer and a portion of the other if the blend ratio is not 50/50. Now that the blended batch is in a keg, you can now adjust the carbonation and dispense it from the keg, or counter-pressure fill into bottles. I suggest counter-pressure filling because your sour beer is already carbonated, and I really hope that this beer is not already bottled.

There is one major consideration that needs to be addressed with your plan, especially if you want to bottle the blends; what is going to happen to the fresh beer when it is mixed with the sour beer? Sour beers often contain super-attenuating yeast strains, like *Brettanomyces*. These yeast strains are capable of fermenting dextrins that cannot be fermented by *Saccharomyces* strains. This is certainly not a bad thing and is one of the reasons I find *Brett* beers refreshing and dry. You do need to keep this information in mind when bottling these beers, though, because dextrins that are normally assumed to not add carbonation do when super-attenuators are present, and this needs to be considered when adding priming sugar. This is why most of these type of beers are bottled in champagne-style bottles that are rated for much higher pressure than the ratings for a normal beer bottle.

"Sour beers often contain super-attenuating yeast strains, like *Brettanomyces*. These yeast strains are capable of fermenting dextrins that cannot be fermented by *Saccharomyces* strains."

Q IF I WANTED TO MAKE A BIG BARLEYWINE AND DIDN'T HAVE ENOUGH MASH SPACE FOR THE NEEDED GRAIN, WOULD MIXING MALT EXTRACT INTO MY STRIKE WATER ALLOW MASH ENZYMES TO BREAK DOWN SOME OF THE MORE COMPLEX SUGARS, OR ARE THEY CHEMICALLY "LOCKED"? ALSO, I HAVE NEVER HEARD OF THE HOP QUALITY GROUP. CAN YOU TELL US MORE ABOUT THEM AND WHAT THEY DO?

ALEC JAMES KLASSEN
SANTA ROSA, CALIFORINA

help me mr. wizard

I love this idea for a number of reasons. The first reason is that many malt extracts seem to be less fermentable than the preference of my palate. If you open a can of malt extract that you know to have a relatively low wort fermentability based on past experience, you can certainly change this wort property by further enzymatic action. It is true that some of the dextrins in wort react with proteins and amino acids during wort boiling, or concentration into extract, and are changed into compounds that will not be hydrolyzed by amylases when you add extract to your mash. But the majority of dextrins in pale malt extract that can be acted on by alpha amylase will be available for the enzymes from the malt in the mash.

I can create a hypothetical argument explaining why this method probably will result in a decrease in extract yield, but the truth is I really don't believe this will be an issue if you don't make the mash too thick. Thick mashes result in higher wort gravity and require more sparging. One way to brew strong beers is to curtail sparging to limit wort dilution prior to the boil. But the volume of extract retained in the grain bed will be no more by the method you suggest and I don't believe the method will have a negative influence on yield.

If the extract you add to your mash needs no further enzymatic activity, the argument can easily be made that this is probably more trouble than it is worth, but one never knows. I have had some really great extract beers that I did not know were brewed from extracts until being told, and I have had many extract beers that are so obviously made from extracts that the extract flavor is a distraction to the overall flavor. This method may be a way of diminishing the extract flavor contributed by some, likely old, extracts.

Onto your question about the Hop Quality Group: there is a very real concern among many US brewers about the changes we are seeing in the very largest breweries in the nation. The fact is that US craft brewers have benefited in many, many different ways from the "big guys." Not too long ago the "big guys group" also included regional brewers like Weinhard's, Latrobe, Rainier, Pearl, Lone Star, National, and Schaeffer in addition to national brewers like Stroh's, Pabst and Schlitz.

About 20 years ago the larger US brewers underwent rapid consolidation, followed by business closings. Since that time we have had a few groups emerge in the market. There are now the "Big 3" domestic brewers with the majority of the national production volume, a handful of large craft brewers (Boston Beer, Sierra Nevada, New Belgium, Craft Brewers Alliance, plus Yuengling) emerge as the second size tier, a larger group of craft brewers ranging in size from about 100,000 to 250,000 BBLs annually emerge as regional favorites (Bell's, Stone, Green Flash, Boulevard, Ninkasi, Odell's, Left Hand, Summit, Dogfish Head, Abita and Sweetwater, for example), and many small package-only breweries and brewpubs.

Historically the "big guys" spent a lot of money on research and development and they also spent a lot of time and effort working with suppliers on things like ingredient quality. In 2002 SAB bought Miller to form SAB-Miller. In 2005 Molson and Coors merged to form Molson-Coors. Two years later in 2007 we saw the formation of MillerCoors, and in 2008 the whale named InBev buys the whale named AB to become ABI. Consolidation of this magnitude has some very real consequences, and one of those has been the consolidation of engineering and research departments, and the loss of many jobs. This means that fewer individuals are looking at the sorts of things that brewing scientists and brewery engineers have studied for centuries.

At the same time the hop produc-

ers were responding to market changes and the varieties being cultivated in the US started to change, planted acreage began to shift and craft breweries who had made a real name for themselves brewing hop forward beers started to feel uneasy. OK, that's a bit of an understatement. Many of these craft brewers spent or borrowed very, very large sums of cash to grow their breweries to keep up with the demand of their hop dominated ales. And a small group of these hop-focused brewers decided to pull together to help ensure that their signature ingredients were not suddenly in short supply.

On Saturday May 5th, 2012 I was at the Craft Brewers Conference in San Diego and entered a hall to listen to "John Mallett and Friends" give a presentation with the obscure name, "Hop Quality Developments." Unlike almost all presentations at this meeting, there was no description of the talk, so my interest was piqued. The Hop Quality Group was unveiled as a group of like-minded brewers from twelve craft breweries who formed a not-for-profit organization to help address concerns about hops. Their concerns include breeding of new varieties, planted acreage of certain aroma varieties, harvesting and processing practices used by growers and processors, and other such topics. Sierra Nevada, Russian River, Firestone, Stone, New Belgium, Boulevard, New Glarus, Bell's and Boston Beer were the members named.

I think this is pretty exciting. Their presentation made it clear that the goal is to protect the business interests of their brewery members. These breweries have real concerns and they formed a small, focused group to act quickly. I believe that these sorts of groups ultimately help the entire industry and I sincerely hope that more groups like this form in the years to come. What the US brewing industry lost in the last 20 years by mergers and closings will not be undone. The future of the US brewing industry is largely in the hands of a group of entrepreneurs that were in the past laughed at by many of the breweries now occupying chapters in history books.

Q WHEN BREWING WITH BERRIES HOW MUCH SHOULD BE USED FOR A 5-GALLON (19-L) BATCH? I AM PLANNING TO MAKE A RASPBERRY WHEAT BEER.

NATHAN PYLES
WACO, TEXAS

Fruit beers run the gamut from being so subtle that the fruitiest part of the beer is the name, all the way to the extreme where the intensity of the fruit approaches a wine and the consumer is surprised that they are drinking beer. I personally like fruit beers that don't leave me guessing if the brewer forgot to add the fruit during the brew.

I like to think about recipes in terms of percentages. One pound of fresh fruit per gallon of 12 °Plato (1.048 SG) wort contributes about 10% of the extract. This is enough fruit to leave no doubt that the beer contains fruit, but not so much to really knock your socks off. Beers with 20–30% of the extract derived from fruit are really pretty fruity! These beers contain 2–3 pounds (0.9–1.3 kg) of fruit per gallon (3.8 L) of wort.

So now you have an idea of how much fruit to add to your wheat wort. The next question is equally important, and that question has to do with the method of addition. Some brewers like to add fruit to the kettle to satisfy their quest to sterilize everything going into fermentation. But boiling fruit is not necessary and is certainly not in line with how wine is made. Another technique is to add fruit to the beer following primary fermentation. This method initiates a second peak of fermentation activity that typically lasts only a few days. Whether you add the fruit to the kettle or to beer after the primary, most if not all of the fermentable sugars will be consumed by yeast.

The fact that fruit beers often times are not sweet means that much of what most people associate with fruit is lost. If you buy a dry red wine and expect to experience the fruitiness of Welch's grape juice you will be very disappointed indeed. Some fruit beers are sweet, but there are some tricks of the trade required to maintain the sweetness, and increasing the amount of fruit added to the beer is not one of these. Some brewers of these sweet or semi-sweet fruit beers arrest the fermentation after a point to retain some of the fruit sweetness. Pasteurization is the method of choice for commercial brewers because it helps to ensure that the residual fermentable extract is not fermented after bottling. Winemakers often times use sulfites to arrest fermentation when producing sweet wines, and this method can also be used by brewers. If you have residual sugar in the beer, bottle conditioning is clearly not an option. Pasteurization can be performed at home if you are feeling especially adventurous. This is a very broad topic of discussion that I will leave for another day, but the seed has been planted! BYO

Do you have a question for Mr. Wizard? Send it with your name and hometown to wiz@byo.com

American Pale Ale

Crisp and hoppy

by Jamil Zainasheff

The very first homebrew I ever drank was an American pale ale my neighbor Steve handed to me over our fence. He was trying to make a beer like Sierra Nevada's pale ale. At the time, that beer was the best beer I had ever tasted and that was the beginning of my own journey into brewing.

Sierra Nevada's pale ale is now the classic example of American pale ale. The American pale ale style is an offshoot of English pale ale, when American homebrewers began brewing English pale ale with American ingredients and techniques. American pale ale is more about hops and less about malt than English pale ale. Yet, it is not just a hoppier version of an English pale ale. An American pale ale has malt character, but not nearly as much as an English pale ale should have. In addition, caramel character is far more pronounced in an English pale ale than it will be in an American version. There is also a significant difference in fermentation character and hop bitterness, with the English version showing significantly more fermentation character and the American version showing far more bitterness.

It may seem obvious, but I think an American pale should always be pale. The BJCP style guide says American pale ale can range from pale golden to deep amber, but the deeper amber is really more appropriate for the English variety of pale ale. By the time a pale ale reaches deep amber color, it often has too much caramel character or malt character overall and is better categorized as American amber instead.

The balance in a good American pale ale can range from slightly bitter to quite firmly bitter. The finish should be medium to medium-dry along with a medium-light to medium body. If you notice a fruity character, it should be coming from the hop selection, as the esters from fermentation should be low for an ale.

You might think that a citrusy character is a requirement in all American styles, but almost any hop character is fine. Generally, American pale ale is citrusy, but fruity, floral, and spicy hop character can be just as welcome. The goal is ample hop character with reasonably firm bittering.

You have some options when choosing base malt for this style. Using North American two-row will give the beer a clean, subtle, background malt character common to many fine American craft beers. Using North American pale ale malt adds a slightly richer background malt character, somewhat of a light bready note. Again, this is the type of malt character common to many fine North American craft brews. Less frequent is the use of British pale ale malt. British pale ale malt provides an even greater depth of malt character to the beer, mainly a biscuit-like taste and aroma often found in British beers. Some folks feel British pale ale malt can be too much for American styles, so if you prefer a more subtle, restrained malt background, go with North American two-row or pale ale malt. All-grain brewers can use a single infusion mash and should target a mash that will leave enough long chain sugars in the beer to help fill out the body. A temperature around 150 to 154 °F (66 to 68°C) creates wort with a nice balance between fermentable and non-fermentable sugars.

American pale ale should not exhibit a lot of specialty malt character, though it can be present. Bready, toasty, and biscuit notes are acceptable, but watch out if you use anything but the lightest caramel malts. It is easy to cross the line and end up with an American amber. If you do use caramel malts, focus more on the light color ones (<30 °L) or use restraint with anything darker. Generally speaking, the darker the

Continued on page 21

American Pale Ale
by the numbers

OG:	1.045–1.060 (11.2–14.7 °P)
FG:	1.010–1.015 (2.6 –3.8 °P)
SRM:	5–14
IBU:	30–45
ABV:	4.5–6.2%

Photo by Charles A. Parker/Images Plus

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

A middle of the road, more malt and hop balanced American IPA.

OG = 1.056 (13.8 °P)
FG = 1.013 (3.2 °P)
IBU = 40 SRM = 6 ABV = 5.7%

Ingredients

10.2 lb. (4.62 kg) Great Western North American pale malt 2 °L
10.6 oz. (300 g) Best Malz Munich malt 8 °L
10.6 oz. (300 g) Briess Victory® malt 28 °L
7.1 oz. (200 g) Great Western wheat malt 2 °L
6.89 AAU Horizon pellet hops (0.53 oz./15 g at 13% alpha acids) (60 min.)
4.5 AAU Centennial pellet hops (0.50 oz./14 g at 9% alpha acids) (10 min.)
3 AAU Cascade pellet hops (0.50 oz./14 g at 6% alpha acids) (10 min.)
4.5 AAU Centennial pellet hops (0.50 oz./14 g at 9% alpha acids) (0 min.)
3 AAU Cascade pellet hops (0.50 oz./14 g at 6% alpha acids) (0 min.)
White Labs WLP001 (California Ale) Wyeast 1056 (American Ale) or Fermentis Safale US-05

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 152 °F (67 °C). Hold the mash at 152 °F (67 °C) until enzymatic conversion is complete. Infuse the mash with near-boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 5.9 gallons (22.3 L) and the gravity is 1.048 (11.8 °P).

Once the wort is boiling, add the bittering hops. The total wort boil time is 1 hour after adding the bittering hops. During that time add the Irish moss or other kettle finings with 15 minutes left in the boil and add the last two hop additions at 10 minutes remaining and at flame out. Chill the wort to 67 °F (19 °C) and aerate thoroughly. The proper pitch rate is 10 grams of properly rehydrated dry yeast, 2 packages of liquid yeast, or 1 package of liquid yeast in a 2-liter starter.

Ferment around 67 °F (19 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in a week or less. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle.

American Pale Ale
(5 gallons/19 L, extract with grains)

OG = 1.056 (13.8 °P)
FG = 1.013 (3.2 °P)
IBU = 40 SRM = 6 ABV = 5.7%

Ingredients

6.6 lbs. (3 kg) pale liquid malt extract
10.6 oz. (300 g) Best Malz Munich malt 8 °L
10.6 oz. (300 g) Briess Victory® malt 28 °L
7.1 oz. (200 g) Great Western wheat malt 2 °L
6.89 AAU Horizon pellet hops (0.53 oz./15 g at 13% alpha acids) (60 min.)
4.5 AAU Centennial pellet hops (0.50 oz./14 g at 9% alpha acids) (10 min.)
3 AAU Cascade pellet hops (0.50 oz./14 g at 6% alpha acids) (10 min.)
4.5 AAU Centennial pellet hops (0.50 oz./14 g at 9% alpha acids) (0 min.)
3 AAU Cascade pellet hops (0.50 oz./14 g at 6% alpha acids) (0 min.)
White Labs WLP001 (California Ale) Wyeast 1056 (American Ale) or Fermentis Safale US-05

Step by Step

If you can't get fresh liquid malt extract, it is better to use an appropriate amount of dry malt extract (DME) instead.

Mill or coarsely crack the specialty malt and place loosely in a grain bag. Avoid packing the grains too tightly in the bag, using more bags if needed. Steep the bag in about 1 gallon (~4 liters) of water at roughly 160 °F (71 °C) for about 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags. Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 5.9 gallons (22.3 liters) and a gravity of 1.0485 (11.8 °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 bittering hops. During that time add the Irish moss or other kettle finings with 15 minutes left in the boil and add the last two hop additions at 10 minutes remaining and at flame out. Chill the wort to 67 °F (19 °C) and aerate thoroughly. The proper pitch rate is 10 grams of properly rehydrated dry yeast, 2 packages of liquid yeast, or 1 package of liquid yeast in a 2 liter starter. Follow the fermentation and packaging instructions for the all-grain version.

malt the less you will want to use in an American pale. Focus your specialty malt usage more on the bready malt notes and make sure that the malt character does not start to overwhelm the easy drinking and hoppy balance that is American pale ale. CaraPils®, wheat malt, Victory®, Munich, and more are common additions to many American pale recipes. Just use restraint so the beer does not become saturated with unfermentable dextrins or cloying flavors. Target between 0 and 15% for these additional specialty grains.

You have quite a bit of flexibility in hopping American pale ales. The balance of bittering versus malt sweetness can range from slightly bitter to firmly bitter. Target a bitterness to starting gravity ratio (IBU divided by OG) of 0.5 to 0.7 for a more balanced beer or 0.7 to 1.0 for a bold American pale. I tend to target right in between at a ratio of 0.7. If you do go toward the upper end of the ratio, just be aware that you run the risk of making something more like an IPA.

Hop flavor and aroma varies from moderate to bold. I really like using citrusy or piney American variety hops such as Cascade, Centennial, Columbus, Simcoe®, and Amarillo® for flavor and aroma, but there are plenty of great examples out there that use a wide variety of hops from around the world. You can use almost any hop you feel has a pleasant character. It is the overall impression that matters. You can bitter with almost any hop as well, but clean, neutral hops are most common. The big picture is that you want hop character and a firm bitterness, but both should complement your malt and yeast

"Generally speaking, the darker the malt the less you will want to use in an American pale. Focus your specialty malt usage more on the bready malt notes and make sure that the malt character does not start to overwhelm the easy drinking and hoppy balance that is American pale ale."

choices. Dry hopping is acceptable as well, but in moderation. Too much will push the beer into IPA territory and can develop resin and grassy notes.

Fermentation for American pale ale is straightforward. Like the majority of American ales, this style most often has a clean profile, with very low to no fruity esters. A slight fruitiness can be welcome, as long as it is not excessive. If you do want some esters and a touch more malty character, a relatively clean English-style yeast such as White Labs WLP002 (English Ale) or Wyeast 1968 (London ESB) at lower fermentation temperatures (63–65 °F/17–18 °C) can produce fine results. However, many English-style yeasts attenuate lower than most American-style yeasts, so you might need to account for that in your recipe formulation. I prefer to

American Pale Ale Commercial Examples

Alpha King Pale Ale
Three Floyds Brewing Co.
Munster, Indiana
www.3floyds.com

Bell's Pale Ale
Bell's Brewery
Kalamazoo, Michigan
www.bellsbeer.com

Burning River Pale Ale
Great Lakes Brewing Co.
Cleveland, Ohio
www.greatlakesbrewing.com

Doggie Style Classic Pale Ale
Flying Dog Brewery
Frederick, Maryland
www.flyingdogales.com

Jackman's Pale Ale
Left Hand Brewing Co.
Longmont, Colorado
www.lefthandbrewing.com

Mirror Pond
Deschutes Brewery
Bend, Oregon
www.deschutesbrewery.com

Pale 31
Firestone Walker Brewing Co.
Paso Robles, California
www.firestonebeer.com

Smuttynose Shoals Pale Ale
Smuttynose Brewing Co.
Portsmouth, New Hampshire
www.smuttynose.com

Sierra Nevada Pale Ale
Sierra Nevada Brewing Co.
Chico, California
www.sierranevada.com

Stone Pale Ale
Stone Brewing Co.
Escondido, California
www.stonebrew.com

XP Pale Ale
Bear Republic Brewing Co.
Healdsburg, California
www.bearrepublic.com

use a clean, moderately attenuating yeast, such as White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale). To get that clean, American-style pub character make certain that you oxygenate the wort and pitch an appropriate amount of healthy yeast. Ferment around 67 °F (19 °C), holding the temperature steady or rising slightly throughout fermentation. Temperature control is important to getting a proper level of attenuation and avoiding off-flavors, especially if you are making a bigger beer. Large temperature swings can result in the yeast flocculating early or producing off flavors. Raising the temperature a few degrees near the end of fermentation can also help the yeast attenuate fully and may also help clean up some of the intermediate compounds that are produced during fermentation. BYO

> "I really like using citrusy or piney American variety hops such as Cascade, Centennial, Columbus, Simcoe®, and Amarillo® for flavor and aroma, but there are plenty of great examples out there that use a wide variety of hops from around the world. You can use almost any hop you feel has a pleasant character. It is the overall impression that matters."

Web extra:

Follow Jamil's blog as he mans his own commercial brewery, Heretic Brewing:

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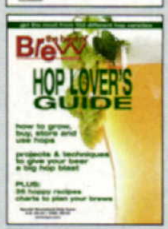

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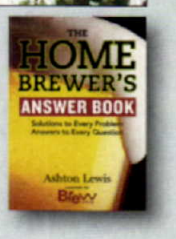

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Malting at HOME

Story and photos
by **Graham Anderson**

Most of your brewing friends will tell you that malting is very difficult and complicated — so difficult in fact that it is a waste of your time even to try it. But probe a little further, and most of the time you'll find that your maltophobic friends have never actually attempted malting. How, then do they know malting is so difficult? Well, they heard from their friend that malting is hard, and . . .

It's time to break the cycle! Malting is neither difficult nor complicated. If you can brew a beer from malted grains, then you already have the equipment and skills you need to malt grains. Malting is just soaking raw barley in water, then allowing the barley seeds to sprout for several days. The last step is drying your malt with a fan, and "cooking" it in your kitchen oven. As you might be guessing, the procedure isn't especially difficult.

Malting does, however, take up a little more space than a fermenting a 5.0-gallon (19-L) carboy. Malting grains need to be spread out in a layer no more than 6" (15-cm) deep, so you'll need 5 or 10 square feet (0.46–0.93 m^2) for a week to be dedicated to malting. If you already brew in your basement or a closet, you should have plenty of room.

While it is true that making specialty malts like Munich and crystal malt require a few extra steps, they aren't that difficult.

And finally, why malt at home? I'm always surprised when somebody who just spent 6 hours plus 2 weeks to make an IPA they could have bought at the local bottle shop asks me this. Malting is an integral part of our art and our craft. The flavors you will develop during malting are just as prominent as the flavors you develop during the boil and the ferment. Welcome to the next stage of crafting your own unique beer.

Equipment and Supplies

First, get your hands on some raw malting barley. Take note: malt has already been malted — you likely won't find what you need at your local homebrew shop. You're looking for raw barley, and not just any barley will do. Malting barley has been bred with characteristics that make it easy to produce high-quality malt, such as a uniform germination rate. It has also met higher quality standards than feed barley, so don't try to malt anything you can buy at your local feed store. When you call around asking for malting barley, most people will think you're asking for malted barley, in the past tense. But a little persistence will pay off, especially if you throw in the word "raw," as in *raw* malting barley.

Popular 2-row malting varieties grown in the US include AC Metcalfe, Conrad and Moravian 69. In 2011, 32% of all US 2-row acreage was planted with AC Metcalfe. Conrad and Moravian 69 were both at 15%. Harrington is still around, too (at 5.4% of US 2-row malting barley acreage).

Among 6-row malting varieties, Tradition is the most popular with 61% of US 6-row acreage, followed by Lacey at 26%. Robust, which has been around since 1984, is still hanging in there at 5.7%. The American Malting Barley Association (AMBA) maintains a website (at ambainc.org) that lists all the malting varieties grown in the US each year since 2007 and gives planting recommendations each year.

You may find that you can purchase raw malting barley in bulk from your local grain elevator, but I've always purchased mine in bulk from Colorado Malting Company. Some garden seed companies also sell barley, wheat and other grain seeds. Shipping is always a killer when you're buying big sacks of grain, but the raw 2-row price per pound can't be beat! The steps for malting wheat are similar, and most people can buy some raw wheat berries at the local specialty grocery store. I started off in this way making malted wheat, but watch out for grocery store grain prices.

Now that you've tracked down a source of raw malting barley, gather all the equipment you'll need: a 5-gallon (19 L) plastic bucket with a spigot, a roll of large plastic garbage bags, a plastic box fan and a baking dish. That's it!

You likely have all these already, and if you're missing the fan, they can be had for less than $20 during the summer at most big box stores.

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As an option, a large food dehydrator can be used to dry the malt, but this isn't required.

When you plan a malting run, make sure you don't have to go out of town for at least one week. The malt needs about 5–10 minutes per day of your time to stay healthy.

Steeping

First, weigh out about 15 lbs. (6.8 kg) of grains in your plastic bucket. Soak them in water that is good enough for brewing. Most of the grains will sink to the bottom of the bucket, but some small grains and some hay-like matter will float on top. Scoop this stuff out — those small grains were not going to germinate uniformly, or at all, and you can throw them away. Stir up the sunken grains in the water, and once they settle, skim off the floating material once more. Pour off the extra water from the grains and then add more while stirring the grains. Wash your raw barley 3-4 times with fresh water until the water is clear. Some remaining yellow color is natural — even the raw grains will quickly turn the water yellow. Just make sure to wash away all the dirt and dust until the water is no longer hazy and turbid. Ideally, your water temperature should be 50–60 °F (10–15 °C).

Now wait 8 hours, no longer, while the barley takes up water. I usually steep my grains overnight, then drain them in the morning. It is very important not to soak the grains much longer than 8 hours. Once the embryos inside the grains come to life, they will need more oxygen than the water contains. If you soak them for 9 hours, they will still be fine, but push your luck and some grains will begin dying, opening up the door for bacterial contamination. If your malt ever smells like garbage or compost, you'll know that you steeped it too long!

How are you going to drain 15 lbs.(6.8 kg) of wet grains? If your plastic bucket has a spigot, like many of ours do, then you can just open it up. Another option is to just dump the grains and soak water into your mash tun. Use your false bottom or filter to drain the water. The grains should rest in air for eight more hours. At this point, you'll notice that your soaked grains are not actually very moist. In fact, after the first 8 hours of soaking, they will still be pretty hard. This is because barley's hull prevents water from penetrating the grain. The grains will ultimately need two more 8-hour steeps, with 8-hour air rests in between. During the air rests, the barley should optimally be held at 50–70 °F (10–21 °C). Your ultimate goal in the steeping step is to take the barley from the 11–13% moisture that it had when you bought it to the 42–46% level required for germination to occur.

Here is the schedule I use when I'm working 8-hour days:

Steeping Schedule

I steep overnight, then drain in the morning. I steep again when I come home from work, and drain before bed time. I then steep for the final time before work, draining the water when I come home.

If I'm working longer than 8-hour days, I will simply steep the grains overnight for three nights in a row.

Why all this effort just to get the grains wet? As Jason Cody from Colorado Malting Company told me, the soak will "ring like a bell" through the rest of the malting. So, if you start with the right amount of water in the grains, you'll get good quality malt without any worries. If your climate is very humid, you may be able to get by with just two 8-hour steeps, because you'll be losing less water later on in the process. But start with three and see how you do.

Now that your grains are full of water, drain them a final time and wait a few hours for water to drip off of them. Then spread out a plastic garbage bag or two (depending on their size) on the floor, and dump your soaked grains onto the bag(s). You'll notice that if you do this right away after draining, the grains will still be covered with a sheen of water, but if you wait a few hours, the grains will be much drier. It is important to leave as much water behind in your drainer as possible, and here's why: from this point on, the only thing standing between you and perfect malt is mold. Mold will grow on malt any time that moisture is allowed to remain on its surface. Say that to yourself three times: Mold will grow on malt any time that moisture is allowed to remain on its surface. Say it once more and you're done! The more water you can allow to drip off of your grains before they are spread out on the bag, the less you have to worry about mold. Allow the grains to drip dry for one hour before dumping them onto the plastic bag.

Caution: Most draining devices still allow a thin pool of water to remain at the bottom — spigoted buckets and mash tuns are no exception. This water can coat your grains if you just dump the entire container onto a plastic bag, so carefully pour this water out of the bucket or tun before dumping the rest of the grains.

Now you should have a pile of soaked grains with very little surface moisture on a plastic surface. Spread out the pile of grains until it is less than six inches deep. Then forget about them until the next morning.

Germination

If it had not already happened, by the next morning you will see that each grain has a small white nub emerging from one end. Congratulations, you're malting! This little white structure is the rootlet, and while it doesn't indicate how far along the malt is, it does indicate that the grains are alive. The malt at this point is called chit malt, and it commonly smells like fresh cucumbers. Ideally, you want to keep the germinating barley at 55–64 °F (13–18 °C). At this temperature, the modification process should proceed evenly. Also, lower temperatures suppress mold growth. You can let the temperature rise up to 71 °F (22 °C) towards the end of the germination step. If you are planning on making darker malts, such as Munich malt, your germination temperature can be slightly higher — 73–77 °F (23–25 °C.)

For the next 3–5 days, devote 2.5–5 minutes to the malt in the morning and in the evening. Wash your hands, and turn the pile of malt the way you would turn dirt in the earth.

Make sure to scoop up all the more moist grains that were at the bottom of the pile and mix them in with all the others. Make sure to mix the drier grains at the top of the pile in with the more moist ones. You just want to randomize the position of every grain. You may notice that the grains at the bottom begin to grow into each other, and some may even form small clumps when the rootlets tangle. This is called felting, and it is common. Break up all of these aggregations of grains, because they can trap moisture, and in extreme cases, lead to molding.

You'll also notice that the malting grains produce a lot of heat! The inside of the pile will feel warm to the touch — another reason to mix the grains is to release this heat. Commercial maltsters take things a step further, maintaining malting grains at 63 °F (17 °C), a few degrees below room temperature. This is not necessary at home, because the size of your grain bed will be small, and the heat it generates will be nothing compared to what comes off of a commercial grain bed. Still, if your pile is thicker than 6 inches (15 cm), a lot of heat can accumulate in just 12 hours, which can lead to condensation, which will lead to molding. If you notice the grains feel hot (not just warm) when you turn your pile, or if you notice that grains on the inside of the pile are shiny with surface moisture, you should spread your pile a little thinner.

Every day, the grains will be a bit different than the last. You will notice the rootlets growing, and you'll also notice your malt slowly becoming dryer. The aroma will change from fresh cucumbers to an alfalfa sprout-like aroma — a bit more sharp and vegetal. The grains should have more than enough moisture to reach full modification. So how do you know when enough modification is enough?

To determine when your malt is fully modified, do not rely on the rootlets. It will be tempting, since they are highly visible, and they do indeed grow longer each day. But the most reliable indicator of modification is the barley seed's shoot, called the acrospire.

The acrospire grows as malting proceeds, but it is locked between the seed and the hull, showing itself as a bulge on one side of the seed. Some malting resources will instruct you to slice open grains with a razor blade to check acrospire length. You don't need to do this, because you can easily spot the outline of the acrospire through the barley's hull. Look at the photo on page 26 and you'll notice that the acrospire's bulge begins at one end of the grain and progresses in a line toward the other end. See, it's not so hard to spot the acrospire once you know what to look for!

Once the acrospire has grown to 75–100% of the length of the grain, that grain is completely modified. As the grain bed approaches complete modification, you may notice one final aroma change from sprout-like to an

earthy aroma — reminiscent of the aroma of radishes.

If you started with malting barley, then your acrospires will all be about the same length throughout malting. Keep on turning the malt (with clean hands) twice a day until the acrospires reach this length. You'll probably notice that the acrospire growth speeds up over time, so if your acrospires are at 75% of the grain length in the morning, they'll probably be at 100% in the evening. This should occur 4-5 days after the soak is completed, and about 7 days after the first soak. If you turned the malt twice a day, you'll see that the acrospire lengths are all about the same, with only slight variation from grain to grain. If you skipped a few turns, then you might notice that some grains are modified while others still have shorter acrospires. Don't worry — even irregularly modified malt will still make beer!

> "That's why I like to malt. When I taste those delicious toasty flavors in a nice pale malt, I can call those flavors my own."

Drying and Kilning

At this point, your malt is called green malt, because it still contains moisture, and it is still alive. You will need to dry the malt so it can be milled. Commercial maltsters accomplish this drying with large drying chambers that apply low heat and lots of ventilation. This dries the grains quickly, but requires conditions that most people don't have — our ovens are usually way too hot for this step, and they aren't equipped with fans either!

However, you don't need to dry your malt as quickly as the pros. You can afford to dry your malt over the course of several days, not hours. Just spread your green malt into a very thin layer and set up a box fan to blow air over it. After 4–5 days, your malt should be dry enough to mill, with crispy brown rootlets that break off when you handle them.

As an option, a food dehydrator will dry your malt within 6–8 hours, in much the same way it would be dried at a commercial maltsters. Set the dehydrator to 100–125 °F (38–52 °C) initially. Then, once the moisture in the grains drops to 10–12%, you can increase the temperature to 140–160 °F (60–71 °C) and dry the malt to 3–5% moisture.

Now, the dry malt is called wind malt, the traditional malt for witbier. You can go ahead and brew with it, but it will still contain those delicious sprout-like or radish-like aromas. You already have access to a malt that for centuries was part of the beer-drinking world, but which commercial maltsters no longer produce! Still, most of us will want the traditional clean flavors of pale or Pilsner malt, or will simply want to be able to store our homemade malt for several months before brewing. Wind malt has a limited shelf life because of the small amount of residual moisture it contains. So if you stop with wind malt, be sure to brew with it before 4-6 weeks pass!

The last step to producing pale or Pilsner malt is kilning in your oven. Kilning develops the classic malty flavor of malt through the production of Maillard products. Kilning also adds color to the malt. Pilsner malt should be heated at 195 °F (91 °C), and British-style pale malt should be heated around 210 °F (99 °C), each for about 3–5 hours with the oven door cracked open to allow moisture to escape.

Simply pour your dry wind malt, rootlets and all, into a baking dish and place on the middle rack in your oven. This step will cook off the fresh vegetable odors, transforming your wind malt into a very familiar-smelling and tasting base malt. Kilning will also remove enough residual moisture that your grains will be shelf-stable for some time. True, your grains may never get as dry as commercial malt because ventilation is limited in your kitchen oven. But it will get dry enough to store for months, allowing you to make malt ahead of time.

Malt Cleaning

All that remains is to clean up your malt. The rootlets will now be dry and crispy, and they will break off with any handling. Put your malt in a plastic bucket and stir it with a wooden spoon or mash paddle. After a minute or two, the grains will flow smoothly and almost 100% of the rootlets will have broken off. To separate the rootlets from the grain, set up your box fan one more time, and pour the malt from one plastic bucket to another in front of the fan. The rootlets will blow away, while the malt will fall into the bucket.

Now you can mill your malt and brew an all-grain beer as usual. If you spent 5 minutes to turn your malt in the morning and in the evening, the grains will be fully modified, and you can brew with a single-infusion mash. People will warn you that your conversion efficiency will be lower with homemade malt, and you may notice a few points difference. But I've only seen efficiency drastically drop when my malt grew unevenly. If you are following these malting techniques, and you still get low efficiency, you can simply use more grain in your recipes, or you can seek out a different supply of raw malting barley. If your supply has a low percentage of grains considered plump, then efficiency can drop.

If your malt was not evenly modified, or was undermodified, mashing by using a decoction mash will yield a higher extract efficiency compared to a single-infusion mash.

There you have it. Compared to brewing, malting requires more daily attention, but only for a few minutes at a time. Malting doesn't require any extra equipment except a box fan and

your kitchen oven, and is quite a bit more relaxed of an endeavor than the brew day. Malting will require 5–10 square feet of counter or floor space for about a week, but I solve this problem with a salvaged box top from a television. I just line the box top with a garbage bag, dump in my soaked and drained malt, then slide the whole thing under my bed. I slide it out in the morning and evening to turn the malt, and my malt is out of the way.

The Hard Way or The Easy Way

Malting at home can be as difficult or as easy as you make it. The numbers (steeping temperatures, germination temperatures and moisture percentages) given in this article are representative of what commercial maltsters shoot for and are provided for homebrewers who'd like a technical challenge. (You can, for example, attempt to assess your moisture levels by carefully weighing a fixed number of kernels at each stage. Also, you can use an empty chest freezer that has been converted to a fermentation chamber for temperature control.)

You can, however, take a more relaxed attitude and simply follow the instructions given here and malt your grains at "room temperature." People made malt for centuries without strict temperature control and I have made malt both with and without temperature control and both ways yielded quality malt.

A Call to Malt

Most of us got into this hobby to make something we can't buy in a store. That's why I like to malt. When I taste those delicious toasty flavors in a nice pale malt, I can call those flavors my own. The malt flavors in your home-malted beer will taste different from anyone else's.

Further Reading

A more highly-detailed description of the process of malting can be found in "Malting and Brewing Science: Volume 2 (Second Edition)" by Briggs, Hough, Stevens and Young (1981, Kluwer Academic). BYO

New Albion

The Oldest Modern Micro Returns

Story by **Betsy Parks**

Thanks to enterprising modern brewers, it seems like you can find craft beer almost anywhere in North America these days. In fact, the Brewers Association estimates that there will be more than 2,000 active breweries in the United States alone this year. But that wasn't always the case. Way back before craft beer enjoyed wide popularity there was only one "microbrewery" serving up Old-World-style brews — the New Albion Brewing Company.

Founded in 1976 in Sonoma, California by Jack McAuliffe, New Albion is considered to be the first microbrewery of the modern era in the United States, and many commercial brewers working today have McAuliffe to thank for helping to paving the way for US interest in present-day craft beer.

McAuliffe developed an appreciation for flavorful beers while stationed in Scotland with the Navy in the 1960s. He returned to the US to live in San Francisco after the Navy, and graduated college in 1971 to work as an optical engineer in the Silicon Valley. During that time, McAuliffe started homebrewing to recreate some of the beers he tasted in Scotland, as well as those he enjoyed from the local Anchor Brewing Company. It wasn't long after that when he started thinking about building a commercial brewery of his own.

Anchor Brewing — which also played a large role in modern craft brewing — had been operating in San Francisco almost continuously since 1896. However, it was in decline until Fritz Maytag bought a majority share in 1965. By 1975, Maytag began bottling Anchor Steam Beer and also introduced Anchor Porter, Anchor Liberty, Old Foghorn and their annual Christmas Ale.

Named for the original moniker given to the San Francisco Bay area by Sir Frances Drake, the New Albion Brewing Company produced around 450 barrels of beer per year at its height on a mostly-homemade, gravity-fed brewing system that McAuliffe cobbled together with repurposed and vintage parts. Unfortunately, New Albion succumbed to a lack of financing and a slow economy in the early 80s and closed its doors in 1982.

"Jack was brewing craft beer when nothing was easy. Nobody made small scale brewing equipment, nobody wanted to invest, retailers and distributors didn't want your beer, drinkers couldn't understand why the beer didn't taste 'normal.' It was so different from today," said Jim Koch, founder of Boston Beer Company, the brewers of Samuel Adams.

The legacy of New Albion lives on, however, and many commercial craft brewers have created beers that pay

Photos courtesy of Samuel Adams

Jim Koch (Boston Beer Co.) and Jack McAuliffe (New Albion) examine a 1970s magazine article profiling the New Albion Brewery.

At the Sam Adams pilot brewery in Boston, McAuliffe and Koch watch as the wort comes to boil on a test batch of New Albion Ale, scheduled to be released as a limited time offering in January 2013.

homage to McAuliffe's early brewing contributions. For example, The Marin Brewing Company in Larkspur, California brews an amber ale called "Albion," and more recently the Sierra Nevada Brewing Company, which credits its early success in part to New Albion, included McAuliffe in its 30th anniversary series of collaboration ales. (Visit www.byo.com/component/resource/article/2598 for a clone recipe of Sierra Nevada's Jack and Ken's Ale, a collaboration with Jack McAuliffe and Ken Grossman, founder of Sierra Nevada Brewing Co.) And this year, Sam Adams, a company that has its own roots in homebrewing and craft brew trailblazing, has taken the New Albion revival a step further by recreating the original recipe for Albion's flagship beer, New Albion Ale.

"New Albion is a true legacy," said Koch. "Jack's passion for craft beer has had a widespread influence, and has

Recipe

New Albion Ale clone
(5 gallons/19 L, all-grain)

OG = 1.055 FG = 1.011
IBU = 30 SRM = 4
ABV = 5.7%

Ingredients

11.5 lbs. (5.2 kg) Great Western premium 2-row malt
3.6 AAU Cascade hops (60 min) (0.6 oz./17 g at 6% alpha acids)
3.6 AAU Cascade hops (30 min) (0.6 oz./17 g at 6% alpha acids)
3.6 AAU Cascade hops (15 min) (0.6 oz./17 g at 6% alpha acids)
1 tsp. Irish moss (15 mins)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) yeast (1.4 qt./1.3 L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mash at 148 °F (64 °C) for 1 hour in 16 qts. (15 L) of brewing liquor. Sparge with 170 °F (77 °C) water over 90 minutes to collect 6 gallons (23 L) of wort (or however much pre-boil wort will yield 5 gallons (19 L) after a 1 hour boil). Boil wort for 60 minutes, adding hops at times indicated. Chill the wort rapidly to 68 °F (20 °C), aerate and pitch the yeast. Ferment at 68 °F (20 °C).

Extract with grains option:

Reduce the amount of 2-row malt to 2.0 lbs. (0.91 kg) and add 5.0 lbs. (2.3 kg) of light dried malt extract. Steep grains at 148 °F (64 °C) for 45 minutes in 3 qts. (2.8 L). Add roughly one third of the malt extract and add water to make at least 3.0 gallons (11 L) and boil for 60 minutes, adding hops as indicated. Add remaining malt extract in final 15 minutes of the boil. Cool wort, top up, aerate, pitch yeast and ferment.

shaped the craft beer landscape. What Jack started 30 years ago was the original craft brew. We wanted to work with Jack to brew his recipe for the first time in almost 30 years and recognize him for his contribution to brewing."

Koch took a special interest in keeping the New Albion brand alive after McAuliffe moved on from professional brewing. In 1993, he took ownership of the New Albion trademark when it was set to expire, and also trademarked the name New Albion Brewing Company.

McAuliffe is known to be private and had shied away from discussing the brewery for many years. In fact, according to Maureen Ogle, author of "Ambitious Brew: The Story of American Beer" (Harcourt, 2007), McAuliffe is so reclusive that to this day he still does not have a listed phone number nor can you find him by searching the Internet. After he emerged for his collaboration beer with Sierra Nevada, however, Koch thought that the time was right to reach out to McAuliffe, who agreed to collaborate. To oversee the recreation of his original recipe, McAuliffe visited Sam Adams headquarters in Boston back in July of 2012 and the two brewers brewed side by side.

"Jim and I share a common passion for craft brewing, so I was honored when he approached me about bringing the New Albion original recipe back to life," said McAuliffe.

"I can't believe I'm brewing New Albion for a new generation of craft beer drinkers — a group that has more great beer choices than I ever had! New Albion will have a place in the growing and diverse craft beer landscape thanks to a fellow craft brewer."

New Albion Ale is an easy-drinking, delicate American pale ale. It has a deep golden color that was originally formulated with American Cascade hops and a 2-row pale malt blend. Sam Adams also kept the recipe true to tradition by using the original New Albion ale yeast strain, which had been preserved at the University of California-Davis since 1977.

The recipe for the ale itself is simple: North American two-row malt

and three additions of Cascade hops throughout the boil, which makes it a very approachable recipe for homebrewers. McAuliffe explained that the simplicity of the recipe was largely due to the availability of ingredients when the brewery began.

"The answer to the question 'why did you select Cascades?' Is it's the only one anyone would sell me," said McAuliffe. Jim pointed out that the hop was so new at that time even Anheuser-Busch wasn't buying it yet. Jack said "I had to buy a 200-pound bale at a time."

The reincarnation of New Albion Ale was released by Sam Adams at the 2012 Great American Beer Festival (GABF) in Denver, Colorado and will be distributed wherever Sam Adams beers are sold as limited edition 12-ounce 6-packs this January — when it's gone, it's gone. So if you like it, try your hand at brewing your own batch of what is considered to be the first American craft brew yourself with the recipe on page 35. And don't forget to raise a glass of that homebrew to Jack!

"The craft brewing movement began as something modest," Koch said during the announcement of the beer's release at the 2012 GABF.

"All we see today is this enormous avalanche of beers and breweries but that avalanche started with one snowflake. That snowflake fell relatively unnoticed and was almost forgotten." To which McAuliffe replied to the crowd, "Hi there. I'm little Jackie Snowflake." BYO

Related links:

• Brew Sierra Nevada's Jack and Ken's Ale, the collaboration between Jack McAuliffe and Ken Grossman for Sierra Nevada's 30th anniversary: www.byo.com/component/resource/article/2598

• Listen to a podcast of Jack McAuliffe, Jim Koch and other brewing notables discuss the 2012 re-release of New Albion Ale and discuss the original recipe at Basic Brewing Radio (from November 1, 2012): www.basicbrewing.com/index.php?page=radio

DARK LAGERS: The New Possibility

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

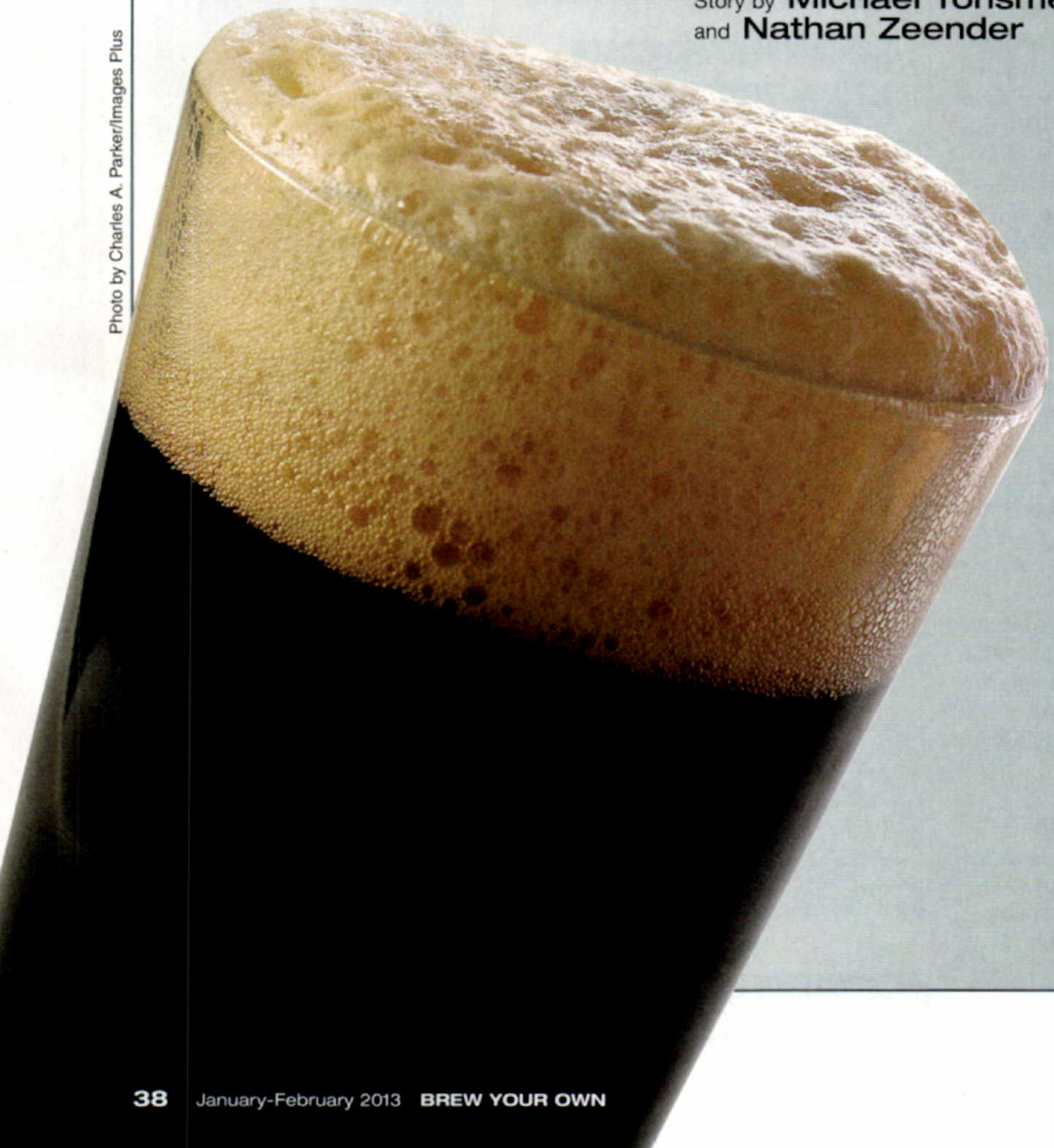

Photo by Charles A. Parker/Images Plus

There are few countries where a lager is not the best selling beer. Despite this, ales were the foundation for both American homebrewing and craft brewing. For many brewers the decision to brew ales is dictated by flavor. Where ale yeasts generate more pointed character in the form of fruity esters and spicy phenols, lager yeasts produce round and polished flavors when properly managed. Ale yeasts are also popular because they ferment beers more rapidly than lager yeast, and require less demanding fermentation temperature control. However, the clean character of lager yeasts allow more expressive malt and hop characters in finished beers, and are well worth the added time, effort, and equipment.

When many people think about lager, they picture a brilliantly clear pale-yellow beer. While this describes the vast majority of the lagers brewed around the world, lagers come in just as many hues as ales. Some dark lager styles like Baltic porter and doppelbock can be as potent as imperial stouts and age just as well, while others like schwarzbier and tmavé are daily drinkers.

In this article we will delve into three examples of dark lagers, and perhaps shed some light on this neglected tradition. We tracked down some highly-regarded experts to help us document the journey of dark lagers from their historical birthplace in Eastern and Northern Europe to the New World of craft brewing, where these traditions have been rediscovered.

Baltic Porter

Baltic porter dates back as far as the 1700s when British breweries began exporting strong dark beer to the Baltics. In America there has been a growing interest in Baltic porter for the past decade that seems to have started when the now shuttered Heavyweight Brewing of Ocean Township, New Jersey revived the tradition with its Perkuno's Hammer in the early 2000s. It has been said that the beer writer Lew Bryson suggested the style to brewer Tom Baker while scrounging for ideas for his next brew. The recipe has since been resurrected by Victory Brewing, of Downington, Pennsylvania, as Baltic Thunder.

For further illumination into the tradition we turned to Anders Kissmeyer, a leading Scandinavian brewing authority and founder of Kissmeyer Beer. He reported, "Like elsewhere in continental Europe, the countries around the Baltic Sea were during the 1800s swept by the lager tide, but the demand for strong, black beers was still significant, and many of the breweries in this area discovered that they could brew very palatable and popular versions of the porter/stout beer styles using the same bottom fermenting yeasts that they used for their normal lager beers. These traditions have survived to this day, meaning that porters — now in the form of Baltic porters — are still brewed by breweries in Denmark, Sweden, Finland, Latvia, Estonia, Lithuania and Poland."

As with many beer styles, there is plenty of room for interpretation. Kissmeyer adds, "Although the strong, dark, bottom fermented beers produced in the different countries around the Baltic Sea now are all formally categorized under the common name Baltic porter, they are actually very different in character. Ranging from slightly sweetish beers, dark brown in color and with ABVs down to about 6% to pitch black, highly roasted, quite bitter beers up to over 8% ABV."

Think of Baltic porter as the smoother, less roasty, less fruity cousin of the modern American imperial porter. Without the harshness of black patent malt, aggressive bitterness, or an estery yeast profile, the general impression is one of sweet cocoa, dried fruits and dense maltiness.

Photos by Michael Tonsmeire

Dark Lager Recipes

Kissmeyer Baltic Porter clone
(5 gallons/19 L, all-grain)

OG = 1.072 FG = 1.012
IBU = 45 SRM = 27 ABV = 8.0 %

"Medium bodied, dry, with a crisp lager background. Medium bitterness, and aroma and flavor dominated by roasted malts, noble hops and a noticeable, but not overpowering smokiness. The taste is rather long, crispy dry with intense roast maltiness, subtly enhanced by the addition of a little bit of raw licorice. Think: your favorite Baltic porter with some extra layers of smoke, complexity and depth!" — Anders Kissmeyer

Ingredients

9 lb. 14 oz. (4.5 kg) Pilsner malt
1.3 lbs. (0.58 kg) dark Munich malt
1.0 lb. (0.45 kg) hand smoked lager malt (using alder as the wood, maximum smoke intensity)
0.50 lbs. (0.23 kg) dark crystal malt
6.0 oz. (0.17 kg) pale wheat malt
6.0 oz. (0.17 kg) chocolate malt
4.0 oz. (0.11 kg) black malt
1.0 lb. local honey (0 min)
0.035 oz. (1 g) raw licorice root (0 min)
12 AAU Perle hops (60 min) (1.7 oz./49 g of 7% alpha acids)
1 AAU East Kent Goldings hops (30 min) (0.2 oz./5.7 g of 5% alpha acids)
1 AAU East Kent Goldings hops (15 min) (0.2 oz./5.7 g of 5% alpha acids)
0.2 oz. (5.7 g) East Kent Goldings hops (0 min)
0.2 oz. (5.7 g) Styrian Goldings hops (0 min)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) yeast (12 qt./11 L yeast starter)

Step By Step

Adjust your water to 60 ppm of calcium using calcium chloride ($CaCl_2$). Mash in at 122 °F (50 °C), before raising to a saccharification rest at 147 °F (64 °C) for 45 minutes, then 158 °F (70 °C) for 15 minutes, before mashing out at 172 °F (78 °C). Alternatively, a single infusion mash at 151 °F (66 °C) for 60 minutes is sufficient.

Boil 60 minutes with hop additions as specified. Add the honey and raw licorice at the end of the boil.

Cool wort to 57 °F (14 °C), ferment, at 57 °F (14 °C) until fermentation is complete (7 to 10 days). Cool beer to 41–46 °F (5–8 °C), leave at this temperature until all traces of sulfur and diacetyl are eliminated (5 to 10 days), then cool to lowest possible temperature just under 32 °F (0 °C) and cold lager for as long as possible (4 weeks will do, 8 weeks is better, 12 weeks is nice, 16 weeks near optimal). Aim for a carbonation level close to 2.5 volumes of CO_2.

Kissmeyer Baltic Porter clone
(5 gallons/19 L, partial mash)

OG = 1.072 FG = 1.012
IBU = 45 SRM = 27 ABV = 8.0 %

Ingredients

2.0 lbs. (0.91 kg) Pilsner dried malt extract
4.5 lbs. (2.0 kg) Pilsner liquid malt extract (late addition)
0.2 lbs. (91 g) Pilsner Malt
1.3 lbs. (0.58 kg) dark Munich malt
1.0 lb. (0.45 kg) hand smoked lager malt (using alder as the wood, maximum smoke intensity)
0.50 lbs. (0.23 kg) dark crystal malt
6.0 oz. (0.17 kg) pale wheat malt
6.0 oz. (0.17 kg) chocolate malt
4.0 oz. (0.11 kg) black malt
1.0 lb. local honey (0 min)
0.035 oz. (1 g) raw licorice root (0 min)
12 AAU Perle hops (60 min) (1.7 oz./49 g of 7% alpha acids)
1 AAU East Kent Goldings hops (30 min) (0.2 oz./5.7 g of 5% alpha acids)
1 AAU East Kent Goldings hops (15 min) (0.2 oz./5.7 g of 5% alpha acids)
0.2 oz. (5.7 g) East Kent Goldings hops (0 min)
0.2 oz. (5.7 g) Styrian Goldings hops (0 min)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) yeast

Step By Step

Place the crushed grains in a large steeping bag and mash the crushed grains in 5.5 qts. (5.2 L) of water at 151 °F (66 °C) for 60 minutes. Recirculate (if possible) until wort runs clear, then begin running off wort. Rinse grain bed with hot water (around 180–190 °F/82–88 °C, but don't let the grain bed exceed 170 °F/77 °C) until you have collected roughly 9.0 qts. (8.5 L) of wort. Add dried malt extract and water to make at least 3 gallons (11 L) of wort and bring to a boil.

Boil wort for 60 minutes, adding hops at the times specified in the ingredient list. Stir in liquid malt extract with 15 minutes left in the boil. Add the honey and raw licorice at the end of the boil. Cool the wort to 57 °F (14 °C) and transfer to a fermenter. Top up to 5 gallons (19 L), aerate wort thoroughly and pitch yeast. Ferment at 57 °F (14 °C) until fermentation is complete (7 to 10 days). Cool beer to 41–46 °F (5–8 °C), leave at this temperature until all traces of sulfur and diacetyl are eliminated (5 to 10 days), then cool to lowest possible temperature just under 32 °F (0 °C) and cold lager for as long as possible. Carbonate to 2.5 volumes of CO_2.

Morana
(5 gallons/19 L, all-grain)

OG = 1.056 FG = 1.016
IBU = 24 SRM = 26 ABV = 5.3%

In December 2010, head brewer Jason Oliver of Devil's Backbone Brewing Co. of Roseland, Virginia collaborated with Alistair Reece, homebrewer and beer blogger (http://www.fuggled.net/), on a traditional double-decocted tmavé. Reece penned the recipe and named the beer for the Slavic goddess of death and renewal. Oliver has won an astonishing amount of brewing medals and is a staunch proponent of decoction mashing (see inset), and Weyermann floor malted Bohemian Pilsner malt.

Ingredients

8.75 lbs. (4.0 kg) German or Czech Pilsner malt
1.25 lbs. (0.57 kg) CaraBohemian® (CaraMunich® I) malt
1.25 lbs. (0.57 kg) German Munich malt
0.45 lbs. (0.20 kg) Carafa® Special II malt
5.3 AAU Saaz hops (60 min) (1.3 oz./38 g of 4% alpha acids)
2.2 AAU Saaz hops (20 min) (0.55 oz./16 g of 4% alpha acids)
0.375 oz. (11 g) Saaz hops (5 min)
Wyeast 2782 (Staro Prague Lager) yeast (7.0 qt./6.5 L yeast starter)

Step By Step

Ideally you should employ a step infusion or decoction mash with rests at 126 °F (52 °C), 144 °F (62 °C), 154 °F (68 °C) and 162 °F (72 °C). If your equipment (or social demands) limit you to a single infusion, mashing 60 minutes at 152 °F (67 °C) is adequate. Boil the wort for 90 minutes, adding hops at the times indicated. Chill to 46 °F (8 °C). Oxygenate with pure oxygen for 60 seconds. Pitch a large starter of the yeast, or multiple vials to reach at least 350 bil-

Dark Lager Recipes

lion cells. Ferment for 10 days keeping the temperature of the wort at 50 °F (10 °C). As fermentation slows, raise the temperature for a diacetyl rest to 60 °F (16 °C). When the final gravity is reached, and there is no perception of diacetyl, chill the wort to 32 °F (0 °C) for two months of lagering. If you want to barrel age the beer, do so before lagering. Carbonate to 2.4 volumes of CO_2.

Morana
(5 gallons/19 L, extract with grains)

OG = 1.056 FG = 1.016
IBU = 24 SRM = 26 ABV = 5.3%

Ingredients

3.6 lbs. (1.6 kg) Pilsner dried malt extract
2.5 lbs. (1.1 kg) Munich liquid malt extract (late addition)
1.25 lbs. (0.57 kg) CaraBohemian® (CaraMunich® I) malt
0.45 lbs. (0.20 kg) Carafa® Special II malt
5.3 AAU Saaz hops (60 min) (1.3 oz./38 g of 4% alpha acids)
2.2 AAU Saaz hops (20 min) (0.55 oz./16 g of 4% alpha acids)
0.375 oz. (11 g) Saaz hops (5 min)
Wyeast 2782 (Staro Prague Lager) yeast

Step By Step

Place crushed grains in a large steeping bag and steep for 60 minutes at 152 °F (67 °C). Add dried malt extract and enough water to make at least 3.0 gallons (11 L) and bring wort to a boil. Boil the wort for 90 minutes, adding hops at the times indicated. Add liquid malt extract with 15 minutes left in the boil.

Chill to 46 °F (8 °C) and transfer to fermenter. Top up to 5 gallons (19 L) with cool water. Oxygenate with pure oxygen for 60 seconds. Pitch a large starter of the yeast, or multiple vials to reach at least 350 billion cells. Ferment for 10 days keeping the temperature of the wort at 50 °F (10 °C). As fermentation slows, raise the temperature for a diacetyl rest to 60 °F (16 °C). When the final gravity is reached, and there is no perception of diacetyl, chill the wort to 32 °F (0 °C) for two months of lagering. If you want to barrel age the beer, do so before lagering. Carbonate to 2.4 volumes of CO_2.

Weizen Trippelbock
(5 gallons/19 L, all-grain)

OG = 1.108 FG = 1.026
IBU = 35 SRM = 24 ABV = 10.8%

Inspired by The Livery's Trippel Weizenbock. Steve Berthel told us that, "Most lagers do not use black patent, chocolate, or roast barley in the recipes. I favor a two-hour boil with dark crystal malts to achieve the raisiny, toffee flavors." He combines extra dark 155–165 °L English crystal malt with bready German base malts (malted wheat, Pilsner, Vienna, and dark Munich). Moderate hopping with Perle and Tettnang provide the balance. Mike's second attempt to dial in this recipe is currently resting in a 5-gallon (19-L) malt whisky barrel from Balcones Distillery in Texas.

Ingredients

7.5 lbs. (3.4 kg) German wheat malt
5.0 lbs. (2.3 kg) German dark Munich malt
5 lb. 2 oz. (2.3 kg) German Pilsner malt
4.0 lbs. (1.8 kg) German Vienna malt
1.25 lbs. (0.57 kg) Simpsons extra dark crystal malt (160 °L)
8 AAU Perle hops (75 min) (1.1 oz./32 g of 7% alpha acids)
4 AAU Perle hops (20 min) (0.57 oz./16 g of 7% alpha acids)
3 AAU Tettnang hops (10 min) (0.86 oz./24 g of 3.5% alpha acids)
White Labs WLP833 (German Bock) or Wyeast 2487 (Hella Bock) yeast (18 qt./ 17 L yeast starter)

Step By Step

Mash grain at 154 °F (68 °C) for 60 minutes. Boil wort for 120 minutes, adding hops as indicated.

Chill to 46 °F (8 °C). Oxygenate with pure oxygen for 90 seconds. Pitch a large starter of the yeast, or multiple vials to reach at least 600 billion cells. Ferment for 10 days keeping the temperature of the wort at 52 °F (11 °C). As fermentation slows, raise the temperature for a diacetyl rest to 66 °F (19 °C). When the final gravity is reached, and there is no perception of diacetyl, chill the wort to 32 °F (0 °C) for at least two months of lagering. If you want to barrel age the beer, do so before lagering. Carbonate to 2.2 volumes of CO_2.

Weizen Trippelbock
(5 gallons/19 L, partial mash)

OG = 1.108 FG = 1.026
IBU = 35 SRM = 24 ABV = 10.8%

Ingredients

5.25 lbs. (2.4 kg) German wheat dried malt extract
5.0 lbs. (2.3 kg) Munich liquid malt extract (late addition)
4.0 lbs. (1.8 kg) German Vienna malt
1.25 lbs. (0.57 kg) Simpsons extra dark crystal malt (160 °L)
8 AAU Perle hops (75 min) (1.1 oz./32 g of 7% alpha acids)
4 AAU Perle hops (20 min) (0.57 oz./16 g of 7% alpha acids)
3 AAU Tettnang hops (10 min) (0.86 oz./24 g of 3.5% alpha acids)
White Labs WLP833 (German Bock) or Wyeast 2487 (Hella Bock) yeast

Step By Step

Mash Vienna malt at 154 °F (68 °C) for 60 minutes. Steep dark crystal malt in a separate pot for same time and temperature. Colect about 2.25 gallons (8.5 L) of wort from partial mash and combine with "grain tea" from crystal malt. Add dried malt extract and water to make at least 3.5 gallons (13 L). Boil wort for 120 minutes, adding hops as indicated. Keep some boiling water handy to keep boil topped up to at least 3.0 gallons (11 L). Stir in liquid malt extract in final 15 minutes of boil. Chill to 46 °F (8 °C) and transfer to fermenter. Top up to 5 gallons (19 L) with cold water and oxygenate with pure oxygen for 90 seconds. Pitch yeast, ferment and condition beer following the instructions in the all-grain recipe.

Tips for Success

These recipes were modified to fit *BYO*'s standard recipe assumptions of 65% extract efficiency and our hop utilization curve (which is very close to Glenn Tinseth's curve). Adjust the amount of Pilsner malt and bittering hops to match your brewing setup.

If you adjust your water chemistry, make sure to have a sufficient level of carbonates in your water to counteract the darkly roasted malts. You can download Greg Noonan's "water witch" Excel spreadsheet in the resource section at byo.com or John Palmer's water chemistry spreadsheet at www.howtobrew.com/section3/chapter15-3.html.

Your biggest key to success is pitching enough yeast. The all-grain recipes give an optimal yeast starter size for a yeast starter that is heavily aerated. (Consider brewing 5.0 gallons (19 L) of helles or other light lager as a yeast starter for the Weizen Trippelbock.)

See the pitching rate calculator at www.mrmalty.com for other options to raise the appropriate amount of healthy cells. Without an adequate pitch, these beers will not ferment properly.

Decocting

While decoction mashes are the most traditional method to produce lagers, few American brewers execute them. Most of the malt available for brewing today is highly modified and as a result does not require the punishment of multiple rounds of boiling to achieve good extraction or breakdown excess protein content. If you choose to decoct, here are a few tips. Always pull a slightly larger decoction than the mash calculator suggests to ensure that you have enough hot grain to raise the temperature of the main mash to the next rest temperature. Pull mostly grain, and add a small amount of water if required to prevent scorching. The liquid in the mash contains most of the enzymes, so leaving as much of it behind as you can ensures good conversion. When you finish boiling the decoction, add it back to the main mash slowly, stir, and take temperature readings to avoid overshooting the target temperature. The safest stage to do a decoction with highly modified malts is bringing the temperature from the saccharification rest to mash out.

Jason Oliver, brewer at Devil's Backbone Brewing Co., winner of eight medals at the 2012 Great American Beer Festival (GABF), has this to say about decoction: "I take pride in the fact that I give certain special beers that extra effort. I don't have to decoct, but I choose to for authenticity and tradition sake. When you are boiling a quarter to a third of your mash and are smelling it, you can't tell me that it makes no flavor addition. Also, if you tell me that specialty malts can create the same flavors, please give me the formula. There are a lot of good reasons not to decoct. Decoction uses more energy, the malts don't need decoction to convert, it makes the day longer, the equipment is more expensive, and not all beers benefit from decoction (most probably don't). In actuality there are far more good reasons not to decoct than to. That said, I am generally a contrarian so all those reasons make me want to decoct even more!! What you can't substitute is the romance of decoction! Even if you do not notice any difference in a beer's taste, the fact you did one is not made any less valid. Craft brewing is a craft, and using a traditional method to brew a traditional beer is something to be celebrated not denigrated. My advice is if you can decoct it then do it on special brews, it makes it extra special, extra traditional, and extra authentic."

Barrel aging, usually reserved for high-gravity ales, can be employed for strong dark lagers as well. This Weizen Trippelbock (recipe on page 41) is being aged in whiskey barrels from Balcones Distillery of Waco, Texas.

Chilling wort to lager fermentation temperature can be difficult, especially if your tap water is not very cold. Using a pump to recirculate ice water through an immersion chiller is one practical solution to this common problem.

Tmavé

Tmavé (tah-ma-vy) is the term for moderate strength dark lagers from the Czech Republic. There is very little literature in English on the subject, so to learn a bit about its history we contacted leading Czech brewing historian Evan Rail. He told us, "Tmavé is the

beer that most people know the least about here: exactly what it is remains somewhat nebulous, and the 'style' varies quite a bit from brewery to brewery, from region to region in the Czech lands. But I can tell you what I know about it now — it's definitely not the same as a dunkles or a schwarzbier." Rail further concurred that although many breweries use the term erné to describe their dark lagers, tmavé is the correct term.

Rail's research has led him to conclude that, "The old type of tmavé pivo was full and sweet, with a lot of coffee and cola flavors in the mouth. But in the past 10 to 15 years, the taste has changed towards more bitter beers and less sugary beers in general. It's fair to say a traditional tmavé is usually deep amber or even darker in color, but it's far short of something like a stout. It's often perfectly clear, and it usually shows bright ruby glints if you hold it up to the light."

A few guiding principles to brewing a traditional tmavé would be a decoction mash de rigueur in the Czech Republic, the use of Saaz hops or other Czech varietals, and color from an addition of debittered black malt. Czech brewers often use local barevný slad (color malt), a roasted malt similar to Weyermann Carafa® Special II, that is not available outside of the Czech Republic.

Trippelbock

Lagers don't have to be static, historic affairs. While many brewers thrive on recreating traditional European dark lagers, others tread new paths to create unique and dynamic fusions.

Steve Berthel, owner and brewer of The Livery in Benton Harbor, Michigan, brews one such example. His Trippel Weizenbock (a.k.a. Wheat Trippelbock) was conceived as a higher-alcohol lager inspired by the rich maltiness of Schneider Aventinus, which is fermented with a traditional hefe weizen ale strain.

Trippelbock is a maligned term. While Boston Beer Company's Triple Bock began the extreme brewing arms race in 1994 with 17.5% ABV, its flavor was most reminiscent of soy sauce.

Thankfully this project evolved into Utopias, which is currently the highest alcohol non-distilled beer in the world, not to mention deliciously complex.

At 6.7% ABV, people think of a German doppelbock like Ayinger Celebrator as a strong lager, but Samichlaus Bier from Austria's Brauerei Schloss Eggenberg is more than twice as strong at 14% ABV. Samichlaus was first brewed in 1980, so extreme brewing clearly wasn't an American invention.

While barleywines and imperial stouts dominate high-gravity brewing in America, they aren't the only option. Strong lagers provide smoother flavors, highlighting the intense maltiness imparted to strong beers by the excessive quantity of malt.

High alcohol ales require long-term aging to condition and mellow, and strong lagers are no different. Barrel-aging, as the Livery does for a special version of their Trippel Weizenbock, is an unusual twist rarely seen in Europe since the rise of stainless steel fermenters.

Grain/Mashing

Traditionally dark lagers lack the sharply roasted, burnt, or charred flavors of the darkest ales (i.e., porters and stouts). There is no reason this has to be the case, but the cleaner yeast character tends to meld better with a mellow roast. This is usually accomplished with an addition of dehusked roasted malt like Carafa® Special, debittered black malt, or chocolate versions of huskless grains like rye and wheat. Another option to achieve a dark colored beer that lacks roasted flavors is to add Weyermann SINAMAR®, made from Carafa® malt, to the boil or fermenter.

If you cannot acquire any of the above mentioned products, a final option is to make an extraction of a standard dark grain (e.g. chocolate, roasted barley, or black patent) in cold water. This is easiest to do in a French press with three parts of water (by volume) to the finely crushed grain. After sitting overnight, press down the plunger and pour the extraction through a coffee filter to remove any small pieces of grain.

There are some dark lagers, like Baltic porter, that regularly include standard dark malts in the mash. However, these recipes tend to call for amounts considerably lower than those commonly used in American and English brewing. Treating your water with chalk or baking soda if it is low in carbonates (< 100 ppm) is especially valuable for these beers because residual alkalinity softens the harsh acrid notes that accompany excessive additions of dark malts. Ensuring your mash pH is in the ideal range will guarantee both proper conversion and a smooth rounded roastiness.

Yeast/Fermentation

Lager yeast strains do not have the wide range of characters displayed by

ale yeasts as diverse as the nearly neutral American ale strain pitched at Sierra Nevada and the fruity and phenolic Weihenstephan hefeweizen strain. However, lager strains are not identical. Some strains boost the perception of malt flavors, like White Labs WLP833 (Bock Lager) or Wyeast 2487 (Hella Bock), while others provide a mild fruitiness, like White Labs WLP800 (Pilsen Lager) or Wyeast 2001 (Urquell Lager). We suggest fermenting several different recipes with a workhorse lager strain like White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) to dial in your fermentation process (i.e., pitching rate, aeration, fermentation/pitching temperature, and diacetyl rest).

When brewing a lager you will need to prepare a large amount of yeast because most brewers recommend pitching twice as many cells as you would for an ale starting at the same specific gravity. Making a starter is always a good idea. Use a pitching rate calculator to determine how big a starter you will need. Some brewers prefer to propagate lager yeast at their desired fermentation temperature, but we have never had an issue growing lager yeast at ale temperatures. Dried lager yeasts are highly effective as well when an adequate amount is pitched, and are a good option if you do not want to make a starter.

When Steve Berthel brews his massive Trippel Weizenbock at The Livery, he prefers to harvest yeast from a batch of maibock or doppelbock. Repitching yeast slurry from a previous batch is a useful technique if you want to brew a strong lager, but requires careful attention to sanitation.

Some homebrewers pitch their yeast when their wort is chilled to an ale fermentation temperature, and then allow the beer to slowly cool to the ideal lager fermentation temperature as the yeast begins to ferment. We find this method to be less than ideal as it can spur the creation of additional fruity and buttery flavors. If your ground water is not cold enough to chill the wort into the high 40s °F (8–9 °C), you have several options. The most basic is to chill the wort as cold as you

can, and then rack it to a sanitized fermenter, attach an airlock, place it at the desired fermentation temperature, and wait to pitch until the wort is fully cooled. This is slightly risky as the longer the wort sits without brewer's yeast, the higher the chances of wild yeast or bacteria gaining a foothold, but with good sanitation we have produced great lagers in this way.

More advanced wort chillers (e.g., counter-flow, plate) are more efficient than immersion chillers, but are still unable to cool the wort below the temperature of the ground water. We have found pre-chillers that first run the ground water through a copper coil submerged in an ice bath to be inefficient. As a homebrewer without the refrigerated glycol that many commercial breweries rely on to reach their desired pitching temperature, the easiest method is to purchase a submersible pump. After using ground water to chill the wort as low as you can, connect the pump to the chiller and submerge it in a bucket with a little water and a lot of ice. The near-freezing water circulates through the chiller before returning to the bucket, quickly cooling the wort. It takes about 16 lbs (8 kg) of ice to chill five gallons (20 L) of lager in this way. This rig is also valuable for chilling ales in the summer when tap water temperatures can exceed 80 °F (27 °C) in some areas.

Holding the fermentation temperature in the desired range, and later cooling it even further for lagering (cold storage) is one of the biggest challenges for most home-lager-brewers. Inspired by the original European lager brewers you might choose to brew seasonally, when a basement, or garage has a constant temperature in the high 40s °F (8-9 °C). Brewing lagers when the weather is hot, and without the temperature-controlled conical fermenters that are used by most craft brewers and some well-heeled homebrewers, requires controlling the ambient temperature where the fermenter is located. Many homebrewers have a refrigerator or freezer with an external temperature controller they use to dial in a precise temperature. This is a good option because the temperature can be adjusted at the push of a button and does not require frequent intervention.

If you are unable to get temperatures cold enough for a true lager, you could use steam lager yeast — Wyeast 2112 (California Lager) or White Labs WLP810 (San Francisco Lager) — or a clean ale yeast to achieve a similar, although not identical, result.

A high pitching rate and cool fermentation temperature around 60 °F (16 °C) will help to produce a more lager-like finished beer, as will cold conditioning of the keg or carbonated bottles in a refrigerator.

Pseudo-lager fermentations are more effective for flavorful dark beers than pale low-hopped lagers where there is no place to hide the fruitier flavors these yeast strains produce.

Depending on the yeast strain you select, a diacetyl rest may be required. As primary fermentation slows, pull a sample of the beer. If you taste butter or butterscotch this is diacetyl that the yeast have produced, but have not yet converted to neutral flavored compounds. To encourage them to absorb the diacetyl, raise the temperature by about 10 °F (6 °C). Taste the beer again after a couple days to ensure the flavor is gone before lagering. If fermentation is complete, and the yeast have reduced the diacetyl the temperature can be dropped quickly. (It does not need to be stepped down a few degrees each day as some brewers advocate.)

Lagering

One of the advantages of dark lagers is that clarity is not a major concern, however these beers still benefit from some time spent in cold storage. Lagering helps to clean up the flavor of the beer, to drop yeast, and allow sulfur and other compounds that were generated during fermentation to dissipate. For lower gravity lagers three to five weeks at a temperature in the low 30s °F (around 0 °C) is usually adequate, but strong lagers will continue improving for months.

If you are bottle conditioning after lagering, it is usually a good idea to repitch the same yeast you used for primary fermentation. 10% of the initial pitching rate is a good rule of thumb. Traditionally breweries used a small amount of young, actively fermenting beer to provide both fermentable sugars and active yeast, but this technique is beyond the scope of this article.

Conclusion

Lagers will probably always take a backseat to ales for most homebrewers. Tmavé will never be as popular as Guinness in most of the world, but that doesn't mean that dark lagers aren't some of the most unique and interesting beers in the world. Take your pick of anything from an ultra-traditional re-creation of Baltic porter to save on the airfare to Latvia, or a unique inspiration that draws on the malts and techniques of disparate regions to create something no one else has tasted. BYO

Schwarz

Story and photos by
Horst Dornbusch

A Shadowy Dunkel From A "Dark Block"

This article is about an unusual, very dark Bavarian dunkel called Schwarzviertler that I encountered during my peregrinations through the world of beer. It is made by Braumeister Cornelius Faust of Brauhaus Faust in Miltenberg, Germany, which has arguably one of the most storied and least known histories of any brewery in Germany. The name Schwarzviertler means from the black block and alludes to the location of the brewery, the *schwarzviertel* (or black block), the part of town where the beer is made. It is at the bottom of a steep cliff that casts a deep shadow over the brewery in the afternoon, even on the brightest day.

The Schwarzviertler is one of a dozen beers in the Brauhaus Faust's regular portfolio (see www.faust.de/-de/bierspezialitaeten/faust_bierspezialitaeten).

The brew is based on an unusual combination of a multi-step infusion mash followed by a single decoction. The grain bill is composed of Pilsner and Munich base malts as well as a touch of dehusked Carafa® I roasted malt — not unusual for this style — and a surprising five percent Weyermann® Rauchmalz (beechwood smoked barley malt). To enhance the brew's darkness to roughly 27 SRM (68.1 EBC), Cornelius adds about 1.8 gallons (7 L) of SINAMAR® natural roasted color extract to his 70-hectoliter brew kettle. (That's 1 mL per liter or 0.13 fl.oz. per US gallon.)

The SINAMAR® gives him a color gain over the color from the grain of approximately 7 SRM (17.4 EBC). The result is a 5.2 ABV, mildly Perle-hopped (23.3 IBU), velvety smooth, highly opaque and very clean-tasting lager.

Cornelius has graciously consented to the reproduction of his Schwarzviertler recipe and brewing instructions — adopted for a multi-step infusion mash

viertler

for North American homebrewers. However, before we get to the technical details of this very individualist variation on the traditional dunkel theme, let's first look at the remarkably influential story of the Faust Brewery and its iconoclastic brewing philosophy that brought about, among other brews, the Schwarzviertler Dunkel.

Miltenberg: A Fulcrum of Medieval Commerce and War

Miltenberg is a charming, medieval, fairy-tale town of barely ten thousand souls, nestled on the banks of the River Main, a tributary of the Rhine, against a backdrop of steep cliffs. Situated barely 80 km (50 miles) southeast from the cosmopolitan Frankfurt International Airport, it is surrounded by two dark expanses of woods, the Spessard and the Odenwald, which together form Germany's largest contiguous forest region. Appropriately, these woods are also the imaginary home of the Brothers Grimm's fabled and mischievous Rumpelstiltskin.

Miltenberg is rich in romantic, centuries-old, crooked, but well-preserved, half-timbered houses. Its Hauptstraße (main street) is a narrow cobble-stoned passage that was once — at the time of the Holy Roman Empire — part of Germany's main north-south thoroughfare that linked Cologne, Nuremberg, Munich, Salzburg and Vienna.

As a stop-over on the old empire's main artery of commerce and war, Miltenberg has seen its share of traveling merchants with their clattering wagons, of knights in their proverbial shining armor, of rag-tag hordes of marauding soldiers and even of lofty emperors. In fact, there is a hotel and pub on Hauptstraße 99 called Zum Riesen ("At the Giant's"), which dates back to the mid-1100s and is considered Germany's oldest continuously operating inn. Historical annals confirm that no less than three German emperors (Frederick I in 1158, Charles IV in 1368, and Frederick III sometime in the 15th Century), as well as the religious reformer Martin Luther in the 16th Century and Austrian Empress Maria Theresa in the 18th Century, have taken up quarters in the "Giant." In more recent times, the "Giant" has given shelter to composer Richard Strauss, "The King" Elvis Presley, and, yes, you guessed it, yours truly. Miltenberg is a hidden gem well worth a visit, I assure you, for both its architecture and its beer!

Behind a Quaint Façade, Great Beer Innovation Is A-Brew

When walking Miltenberg's cobble stones today, especially in the dim light of a misty winter afternoon, it seems as if all the hustle and bustle of yesteryear has given way to a life that is at once orderly and placid. However, that calm and quiet can be deceiving, because at a place where the old road

Schwarzviertler Clone Recipe

Faust Schwarzviertler clone (5 gallons/19 L, all-grain)

OG = 1.052 FG = 1.013
IBU = 23 SRM = 27 ABV = 5.2

The Schwarzviertler is part of the brewery's year-round portfolio. It is a fiery dark quaffing lager with delicate, mildly smoky aromas of caramel and bitter chocolate, and a satisfyingly clean, dry finish. Here is how a New World homebrewer can clone this fine brew.

Ingredients

7 lb. 15 oz. (3.6 kg) Munich I malt
2 lb. 10 oz. (1.2 kg) Pilsner malt
9.1 oz. (0.26 kg) Weyermann® Rauchmalz (smoked malt)
2.9 oz. (82 g) Weyermann® (dehusked) Carafa® I Spezial
0.64 fl. oz. (19 mL) SINAMAR®
5.9 AAU Perle hops (60 min) (0.9 oz./27 g of 6.5% alpha acids)
0.1 oz. (2 g) Perle hops (10 min)
Bavarian-style lager yeast (your choice) (4 qt./4 L yeast starter)

Step by Step

Two or three days before you brew, make a 1-gallon (~4 L) yeast starter. Aerate the starter wort well and pitch your yeast. Ferment the starter at room temperature, then refrigerate (or place in your fermentation chamber) at the beginning of your brew day, to force the yeast to flocculate as completely as possible.

To approximate the mash conditions (and lautering process) used by the brewery, mash in so that you use around 20 qts. (19 L) of brewing liquor. For the grain amounts above, this is a mash thickness of about 1.8 qts./lb. (3.7 L/kg), thinner than a typical homebrew mash. If you alter the amount of grain to adjust for your extract efficiency, you should still use roughly same amount of brewing liquor unless your mash would be way too thick or way too thin. (These instructions assume that you can heat your mash tun. If you can't, mash in as thickly as possible and use boiling water infusions for each step in the mash.)

Mash in to 113 °F (45 °C), and give the mash an initial hydration rest of about 30 minutes. Slowly heat the mash to raise the temperature to 149 °F (65 °C). A rate of just over 1 °F (~0.5 °C) every minute will mean the temperature ramp will take about a half hour. Rest at 149 °F (65 °C) of 20 minutes. Then repeat the temperature increase, this time to 154 °F (68 °C) for a 5-minute rest. The next rest is at 162 °F (72 °C) for about 10 minutes. To raise the temperature for the mash out, you have two options. Heat the mash as before or boil a decoction, as is done at Faust. For the decoction, draw about one-quarter of the mash (a little over a gallon/4 L) into a large pot and bring it to a boil. Boil for 10 minutes, then return the decoction to the main mash for a temperature increase to 169 °F (76 °C). Recirculate for about 15 minutes before you collect your wort.

Collect all the wort from the grain bed, without sparging. At Faust, collection takes about 2 hours, but this is most likely a limitation of their brewhouse as a quick run off is not going to have any negative effects on wort quality. Run off as quickly as you can without inducing a stuck mash. When all the wort is in the kettle, measure the volume. Subtract this from your target pre-boil volume. (The boil is 70 minutes, so 6.2 gallons/23 L of pre-boil wort would work if you typically boil off a gallon an hour.) This is the volume of sparge water you will use. Divide this into three aliquots and sparge with each, taking about 30 minutes to rinse the grain bed and collect the wort each time. (If you collected 4.0 gallons/15 L of wort, you would need 2.2 gallons/8.3 L of sparge water separated into three 2.9 qt./2.7 L aliquots, to reach 6.2 gallons/23 L of pre-boil wort.) Your sparge water should be 169 °F (76 °C), or hotter if your grain bed temperature has dropped below 169 °F (76 °C).

The boiling time is 70 minutes. Add the bittering hops about 10 minutes into the boil and the aroma hop and the SINAMAR® about 10 minutes before shut-down. Whirlpool the wort and let the trub sediment, allowing up to 20 minutes for this to happen. Then, chill the wort to the temperature range of your selected yeast, usually to about 50–59 °F (10–15 °C) for most Bavarian lager strains.

Ferment the brew like a typical German lager. After primary fermentation (and a diacetyl rest, if needed), rack the beer off the yeast and lager it for a month to 6 weeks. The optimal lagering temperature would be 28 °F (-2 °C), but refrigerator temperature (around 40 °F/4.4 °C) will work.

Faust Schwarzviertler clone (5 gallons/19 L, partial mash)

OG = 1.052 FG = 1.013
IBU = 23 SRM = 27 ABV = 5.2

Ingredients

3 lb. 4 oz. (1.5 kg) Munich I malt
9.1 oz. (0.26 kg) Weyermann® Rauchmalz (smoked malt)
2.9 oz. (82 g) Weyermann® (dehusked) Carafa® I Spezial
5 lb. 4 oz. (2.4 kg) Munich liquid malt extract
0.64 fl. oz. (19 mL) SINAMAR®
5.9 AAU Perle hops (60 min) (0.9 oz./27 g of 6.5% alpha acids)
0.1 oz. (2 g) Perle hops (10 min)
Bavarian-style lager yeast (your choice)

Step by Step

Mash the malts in 5.5 qts. (5.2 L) at 149 °F (65 °C) for an hour. While the mash is resting, heat 1.0 gallon (3.8 L) of water to a boil in your brewpot and stir in roughly half of the malt extract. Also heat 5.5 qts. (5.2 L) of sparge water to 169 °F (76 °C). Drain the wort from the mash tun. Pour roughly 2 qts./1.8 L of the sparge water over the grain bed and drain the wort again. Repeat twice. Boil wort for 70 minutes, adding hops at times indicated. Stir in remaining malt extract and SINAMAR® with 15 minutes left in the boil. Chill wort and transfer to fermenter. Top up with cold water to make 5 gallons (19 L) of wort at your fermentation temperature. Aerate and pitch yeast. Ferment according to instructions in the all-grain recipe.

Faust Schwarzviertler clone (5 gallons/19 L, extract with grains)

OG = 1.052 FG = 1.013
IBU = 23 SRM = 27 ABV = 5.2

Ingredients

1 lb. 4 oz. (0.57 kg) Munich I malt
9.1 oz. (0.26 kg) Weyermann® Rauchmalz (smoked malt)
2.9 oz. (82 g) Weyermann® (dehusked) Carafa® I Spezial
6 lb. 10 oz. (3.0 kg) Munich liquid malt extract
0.64 fl. oz. (19 mL) SINAMAR®
5.9 AAU Perle hops (60 min) (0.9 oz./27 g of 6.5% alpha acids)
0.1 oz. (2 g) Perle hops (10 min)
Bavarian-style lager yeast (your choice)

Step by Step

Steep the grains at 149 °F (65 °C) for 45 minutes in 3.0 qts. (2.8 L) of water. Add water to make at least 3 gallons (11 L), add half the extract and boil for 70 minutes. Add hops at times indicated. Add remaining extract and SINAMAR® with 15 minutes left in boil. Chill, top up, aerate and pitch yeast as usual. Ferment according to the instructions in the all-grain recipe.

Brauhaus Faust resides in the *schwarzviertel*, or black block, in Miltenberg, Germany. This part of the city is in the shade of a large cliff. The brewery has been in existence since 1654, but currently brews with a mid-20th-Century brewhouse.

is almost too narrow for a beer truck to squeeze through, at Hauptstraße 219, is the Brauhaus Faust. It was founded in 1654, only six years after the devastating Thirty Years War (1618–1648), by Kilian François Mathieu Servantaine, a *cervois* (brewer) from Liège in what is now Belgium. Kilian François Mathieu had escaped the war's turmoil in his homeland and moved across the Rhine to Miltenberg. He named his new place Löwenbrauerei ("Lion's Brewery").

Almost two hundred years later, in 1825, after the Napoleonic Wars, when much of Europe was in the repressive grip of restoration forces determined to bring back the old monarchical order, the Löwenbrauerei was acquired by Georg Anton Krug and his son August. These two, however, were a freedom-minded pair who would later become local leaders of the failed democratic movement that swept Germany in 1849. To avoid being arrested by the authorities, August and his father — like many of their rebellious compatriots — saw no choice but to pack their bags in a hurry and move to a better life in the New World. They ended up in Milwaukee, where they promptly founded . . . a new brewery. August, unfortunately, died a few years later, in 1856, and his accountant Joseph Schlitz took the opportunity not only to buy the Krug brewery, but also to marry the grieving widow Krug. Herr Schlitz turned out to be a brilliant businessman, because, by 1902, the renamed Joseph Schlitz Brewing Company had become the largest brewery in the world — and it all started with two rebels from Miltenberg!

Back in Miltenberg, after Krug's escape to the New World, the Löwenbrauerei changed hands several times until it was purchased, in 1875, by Johann Adalbert Faust, a cooper and brewer. The brewery has remained in the Faust family ever since. Renamed Brauhaus Faust, the brewery is now run by two cousins, brewmaster Cornelius Faust and businessman Johannes Faust. Today, Brauhaus Faust also owns the pub inside the ancient "Giant" Zum Riesen, which is now a protected historical site. The modern

Brauhaus Faust now brews a regular portfolio of one dozen beer styles at Hauptstraße 219, including not just the standard Pils and hefeweizen, but also several super-strong festbiers and a nourishing dunkel doppelbock.

In addition to its regular selection, Faust offers several limited-edition seasonal specials, such as a spectacular Eiswein and the so-called Faust Auswandererbier 1849 ("Faust emigrant's beer 1849"). The Auswandererbier 1849 is an amber imperial IPA, which is an extremely rare beer style in Germany.

The Auswandererbier was brewed to commemorate former Faust brewery owner and Schlitz founder Anton Krug. This ale is a 1.076-OG, 8%-ABV, 80-IBU humdinger of an amber ale with a bi-continental hop profile of German Perle and Tettnanger hops, as well as American Chinook, Citra®, Columbus and Cascade hops. Not a typical German beer, to say the least.

Faust Schwarzviertler Brewing Instructions

The Schwarzviertler is part of the brewery's year-round portfolio. It is a dark quaffing lager with delicate, mildly smoky aromas of caramel and bitter chocolate, and a satisfyingly clean, dry finish. This beer is similar to what the BJCP would label a Munich Dunkel, but with elements of a schwarzbier and a rauchbier also included. Here is how a New World homebrewer can clone this fine brew.

Brewhouse Process

The Miltenberg 70-hectoliter (hL), (approximately 60-barrel), brew house, is, of course, thoroughly professional with steam jackets and an agitator. For the mash, Cornelius lays a base with 37 hL of hot brewing liquor. That's about 53% of the expected kettle volume at the end of the boil. During the mash-in via a pre-masher, an additional 8 hL brewing liquor — roughly 11.5% of expected net kettle volume — reaches the grain bed. This makes a total of 45 hL — almost 65% of the net kettle volume — of liquor in the mash. The total volume of liquor and malt in the mash tun is about 57 hL (roughly 81.5% of net kettle volume).

The grains are step mashed with the mash tun being heated via a steam jacket. For homebrewers who cannot heat their mash directly, try a very thick dough-in instead of a mash-in. This allows for successive hot-liquor infusions to maintain and raise the mash temperature as required, without overflowing the mash tun. Heat up about 15 to 20% more brewing liquor than your target net kettle volume. For the dough-in, use as little of that liquor as possible without clumping the mash, while aiming for the Miltenberg mash starting temperature of 113 °F (45 °C), and give the mash an initial hydration rest of about 30 minutes before starting to step-infuse it.

Slowly raise the mash temperature by the application of external heat (if your equipment allows it) or an infusion of hot liquor for several rest steps. During this process, the amount of water added is less significant than reaching the correct rest temperatures. Raise the mash temperature first to 149 °F (65 °C) for a beta-amylase rest of 20 minutes. Then repeat the temperature increase, this time to 154 °F (68 °C) for a 5-minute alpha-amylase rest. The next rest is at 162 °F (72 °C) for about 10 minutes.

At this stage, Cornelius draws roughly one-quarter of the mash into a cooker for a 10-minute boil and then returns that decoction to the main mash for a temperature increase to 169 °F (76 °C).

Homebrewers may skip this decoction step, if their brewing setup would make it difficult to achieve, and instead raise the mash temperature through direct heat or hot-water infusion. Rest the mash again at 169 °F (76 °C) for about 20 minutes. Then, recirculate for about 15 minutes.

Finally, lauter the mash very slowly into the kettle. At Faust this takes about 120 minutes. However, do not sparge! Instead, let the mash run almost dry, while maintaining the mash-out temperature if possible. These first runnings in the kettle are known in Germany as *vorderwürze* (literally advance wort). At the end of lautering, as is the German way, flush

the grain bed (called *überschwänzen*, meaning pouring-over) three times with hot *nachgüsse* (or after-pours). To get a rough idea of each *nachgüsse* volume, measure the *vorderwürze* kettle-volume, subtract it from your expected net kettle volume, and divide this figure by three. The combined lautering time for the three "after-pours" should be another slow 120 minutes. Yes, that's about four hours of lautering to flush out as much of the extract as possible! It is this process that gives the final beer its rich, malty, velvety depth.

Keep monitoring the kettle gravity. Assuming a roughly 10 percent evaporation rate, stop the run-off at a kettle gravity of about 1.048. It is always preferable to liquor the wort down at the end of the boil than to end up with a wort that is too thin.

The boiling time is 70 minutes. Add the bittering hop about 10 minutes into the boil and the aroma hop and the SINAMAR® about 10 minutes before shut-down. Then transfer the wort to a whirlpool for some thorough trub sedimentation of perhaps 20 to 30 minutes. Lastly, heat-exchange the green beer to the temperature range of your selected yeast, usually to about 50–59 °F (10–15 °C).

Cellaring

Ferment the brew like a typical German lager. Keep it for about 7 days (give or take) in the primary fermenter. Then rack it into a secondary fermenter and leave it there for about 2 weeks. Rack it off the debris again and lager it at a temperature as low as your equipment allows — preferably at 28 °F (-2 °C) — for at least 4 weeks (6 weeks is preferable). Finally rack, condition (or prime) the finished brew as desired, and package it.

Extract Alternatives

There are several ways to approximate the Miltenberg all-grain original with liquid malt extract (LME). The easiest way is to use a commercial, preformulated, unhopped Dunkel LME, such as Weyermann® Bavarian Dunkel, which is made from a double decoction of Munich Type I, Caramunich® Type II, and Pilsner malts. Steep Rauchmalz and dehusked Carafa® I in the quantities specified in the all-grain recipe.

If steeping grain is not your mug of beer, you can even skip this step by substituting about 10% of the Bavarian Dunkel LME with Weyermann® Bamberg Rauchbier LME, which is made from a double decoction of 98% Weyermann® Rauchmalz and 2% dehusked Carafa® Spezial I. The convenience of this brew, however, is bought at the expense of a tad less roastiness compared to the Faust original because of the smaller amount of Carafa® Spezial I.

Regardless of whether you employ all-grain or extract methods of wort production, your biggest key to success will be pitching an adequate amount of yeast and keeping your fermentation temperature steady. BYO

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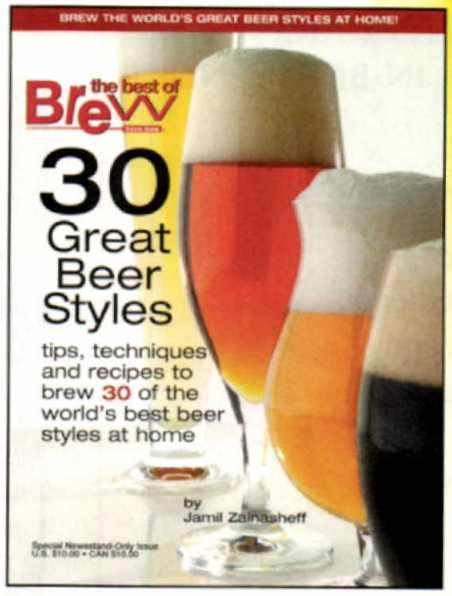

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Plug-n-Brew

My electric homebrew system

by Terry Foster

Far too many people seem to assume that using propane heaters is the only way to go. After all, most US craft brewers use steam heating in the kettle and hot liquor tank; direct firing of the kettle is rarely, if ever practiced.

I have been using electrical heating for homebrewing for some forty years or so, and have tried all sorts of setups. My first point is only about electrical heating, and not about complicated electrically-run control systems. You can take electic brewing as far as you like and build the sort of set-up where you just press a button and the finished beer comes out the other end, but I like to keep things simple. My second point is that I am not going to give you a step-by-step approach to building your own electrically-fired kettle, but rather a general guide as to how I went about setting up such a system, and my experiences of what not to do.

My original attempt at electric brewing, back before I moved from England to the US, was an ignominious failure. We bought a new washer, leaving me with the old small one, which came with a heating element and held about 5-6 gallons (19-23 L) of water. I thought it would be perfect and started to boil a brew in it (after thorough cleaning, of course). In those days I only had access to cone hops, and these little beasts handily blocked up the fine grating that sat above the heating element. In a matter of minutes the element was no longer covered by liquid and promptly burnt itself out. Lesson I – do not let the element run dry!

Plan B was that at the time I could buy old 10-gallon (38-L) wash boilers quite cheaply. These had electric heating under the bottom of the boiler, with something like a 5KW output and were complete with a suitable faucet for wort run-off. I tried one and quickly bought another, for the first worked very well, giving rapid boiling and with no risk of the element going dry.

When I moved to the US in 1978 I brought one of these along with me. It of course required a 240-volt source to work properly, but that was not a problem since all I had to do was to change the plug and cable so that I could connect it to the socket designed for our electric drier. All was well for some years, but it was old when I bought it and eventually the heating arrangement gave up the ghost and I could find no one who could repair it. So I bought a Bruheat boiler, a British product that was sold in the US in the 1980s. It was made of plastic, held 7 gallons (26 L), and was heated by a 3KW element fitted with a thermostatic variable control on the outside of the vessel. Being British, it needed a 240-volt supply, and since I lived in a new house with the drier far from my brewing area, I had to install such a supply. That was easy enough because it was an old house and I had to get it converted from fuses to circuit breakers, for which I employed an electrician, and simply got him to hook me up with 240-volt supply in my brewing area. Lesson II – do not do this yourself — get a professional!

I ran with this type of bucket for a good many years and generally had good results. I did not use it as a mash tun, a purpose it was supposed to serve, partly because I had a separate mashing system, also electrically controlled, which worked very well until it packed up and I could not get it repaired. The Bruheat boiler lived on, however, although it did present a couple of problems. First the plastic faucet did not permit attaching a sparge arm, so I had to sparge manually. Second, the faucet began to leak after a while and had to be replaced two or three times, a minor fault, but an annoying one. Third, I would sometimes have problems with hop material blocking the faucet, even though I put in a mesh strainer. Fourth, I did not have a separate hot liquor tank, which

"I have been using electrical heating for homebrewing for some forty years or so, and have tried all sorts of setups."

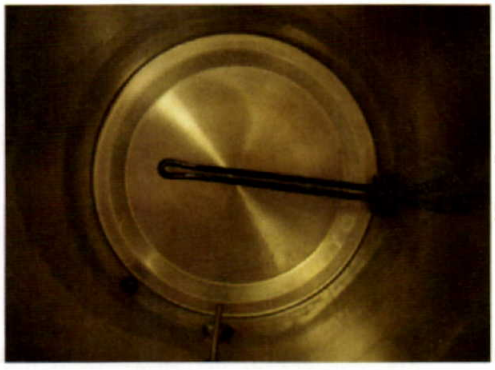

Photo courtesy of Terry Foster

presented me with some problems that would require some hard work.

So the next stage came when I wanted to improve the system and to incorporate a hot liquor tank sparge arm and to convert to stainless steel vessels, partly for looks and partly for convenience in cleaning. By this time I was living in the condominium I presently inhabit, and one of the first things I did after moving in was to get an electrician to put in a 240-volt point in what was to be my brewing area. Perhaps I should point out here that I have always brewed in a basement, and had no choice to brew anywhere else in the condo, so propane gas heating was entirely out of the question. Lesson III – do not use a burner inside, carbon monoxide really does kill!

So I built a system with a boiler powered by two 3 KW heating elements each separately controlled by a rheostat. For the latter, after much hunting around I used controls for an electric cooker, and built a junction box to connect them up to the heating elements. Well, that was not a success, largely because I had long forgotten my soldering technique. I think the thing worked twice before the rheostat and junction box burnt out. Lesson IV – do not try to build electrical systems yourself!

I had now to go to Plan X, which started with purchasing a 10-gallon (26-L) stainless pot, complete with thermometer, sight glass and ball valve, the latter being suitable for attaching a proper sparge arm. I drilled a hole of appropriate dimensions and fitted in a Bruheat element and controller. My reasoning was that (a) I had such an element, and (b) it would not only heat the water but the thermostat would also maintain it at 160–170 °F (71–77 °C), just right for sparging. So I now had a working stainless hot liquor tank. In case you are wondering, five or six years ago you could still buy these elements and thermostats separately in the US, but I have been unable to locate any current US source, (though there is an alternative, read on).

My next step was to set up a boiling kettle, and I started with a 10-gallon (26-L) Blichmann Boilermaker. I first thought of using another Bruheat-type element, but then I asked myself whether I really needed thermostatic control in the kettle since all I needed from that was to be able to reach a boil quickly and to keep the wort at a rolling boil. So then I wondered whether I could simply use a standard water heater element, and if I did so, how big would it need to be and whether an ordinary 110-volt system could be used to run it. I could have consulted an electrician to answer these questions, but I did not need to. For at that time I ran across a supplier that sold a 3.5 KW element securely fixed to an appropriate cable and plug, together with a fitting to fix it to a 5- to 7-gallon (19- to 26-L) boiler, at the sum of $59.95, although of course you can build your own using a 30-amp drier cable. That was fine for my pur-

pose, but if you want to build a setup for larger volumes of beer they also have elements of higher wattage. And if you want to put a variable control on it, some electric brewing suppliers offer those as well, of varying complexity and price.

Now I had to drill a suitable hole in the Blichmann boiler. No problem and I did this so that the element sat at right angles to the faucet. Next was the small matter that the element, although it would run off the 110-volt supply, needed a 30-amp circuit. Back to calling in the electrician, who installed such a point, along with a GCFI in the circuit. Note that any electrical supply in a wet area should incorporate a GCFI, and not just in your brewery. I also had him install a separate switch for this circuit on the wall so that I could turn the element off quickly and could easily avoid a boil over. In no time at all I had filled the boiler with water switched on the juice to try it out, with complete success, taking 6 gallons (23-L) of cold water to the boil in about half an hour. In other words the most straightforward system was ideal for my needs, something I had overlooked when I first went for the all-too fancy double element heating system. Lesson V – keep it simple.

Lastly, I normally do not brew in high summer, but for once I did, thinking that with the air conditioner on all would be well. I had not got too far into the wort boil when the whole basement steamed up – I had simply overloaded the a/c unit to the extent that it took a day or so to get back to normal! There is always something waiting out there to trip you up, so Lesson VI — never forget Murphy's Law.

The boiler now sits under a fan hood that was designed for kitchen use, which ventilates to the outside, and fogging up is no longer a problem. Finally all I had to do was run a length of "elephant trunk" hose to an exit point in the wall of the basement.

I'm an electric brewer

In the end my system is pretty simple, and not particularly expensive. You can do the same and be able to brew indoors close to a water source and with steady, dependable heating that is not going to poison you. You may think that I took a long time to sort out such a straightforward solution, but that in part was due to the fact that I always put more effort into the actual brewing than I did into the technology of my brewery. Surely that isn't a bad thing? BYO

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Milling

Theory and practical consideration

by Chris Bible

Milling is an important step in the brewing process. The purpose of milling is to crush the grain kernels in order to expose the starches to liquid during the mashing process.

Ideally, the kernels should be crushed in a way such that the inner starches are ground into relatively fine particles, but not so much as to turn the starch component into flour. A finer crush produces a higher surface area of the starch in the mash, and this allows the starch to gelatinize more easily and be more readily available for conversion into sugars. This should, theoretically, produce a higher extract per pound of malted barley. But there is a practical trade-off regarding fineness of crush. If the grain starch components are so finely crushed that there is a significant amount of flour in the mash, there is an increased likelihood of a "stuck" mash and the corresponding reduced extract efficiency.

Additionally, if the grain is crushed to the point of flour, it is likely that the grain husks have also been ground up to a point such that there will be an increase in the amount of tannins and other less desirable husk components extracted into the wort.

It is important to obtain a good crush such that the inner starches are ground into relatively fine pieces, but the kernel husk is left mostly intact. Allowing the husks to remain relatively intact is crucial, as the husks form a filter bed in the lauter tun and prevent the run off from becoming stuck. The filter bed also helps to clarify the wort during the run off. If the husks are ground too finely, they will not form a good filter bed structure. Without a good filter bed, sparging and run off will be problematic.

Roller mill configuration

The most common type of milling equipment used by homebrewers is a hopper-fed roller mill. The roller mills used by homebrewers typically consists of two metal rollers separated by a gap. Usually only one roller is powered and the second roller is allowed to freely rotate. Because of this, the powered roller rotates faster. Grain is fed by gravity into the mill from a hopper, as shown in Figure 1 below.

Roller mill crush quality

There are many variables that affect the quality of crush when using a roller mill. Physical characteristics of the grain and the configuration and

"If the husks are ground too finely, they will not form a good filter bed structure. Without a good filter bed, sparging and run off will be problematic."

Figure 1

Photo by Les Jörgensen

operational parameters of the mill directly influence the quality of the crushed grain.

Crushed grain quality

The physical characteristics of the grain will impact the quality of the crush. Important variables related to the grain include moisture content, grain size distribution and friability. Grain with higher moisture content is more pliable and less brittle, and so will be broken apart less during milling than grain with lower moisture content. Grain size distribution is important because it is related directly to the variability of the size distribution of the crushed grain. Grain with less variability in size distribution will produce crushed grain with a more uniform size distribution. Grain friability is related to moisture content and refers to the overall tendency of the grain to shatter under stress. Grains that are characterized as very friable will be very easily broken into smaller pieces during milling.

Configuration and operational parameters

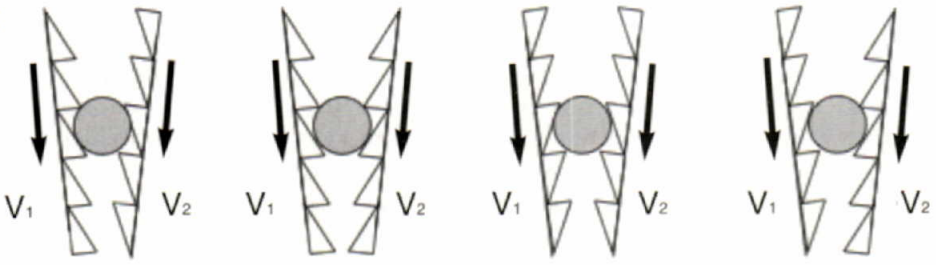
Roller mills crush grains through a combination of forces. If the mill rollers rotate at the same speed, compression is the primary force used. If the mill rollers rotate at different speeds, both shearing and compression forces are important. If the mill roller surfaces are grooved or textured, a tearing or grinding force is also present.

Mill roller gap distance is important because a smaller gap will produce a finer crush. A typical gap setting for a homebrewery roller mill is between about 0.035–0.055 inches (0.9–1.4 mm). (You can measure the gap size with a tool designed to measure spark plug gaps.)

A more uniform roller gap will produce crushed grain with less variability in the particle size. Faster absolute speed will produce a finer crush, while a slower absolute speed will produce a coarser crush. Relative differential speed of the rollers is directly related to the amount of shear that the grain experiences during milling. Rollers with a higher amount of differential speed (one roller moving much faster than the other) will impart a much greater amount of shear stress to the grain and will produce a finer crush. The higher shear stress is also more likely to tear apart the grain husks.

Roughness and disposition of the roller surfaces is important because the way the grain contacts the rollers during the milling process affects the magnitude and types of forces that are transferred to the grain. Some rollers are textured and configured in such a way as to purposefully try to impact the way that force is transmitted, and therefore impact the characteristics of the crushed grain. The impact of roughness and roller disposition is illustrated by research that was conducted by Fang and Campbell. These researchers investigated the effect of roller disposition on

Figure 2



Four Types of Roller Disposition For $V_1 >> V_2$
S-S = Sharp-to-Sharp, S-D = Sharp-to-Dull,
D-S = Dull-to-Sharp, D-D = Dull-to-Dull

If the "teeth" are pointed down on the (powered, faster-moving) left roller, the sharp point contacts the malt. In contrast, the slower-moving right roller is spun by malt contact and "teeth" pointing up are described as sharp.

the breakage of grain kernels during roller milling and found that different dispositions produce different particle size distributions. Figure 2 (above) shows the roller dispositions that were investigated. It illustrates four different scenarios in which the surface characteristics and the working angles of the texture of the roller surfaces are different. Because of these differences, the forces acting on the grain are different in terms of direction, magnitude and shear-force intensity, and so the grain is crushed differently. In the S-S (sharp to sharp) disposition scenario, grain husk and endosperm break together resulting in a broad and relatively even distribution of particle sizes. The grain husk is not left intact. In the D-D (dull to dull) disposition scenario, the force transmitted by the mill rollers to the grain is primarily compressive, which causes disintegration of the fragile endosperm while leaving the grain husk relatively intact.

This results in a U-shaped particle size distribution, with many small (endosperm) and large (husk) particles, but few in the midsize range. The particle size distributions resulting from the mixed dispositions (S-D and D-S) lie between these extremes. The differences in particle size distribution clearly show the importance of mill roller roughness and disposition on the quality of the crushed grain.

Practical considerations

You can determine the quality of your crushed grain by visually examining the grain discharged from your mill. Ideally you should see few or no uncrushed kernels, and have the majority of the kernels broken into two to four pieces with only a very minimal amount of flour. As a rule of thumb, having approximately 70% (by weight) of crushed grain retained on a #14 sieve is a good crush.

If your grain looks like it is crushed too finely, or if you get high extract efficiencies, but experience stuck mashes and astringent beers, you have several options. You can widen your mill gap setting or slow down the speed of the mill rollers, either by cranking more slowly (in the case of a hand-cranked mill) or by manually "throttling" the speed of drill. Ideally, you can motorize your grain mill with a motor and a system of sheaves to run at an optimal speed (for homerew-sized roller mills) of 150–200 rpm, as opposed to the over 1,500 rpm that most drills run at. Construction details are explained in the online article at: http://www.byo.com/component/resource/article/1171-motorize-your-grain-mill-projects

If your grain looks like it is not crushed enough, or if you get lower than desired extract efficiencies, you can crush more finely by doing the following — adjusting your mill to a smaller gap setting or increasing the speed of the mill rollers. You can also mill the grain a second or third time.

In general, ensure that the mill roller surfaces are clean and dry before milling. Use a spark plug gap gauge to ensure that the gap between the mill rollers is uniform along the full length of the rollers.

Be sure that the grain being fed into the mill is entering the mill roller gap constantly, and that the grain is spread across the whole length of the rollers as much as possible.

Some commercial breweries condition (wet) their grains slightly immediately before milling to yield smaller starch particles but larger husk particles. See the March-April 2010 issue of *BYO* for how to do this at home.

Properly milled grains are very important to the quality of your finished beer. Take the time to run some trials in which you vary your mill gap and roller speed. "Sacrificing" a little grain in this way will allow you get a better crush, allowing for better extract efficiency, easier run off and no astringency. BYO

Heated Mash Tun

Build an internally heated mash tun

by Walter Diaz

Mashing is one of the most defining steps of the brewing process. This step will define the fermentability of your wort and affect mouthfeel, flavor and even head retention of your beers. This was the reason why I started looking for precise and accurate mashing equipment.

My first attempt to control my mash temperature was done by direct flame heated mash, but I found that it often had hot spots and temperature overshoots. It also needed constant attention. The typical ice chest is an easy and tempting route but I like to be able to execute temperature program mashes if I need to, and don't like to have to dilute the enzymes with water by hot water additions as I feel that in itself is a source for variability. I looked into brewing using a re-circulated infusion mash (RIMS). However, I could never get comfortable with the idea of pumping hot wort around for a whole hour or more. Under the stress of a centrifugal pump, I believe any oxygen in solution will react to oxidize the wort. Also, mashing enzymes are much more heat sensitive in a thin mash, and that is exactly the kind of environment that enzymes are exposed to when wort is being re-circulated through a heater element outside of the mash tun. At that point I moved on from RIMS and this eventually led me to the mash system that I am about to describe.

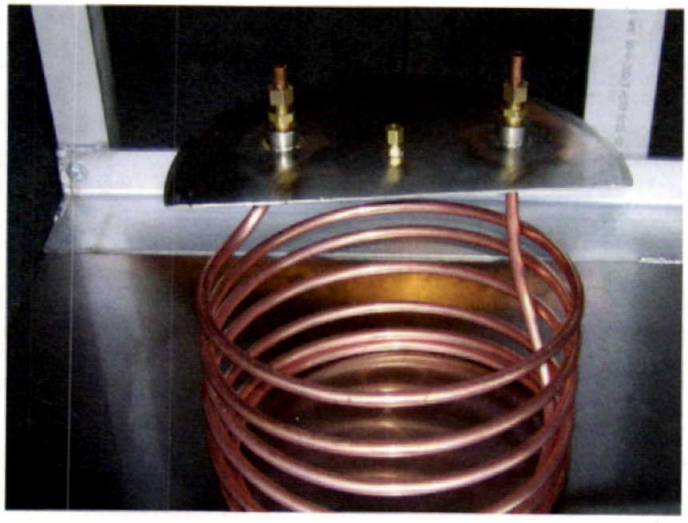
I built a coil-heated mash tun that closely resembles the mechanism of mash mixing vessels that professional brewers normally use. This system uses a large copper coil heater, evenly distributed throughout the inside wall of the mash tun. Hot water from a regular hot liquor tank (HLT) is pump re-circulated through this coil and back to the HLT. This process is regulated by a PID temperature controller that turns the recirculation pump on/off as the heat is demanded by the controller to keep a repeatable temperature within 1 °F (0.5 °C). A heater coil throughout the mash tun at a low temperature differential provides gentle heating to the content of the mash tun, while at the same time being capable of executing a temperature program mash adding heat at a controlled rate of 2 °F (1 °C) per minute.

Editor's note: This project requires electrical wiring. Do not attempt electrical wiring projects unless you are experienced with electrical wiring as mistakes can cause serious physical harm. Ask a licensed electrician to help you if you are not comfortable with electrical wiring.

> "I built a coil-heated mash tun that closely resembles the mechanism of mash mixing vessels that professional brewers normally use."

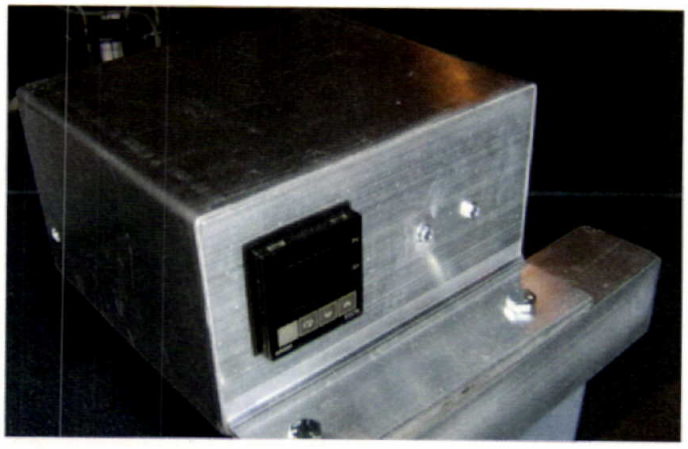
Parts & Equipment List

- 20 feet copper coil (or enough to provide full coverage of your mash)
- Mash tun equipped with false bottom and drain valve
- Two ⅜ NPT by ⅜ compression fittings
- One ⅛ NPT by 3/16 compression fitting
- Six feet (or shorter) grounded electrical extension cord
- PID temperature controller
- Thermocouple probe 3/16 sheath size by 12-inch (30 cm) long to match input signal for PID controller (in this case type J thermocouple)
- One solid state relay (SSR) at least 4 amps, assuming your pump pulls less than 2 amps
- Recirculation pump suitable for hot water
- 10 feet (± depending on the layout of your set up) of silicone high temperature hose



1. CREATE THE HEATER COIL

Create the heater coil and secure it onto the lid of the mash tun for top entry. To secure the coil ends to the lid I used ⅜ NPT by ⅜ tube adapters. For the lid, I recommend leaving at least half-open spacing for you to be able to hand mix the mash when going up in temperature for a step mash. I also found it easy to secure the thermocouple on the center of the mash lid using a ⅛ NPT by ⅜ tube adapter.



2. ATTACH THE PID CONTROLLER

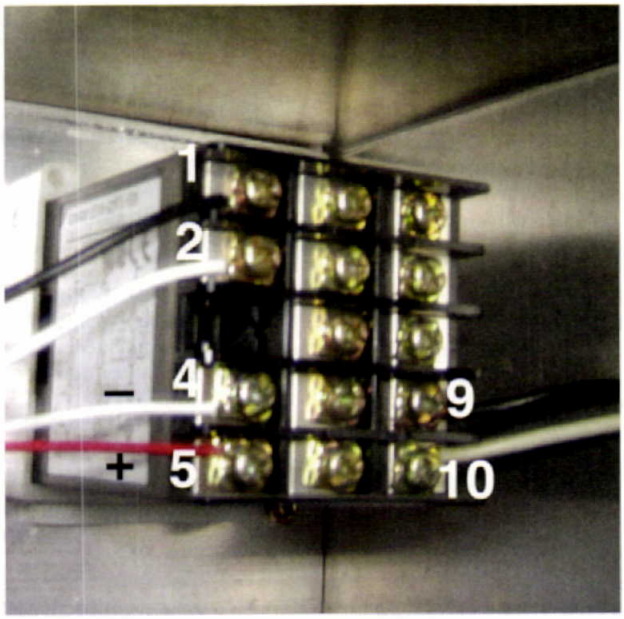
Attach PID controller and SSR to the mounting panel. I built mine using a 5-inch (13-cm) piece of aluminum framing material and sheet metal. An easier and more elegant option is to buy the appropriate box for a ⅛ DIN controller off the shelves. I have seen them online for around $28.

3. PREPARE

Prepare extension cord to power recirculation pump by installing slip connectors. These slip connector ends attach to the output side of the SSR (right side terminals in SSR image). The electrical extension cord connects to the wall power outlet on one side and to the recirculation water pump on the other. The electrical connections from slip connectors to SSR must be properly secured inside of the PID enclosure. Also, if the PID enclosure is made out of metal the equipment ground from the extension cord must be attached to the metal housing. This can be done with a grounding bus, or a pigtail to a grounding bolt.

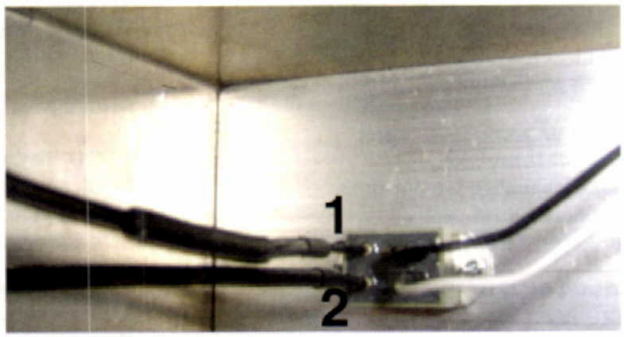
4. CONNECT THE THERMOCOUPLE

This figure shows the wiring for the particular PID controller that I am using (Omron E5CN). Connect the thermocouple to input side of PID controller (terminals #4 and 5 in photo). Connect 110-volt power to PID controller (terminals #9 and 10). Connect output terminals of PID controller to input side of SSR (terminals #1 and 2).



5. WIRE THE SOLID STATE RELAY

Connect the output terminals of PID controller (terminals #1 and 2 from PID) to the input side of SSR (black and white wires on the right side). Connect the slip connectors from power extension cord to pump to left side terminals of SSR (output side).



6. CONNECT THE SYSTEM AND TEST

Measure and cut the length of silicon hoses necessary for hot water recirculation loop. The drain valve of the HLT connects to the inlet side of the water pump. Attach the outlet side of the water pump to one side of the copper heating coil in the mash and connect the other side of the coil to return water to the HLT to be re-heated. Before brewing an actual batch of beer, test the system with water to familiarize yourself with its use. The owners manual of your PID explains how to set up the unit, however, the most important thing is to make sure that the PID is set up for the correct temperature probe. You also have to make sure that the temperature range in your PID's settings covers the temperature you plan to use.

As a final note, this system takes hot water from HLT (hot liquor tank) and pumps it through a copper coil placed inside of the mash tun to add heat for a constant temperature or step mash. The pump is controlled by the PID so it will only run to add enough heat to the mash with little to no overshoot. The HLT does not need to be regulated but it must be higher than the desired mash temperature. BYO

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Take Your Medicine

Drink to good health

Olan Suddeth • Birmingham, Alabama

I have recently doubled my alcohol intake — doctor's orders. Not long ago I decided to address my life insurance situation, which required a routine health screening. "No sweat," I thought; after all, I have been the picture of health for the first thirty-six years of life. Sure, I could stand to lose fifteen or so pounds, and yes, I could stand to be more active, but I had no reason to suspect that I would get anything but good news.

Suffice it to say that I was less than pleased when my blood test results came back with elevated triglicerides and almost nonexistent HDL (aka "good" cholesterol). The life insurance company I was working with responded to the news by promptly tripling the rate they had quoted me, so I reluctantly set up an appointment with an actual internal medicine doctor (my normal level of medical interaction is a visit to the "doc-in-the-box" if I simply have no other choice).

I did some homework on cholesterol ahead of the appointment and was prepared to meet the doc. We went over my numbers (he of course took his own blood samples), and I expressed a desire to avoid taking medication, if possible. He informed me that it was good that I felt that way, as cholesterol medications are used to lower "bad" cholesterol — they currently do not help to raise the "good" HDL number. We talked about the lifestyle changes I had already put into place — some jogging and lifting light weights, as well as adding more fiber to my diet (in the form of daily oatmeal, bananas or apples and "heart healthy" nuts), some reduction of my junk food calories, and addition of fish oil supplements — all with an eye towards shedding those pounds.

All of the changes I had put in place were great, he told me — I was doing absolutely everything that he would recommend. However, he let me know, there are only two real ways to raise HDL levels — exercise and alcohol.

We then had a talk about my beer consumption, specifically the fact that I typically only drank a few beers per week. I asked him about the amount of beer that I should drink to get my numbers up. To gain the benefit to my HDL, he told me, I would really need to drink at least three to four beers per week . . . but he would prefer that I not go over one drink per day.

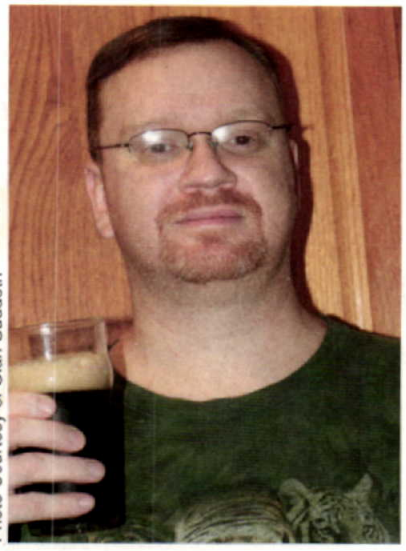
As a result, I've *reluctantly* forced myself to enjoy twice as much beer as I once did — I now make sure I always hit that four drinks per week level, whereas as a busy dad of six children I sometimes did not. It's been a great excuse to homebrew more, but when there's no homebrew around my wife has been supremely supportive; she's picked me up mixed six packs of craft beers on several occasions, and has made sure that I always keep beer in the fridge.

I have of course used the excuse to annoy my teenaged daughter by adopting a horrible redneck accent and informing her from time to time when I open a bottle of beer that it's "time for mah medication." This irritates her severely . . . which to me is a sign of effective parenting. It's even better when my wife points out to her that since the beer is good for my heart at moderate levels, it is medicinal. I love that woman.

At any rate, I've been on this regimen for six weeks or so, and in another six weeks, I'll head back to the doctor to see if I've made any progress. In the meatime, I'll continue to homebrew for my health and enjoy that medicinal beer. BYO

Editor's Note: excerpted from Olan's blog: www.homebrewdad.com

> "I've *reluctantly* forced myself to enjoy twice as much beer as I once did . . ."



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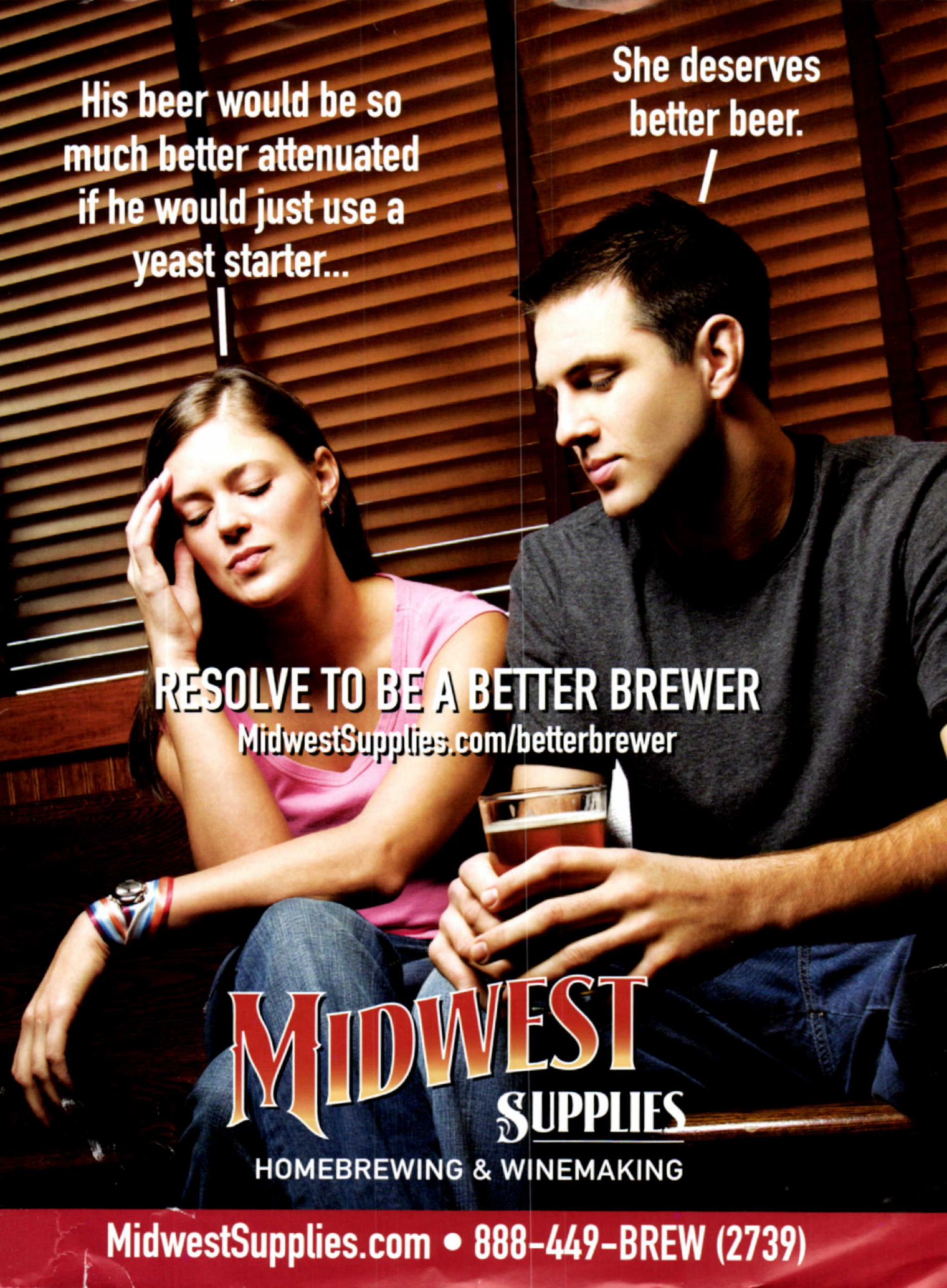
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