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THE HOW-TO HOMEBREW BEER MAGAZINE

MAY-JUNE 2015, VOL. 21, NO. 3

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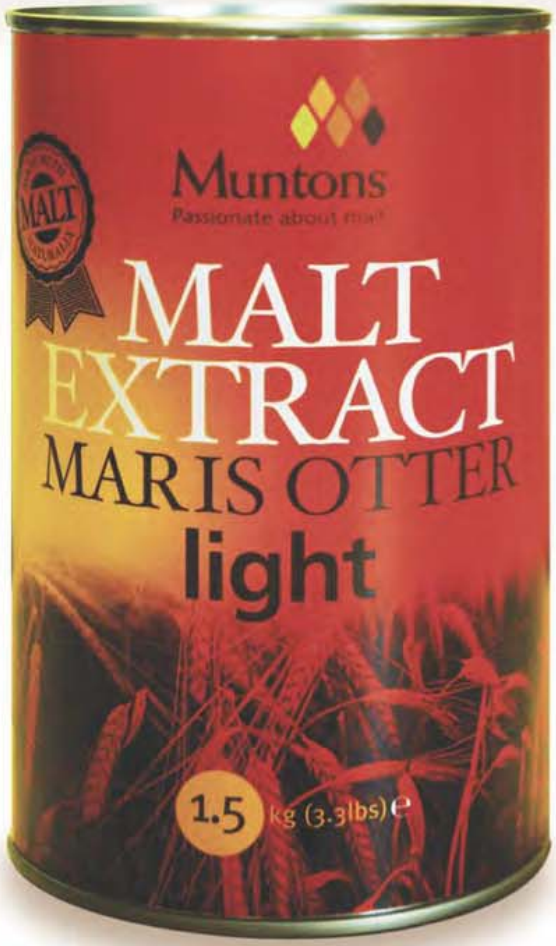

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Dr Bell bred *Maris Otter* barley from a cross of *Proctor* and *Pioneer* - two top quality traditional malting barley varieties. To this day, *Maris Otter* seed is only sold to a select group of farmers who are specially chosen to grow the variety.

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Find out more from Terry McNeill email: sales@muntons-inc.com
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contents

MAY-JUNE 2015, VOL. 21 NO. 3

features

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Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

departments

where to find it

RECIPE INDEX

RECIPE STANDARDIZATION

EXTRACT EFFICIENCY: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one US 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. For post-boil hop stands, we calculate IBUs based on 10% hop utilization for 30-minute hop stands at specific gravities less than 1.050.

Gallons:
We use US gallons whenever gallons are mentioned.

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Barrel Aging: Tips from the Pros

Want even more great advice on barrel aging your homebrew? Ask the pros! Check this link out for tips from the brewers of Oakshire Brewing, Sun King Brewing, and Three Brothers Brewing, all of whom won medals for their barrel-aged brews at the Great American Beer Festival:
http://byo.com/story2956

Bohemian Pilsner: Style Profile

The Czech pale lager featured in "Style Profile" on page 30 of this issue is considered a session version of the more globally available style Bohemian Pilsner, featured in this article:
http://byo.com/story247

Beer and Cheese

A glass of good beer, a chunk of fine cheese … it's the ultimate pub-food partnership. Here's a complete guide to pairing beer and cheese, from throwing a tasting party for your friends to cooking a tasty meal with cheese and homebrew as the star ingredients.
http://byo.com/story187

Sour Mashing: Techniques

Do you like beers with a little tart twinge to them? Or would you like to acidify your mash without adding calcium? If so, you may want to think about sour mashing — the other sour brewing technique.
http://byo.com/story1691

Brew Your Own — THE HOW-TO HOMEBREW BEER MAGAZINE

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Volume 21, Number 3: May-June 2015

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MAIL

TERRY FOSTER'S PORTERS & STOUTS

Tell Terry Foster I just tapped my oatmeal stout #homebrew inspired from reading his latest book. (see photo, left)

Sean "@Chillindamos" • *San Diego, California (via Twitter)*

Brew Your Own *Editor Betsy Parks replies: "Sean, thanks for the photo! Everyone at the* Brew Your Own *office has been enjoying Terry's new book,* Brewing Porters & Stouts *(Skyhorse Publishing, 2015) since it landed on my desk a few weeks ago. Of course I am a longtime fan of Terry's writing (and having met him in person I can say that he's also an extremely nice guy) so it's great to have a new collection of his writing for the reference library. For anyone else who hasn't had a chance to read Terry's book, Skyhorse Publishing has generously allowed* BYO *to print an excerpt, which you can find in this issue, starting on page 42. There can never be too many porters and stouts, I say!*

AWESOME IPA

Awesome IPA article by @bearflavored in @BrewYourOwn magazine

Brendan Palfreyman "@bpalfrey10" • *Syracuse, New York (via Twitter)*

Brew Your Own *Editor Betsy Parks replies: "Brendan, glad you enjoyed 'Award Winning IPA' in the March-April issue of* BYO. *I think the author, Derek Dellinger (@bearflavored on Twitter), did a great job, too! What many readers probably don't know is that Derek managed to eek out that story while also working on opening a commercial brewery — a task not known for affording much free time. In early March 2015, Derek announced on his blog (http://www.bear-flavored.com) that he is officially going to be the brewmaster at Kent Falls Brewing Company in Kent, Connecticut (http://www.kentfallsbrewing.com). It will be the first 'farm brewery' in Connecticut. I recommend following Derek at his Twitter handle as he regularly posts blogs and photos with brewery progress."*

Christian Lavender is an Austin, Texas area homebrewer and the founder of HomeBrewing.com, a website that helps brewers find the best prices on homebrewing kits and homebrew supplies, as well as new and refurbished wooden oak homebrew barrels. He also runs Kegerators.com, a website for those looking for home draft equipment. You can ask him questions at the site's "ask an expert" section.

In this issue, beginning on page 50, Christian explores the world of brewing with oak barrels and oak barrel alternatives. From sourcing barrels, to prepping them for use, to storing and maintaining, Christian covers everything you need to know about oak and beer — including some tips from two Austin, Texas pro brewers. Plus, check out five commercial oak-aged beer clone recipes.

Brad Smith is the author of BeerSmith homebrewing software and host of the BeerSmith podcast on iTunes. Brad has been brewing for 26 years, is author of the book *Home Brewing with BeerSmith* (http://beersmith.com) and also created BrewWiki.com, the BeerXML beer recipe standard. Brad maintains a blog at BeerSmith.com which includes topics such as brewing tutorials, homebrewing techniques, product and book reviews, articles on brewing popular beer styles and brewing news. He also regularly speaks at beer-related events, writes on homebrewing, and is a frequent contributor to *Brew Your Own*.

In this issue, on page 76, Brad discusses adding fermentable sugars to your finished beer to create carbonation — aka priming. Find out how much sugar to add to your homebrew to get the best bubbles.

Gordon Strong is the President and highest ranking judge of the Beer Judge Certification Program (BJCP), the organization that certifies beer judges for homebrew competitions and also registers qualifying homebrew competitions. In addition to his Grand Master Level V judge status, Gordon is a three-time winner of the National Homebrew Competition Ninkasi Award and the author of *Brewing Better Beer: Master Lessons for Advanced Homebrewers* (Brewers Publications, 2011). He frequently contributes to *Brew Your Own*.

In this issue, on page 30, Gordon makes his debut as *BYO*'s new "Style Profile" columnist.

MAIL

PEDIOCOCCUS STARTER

I have a question about an article from back in 1997 ("Lambic: Brewing with Bacteria"), which says to pitch a *Pediococcus* starter. How would I make that starter (pH, temperature, etc.)

Per Karlsson • *via Facebook*

Brew Your Own *Editorial Reviewer Michael Dawson (of Wyeast) replies: "Hi, Per. Making a* Pedio *starter is similar to how you would make a starter for any other yeast strain. I would suggest 1.040 S.G. wort, incubating at 80–90 °F/27–32 °C (or on the warm end of the manufacturer specs — that would be for Wyeast 5733), without agitation. A pH drop would be the best indicator of when it's ready, probably about 48–96 hours. I've read that the optimal pH for* Pedio *is 5.5, but for propagating in a starter that would be used immediately I'm not sure the acidity of the culture would reach a level that would inhibit growth within that timeframe."*

ELECTRIC BREWING

It seems there are more and more electric brewing systems almost every month. Is there a good way to differentiate between them and see which one might best meet your needs?

Jeff Renz • *Hilliard, Ohio*

Brew Your Own *Editorial Reviewer Kal Wallner (of The Electric Brewery — http://theelectricbrewery.com) replies: "Hi, Jeff. When it comes to electric setups, there is most certainly a large selection available. Possibilities are also endless if you build your own. Setups range from completely manual with a single switch to turn a heating element on and off, to custom computerized touchscreen setups that are completely automated: Push a button and wort comes out. What you choose to use yourself depends on how you wish to brew, what sort of control you want to impose on the process, and how much you want to leave to a computer. You need to decide on your level of control and your brew process before any equipment is built or purchased. The process needs to be looked at as a complete functioning system that works together, instead of 100 parts and trying to pick the best of each. Doing so will not result in a setup that works well together.*

I get asked all the time what electric brewing setup or control panel is right for someone and that's an impossible question to answer as everyone's needs are different. To help brewers answer that question I've put together some information on the thought process I went through a few years ago when designing my own control panel. I considered all options from discrete PID temperature controllers to more automated or specialized control systems with computer based touchscreens, or embedded controllers. I documented it here: http://www.theelectricbrewery.com/forum/viewtopic.php?t=25382." BYO

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READER PROFILE & RECIPE

BREWER:
William Gardner

HOMETOWN/STATE:
Hoosick Falls, New York

YEARS BREWING:
5

TYPE OF BREWER:
All-grain

HOMEBREW SETUP (VOLUME, STYLE, EFFICIENCY):
12 Gallon (45 L), All-grain, 75% efficiency

CURRENTLY FERMENTING:
Single Hop Mosaic™

WHAT'S ON TAP/IN THE FRIDGE:
Cession Citra® IPA, Summer Thyme Saison

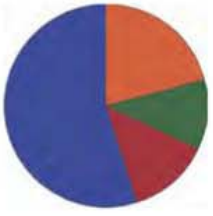
How I started brewing: I started with an extract kit and progressed to all-grain over the span of about a year. I am currently a part-time brewer at Madison Brewing Co. in Bennington, Vermont and develop all the hoppy and seasonal recipes for them, including the HopBack IPA, which is now a year-round offering. I also own my own hop growing business, Hop Ridge Farms, where we have 500 hills and grow seven different varieties. I brew professionally about two times per week and try to homebrew at least twice a month.

A little about the recipe I'm sharing: My wife and I have a large herb garden at our home and decided to plant lemon thyme. During the second year of growth I noticed how robust the lemon thyme had grown and picked off a piece to try. It was incredible with a huge lemon aroma and flavor. My mind instantly went to saison and Sorachi Ace hops! I developed a recipe and it was a hit right from the start. I even decided to dry hop with the lemon thyme and Sorachi Ace hops for added aroma and complexity. The result is a crisp, aromatic beer with the classic saison taste. The lemon thyme and Sorachi Ace hops lend a nice earthy and lemony component. A great beer for summer or harvest time.

My blog/website: www.hopridgefarms.com, www.madisonbrewingco.com

BYO.COM BREW POLLS

Do you try to pair the beer and food you serve?



21% Yes, frequently
11% Only on special occasions
13% I haven't, but I'd like to learn how
55% I drink beer I like, eat food I like, and don't worry about pairing them

Visit byo.com to participate in our monthly poll question

Lemon Thyme Saison

(5 gallons/19 L, all-grain)
OG = 1.048 FG = 1.002
IBU = 24 SRM = 6 ABV = 6.1%

INGREDIENTS

7 lbs. (3.2 kg) Pilsner 2-row malt
0.5 lb. (0.23 kg) caramel malt (60 °L)
0.5 lb. (0.23 kg) flaked oats
0.5 lb. (0.23 kg) white wheat malt
6 AAU Sorachi Ace hops (15 min.) (0.5 oz./14 g at 12% alpha acids)
6 AAU Sorachi Ace hops (10 min.) (0.5 oz./14 g at 12% alpha acids)
6 AAU Sorachi Ace hops (5 min.) (0.5 oz./14 g at 12% alpha acids)
0.5 oz. (14 g) Sorachi Ace hops (0 min.)
1 oz. (28 g) Sorachi Ace hops (dry hop)
1.5 tsp fresh ground pepper (5 min.)
1 lb. (0.45 kg) orange blossom honey (5 min.)
3 oz. (85 g) fresh lemon thyme (0 min.)
3 oz. (85 g) fresh lemon thyme (secondary)
Wyeast 3711 (French Saison) or Lallemand Belle Saison
1 cup corn sugar (if priming)

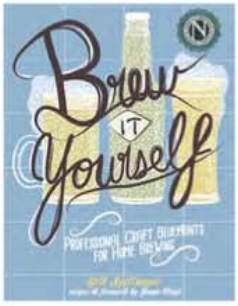
STEP BY STEP

Follow your normal mash in calculations for your equipment. You want your mash to come to a rest at around 150 °F (66 °C). Follow the hop schedule above and add the pepper and honey at 5 minutes left in the boil and the lemon thyme at flame out. You may want to consider putting the lemon thyme in a muslin bag. It is OK to use the entire branch (sprigs) with the small leaves still attached, just make sure to rinse thoroughly. Let steep for 30 to 45 minutes and then cool the wort to 67 °F (19 °C) and pitch the yeast.

Ferment at 67 °F (19 °C). After you reach your final gravity (will be quick as the 3711 works fast!) rack to secondary and dry hop with the Sorachi Ace and lemon thyme. You may want to consider soaking the lemon thyme in a small amount of vodka to make sure it's sterile. Dry hop for five days and then bottle or keg.

BYO WHAT'S NEW?

BREW IT YOURSELF: PROFESSIONAL CRAFT BLUEPRINTS FOR HOME BREWING



Erik Spellmeyer, a former cellarman of Ninkasi Brewing and longtime craft beer enthusiast, outlines the key methodologies of all-grain and extract brewing in his new book *Brew it Yourself: Professional Craft Blueprints for Home Brewing*. Spellmeyer provides professional advice on how to get started, introducing readers to industry jargon and terminology, while giving clear instruction on the formalities of homebrewing. Equipped with illustrations, images, a glossary, photographs, and step-by-step assembly instructions for building your own equipment, this is an all-in-one guide to getting started, no matter your brewing knowledge. Available at major booksellers.

BREW BETTER BEER

Brew Better Beer builds a foundation for readers to learn the core styles and the flavors and ingredients that pair best with those beer styles. Author Emma Christensen shares the secrets of thinking like a brewer in this building-block approach covering basic recipes for each style of beer that allow homebrewers to become "fluent" in brewing beer and to create their own signature variations. With small 1-gallon (4-L) batches perfect for experimentation, plus 5-gallon (19-L) instructions, this book includes traditional recipes as well as other recipes such as kombucha sour ale, Finnish juniper rye sahti ale, and farmer's market gruit. Available at major booksellers.

KIT LAB

Kit Lab is a new marketplace that makes it easy to support your favorite brewers by buying ingredient kits of their latest homebrew recipes. Each order you place gets packed fresh and a portion of the sale goes to the brewer — the perfect way to say "thanks!" for all the great recipes they've posted over the years. Kit Lab will even tell you when your favorite authors publish new recipes so you'll be first in line to check out their latest work. And if you're the type of brewer that already shares your recipes online, you might enjoy becoming a Kit Lab author too! Everyone is welcome to go join the mad scientists in the lab. Visit kitlab.co before May 2 to consider backing their Kickstarter campaign.

KIT LAB

7 CALENDAR

MAY 3

NEW ENGLAND PRO-AM BEER FESTIVAL

Brattleboro, Vermont

The Brattleboro Eagles Aerie Post #2445 is hosting the region's first annual New England Pro- Am Beer Festival on May 16. This festival will give homebrewers an opportunity to see how their brew stacks up against other homebrewers in this AHA/BJCP sanctioned competition based on the 2008 BJCP guidelines. Entries will be judged by a panel of certified judges. The Pro-Am portion also pits 20 homebrewers against five local microbrewers for a Best of Show award, decided by the general public. The entry fee is $5 per entry and the deadline to enter is May 3. www.newenglandproambeerfestival.com

MAY 16

8 SECONDS OF FROTH

Cheyenne, Wyoming

The High Plains Drafters homebrew club is hosting their 21st annual homebrew competition on May 30. Last year the competition attracted over 300 entries. The deadline to enter is May 16. Beautiful wooden trophies will be awarded to the top brewers and there will also be a Pro-Am component. Local clubs will compete in the Ace of Clubs competition within the competition, where the club awarded the most points based on entries and medals brings home the trophy and bragging rights. www.highplainsdrafters.com/8-seconds-of-froth/

JUNE 19

BECAUSE BEER HOMEBREW COMPETITION

Hamilton, Ontario

Part of the Because Beer Craft Beer Festival (which brought more than 3,000 people and 30 craft brewers to Pier 4 Park in Hamilton last year) is the homebrew competition that drew over 300 entries from across North America last summer. This year's entry deadline is June 19 and the medal winners will be announced at a ceremony during the festival from July 10-11. Prizes will be awarded and the top three beers in each category will receive medals. The festival will also feature a specialty cask ale session, music and a group of expert guest speakers. The competition entry fee is $7 for the first entry and $6 per subsequent entries. www.becausebeer.ca/competition/

BY DAWSON RASPUZZI

COOK WITH MALT EXTRACT

In addition to the purpose we know it best for — making beer — malt extract can be a tremendous ingredient to keep on hand in the kitchen. Next time you find yourself with leftover extract after brewday, give it a try as a natural replacement for sugar or an addition to a recipe to add new flavor, enhance other flavors, improve texture and mouthfeel, and bring more color to your culinary masterpiece.

The opportunity to add extract, whether liquid malt extract (LME) or dried malt extract (DME), is nearly limitless — from breads to meats, soups to sauces, or to enhance something on the sweeter side like milkshakes and cheesecakes.

In addition to adding a sweetness and malty flavor, malt extract is used in many chef's kitchens for its other benefits. According to Richard Platt, Applications and NPD Technologist for Muntons, adding a little malt extract to a recipe will help with the texture of foods — tenderizing meats, improving crumb texture, making cakes softer and lighter and giving cookies more of a snap and crunch. And when it comes to flavor, extract does more than just add it to your recipe — it also rounds out and enhances other flavors, he says. In a beef and vegetable soup, for instance, a tablespoon of extract can bring out the flavors of the carrots and onions that may otherwise get left to pasture.

If using extract as a sweet alternative to sugar, try replacing about half of the sugar called for in the recipe with an equal amount of dried malt extract. Or, feel free to use liquid malt extract, but in that case it is best to reduce an equal amount of water or other liquid called for in the recipe. Using a darker extract will result in more of a malty and roasted flavor, as well as a darker product — which can be appealing in fresh breads or muffins! A word of warning, you may need to keep an eye on the oven or stove when doing an unscripted extract substitution as these products will cook and brown a lot quicker.

When using DME, Platt recommends mixing it with the dry ingredients before adding it to the recipe because it is a hygroscopic ingredient (meaning if it is not pre-mixed it will absorb water rapidly when added by itself, resulting in clumps of malt balls). LME can be added at the same time as the other liquid ingredients.

Usually, unhopped malt extract is what is used to cook with — however there are recipes that can be enhanced with a little bitterness and hop flavor. Muntons has done a lot of experiments with both dried and liquid hopped extracts in foods and Platt said he appreciates these extracts when looking to achieve a beer style flavor without adding beer, or to boost hoppy notes in recipes that do call for beer. "Normally when including beer in baked goods you lose much of the flavor volatiles, so hopped extracts top up the flavor beautifully," he said.

Got your culinary interests piqued but still unsure of what to cook? Try this three-course meal provided by Muntons that starts with a simple malted salad, then serve up your main course of gastro style beef burgers (pictured to the left), and to finish it off how about a quadruple malted cheesecake? http://byo.com/story2330

BYO REPLICATOR

BY MARC MARTIN

DEAR REPLICATOR, I have to say that my experience with farmhouse style beers had not been good. I'm more of a pale ale, IPA guy. That all changed when my brewing buddy brought back a growler of Rockford Country Ale from Rockford Brewing Company in Rockford, Michigan. He raved about it and I found out why. It is one of the best overall beers I have ever had. It's not sold here in Indiana and my buddy says he's not driving back to Rockford for more. I'm hoping you can give us an idea of how to reconstruct a 5-gallon (19-L) batch. Also, thank you for all you and the rest of the writers at *Brew Your Own* do; your magazine has been a big help making our homebrews better.

Jim Broder
Indianapolis, Indiana

Jim, I really have to thank you for this request. It allowed me to reconnect with an old friend that I hadn't talked to in many years. My call to the brewery was answered by Rockford Brewing Company (RBC) Co-owner and Brewmaster Jeff Sheehan. While traveling on business with my former corporate job I had met Jeff in Pocatello, Idaho in 2004. He had been attending Idaho State University planning to graduate with a geology degree. His only previous brewing experience had been with a Mr. Beer kit a few years earlier. At that time, the owner of Portneuf Valley Brewpub, Penny Pink, was in need of an assistant brewer and Jeff took the job. Jeff still holds a great appreciation for Penny and credits her for hiring him and setting him on the path to his brewing career.

Their system was only three barrels, but it gave him plenty of opportunity to learn brewing and to dabble in many different beer styles. Every time I was in Pocatello I would stop by the brewery and sit and sample his latest brews. Many times I would bring one of my homebrews and we would discuss the style.

By 2007 Jeff and his wife Amy decided that it was time to get back to their home state of Michigan. Having developed a real passion for brewing he sought a job with any brewery that was hiring. Fortunately, there was an opening at New Holland Brewing Co. in their production facility. Through perseverance and hard work Jeff eventually advanced to be their Lead Brewer at their Pub Brewery. There he was really able to show his skills brewing on their 10-barrel system. Jeff wanted me to give recognition to John Haggerty, New Holland's Brewmaster at that time, for further development of his brewing knowledge.

Talks of opening his own small brewery began during his first year at New Holland and in January 2011 he resigned to do just that. At that time the city manager of Rockford informed him that another person had also been inquiring about the same possibility. Seth Rivard, an IT specialist of 13 years, met with Jeff and the two decided to partner. Soon a business plan was being developed. In 2011 a suitable building was located downtown and, many difficult renovations later, a brewpub was born.

In December 2012, Jeff and Seth opened the doors of RBC with the concept of incorporating the natural world around the brewery into their establishment and products. The pub sports a bar top made of Michigan curly maple and a giant window allowing for views into the brewery. More huge windows on the second floor allow a 360-degree view of downtown, the surrounding woods, and river. "We want to promote a healthy, outdoor lifestyle and being right in between the Rogue River and the White Pine Trail State Park does just that," said Jeff. Future expansion is planned with a full kitchen and a rooftop patio for watching the salmon swim up the river.

Jeff, along with another brewer and a cellarman, produce all of the beers on a 7-barrel system made by Metalcraft Fabrication of Portland, Oregon. A big focus of recipe development is the use of local ingredients. A good example of that is the Michigan beet sugar used in this article's featured beer. Production in 2014 was 1,000 barrels, and an increase to 1,250 is scheduled for this year. Distribution is limited to kegs, and their beers are only available in Michigan. Currently, 80% of their beer is sold right at the pub. They have experimented with some hand bottling of special beers in 750 mL corked and caged bottles, but further bottling or canning is not planned for the immediate future.

To support the local homebrewing community they team up with one of the local homebrew shops in Grand Rapids, O'Connor's Home Brew Supply, to conduct an annual competition. Last year there were over 200 entries. The winner gets to brew his/her recipe on the RBC 7-barrel system. The beer is then served during a special beer release night at the brewery.

Jeff talked about Rockford Country Ale and offered some brewing tips. He says that this recipe was designed as a cross between a bière de garde and a saison. It most closely resembles a French farmhouse ale. The idea was to focus more on a complex malt bill with just enough hops to offset any residual sweetness. A low temperature, thin mash ensures a spicy, crisp, dry finish with some fruity esters and herbal, grass-like notes. The finished, unfiltered beer has a bright, golden-colored body with a dense, creamy head. Jeff recommends a long, low temperature fermentation to allow the yeast to fully develop the flavors.

Jim, your brewing buddy won't have to drive to Michigan for more Country Ale because now you can "Brew Your Own." For more information about Rockford Brewing Company and their other fine beers visit them on the web at www.rockfordbrewing.com.

ROCKFORD BREWING CO.'S ROCKFORD COUNTRY ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.058 FG = 1.007
IBU = 28 SRM = 7 ABV = 6.8%

INGREDIENTS

9.5 lbs. (4.3 kg) 2-row pale malt
9 oz. (0.25 kg) Munich malt
6 oz. (0.17 kg) white wheat malt
4 oz. (0.11 kg) Caravienne malt (20 °L)
4 oz. (0.11 kg) Victory® malt
3 oz. (85 g) Carapils® malt
9.2 oz. (0.26 kg) beet sugar (10 min.)
5.33 AAU Brewers Gold hop pellets (60 min.) (0.75 oz./21 g at 7.1% alpha acids)
2 AAU Hallertau hop pellets (30 min.) (0.5 oz./14 g at 4% alpha acids)
1 AAU Hallertau hop pellets (10 min.) (0.25 oz./7 g at 4% alpha acids)
½ tsp. Irish moss (30 min.)
½ tsp. yeast nutrient (15 min.)
White Labs WLP566 (Belgian Saison II) or Wyeast 3711 (French Saison) or Lallemand Belle Saison yeast
¾ cup of corn sugar (if priming)

STEP BY STEP

This is a single step infusion mash. Mix all of the crushed grains with 4.9 gallons (18.5 L) of 168 °F (76 °C) water to stabilize at 148 °F (64 °C). This is a medium-thin mash using 1.4 quarts (1.3 L) of strike water per pound of grain. This is designed to help achieve maximum fermentability. Mash for 60 minutes then slowly sparge with 175 °F (79 °C) water.

Collect approximately 6.2 gallons (23.5 L) of wort runoff to boil for 60 minutes. While boiling, add the hops, Irish moss and yeast nutrient and beet sugar as per the schedule.

Cool the wort to 75 °F (24 °C) and transfer to your fermenter. Pitch the yeast and aerate the wort heavily. Allow the beer to cool to 66 °F (19 °C). Hold at that temperature until fermentation is complete. This may take 10–14 days. Gently transfer to a carboy, avoiding any splashing to prevent aerating the beer. Allow the beer to condition for an additional week. Prime and bottle condition or keg and force carbonate to 2.7 volumes CO_2. Allow the beer to age for two more weeks to fully develop the flavors.

ROCKFORD BREWING CO.'S ROCKFORD COUNTRY ALE CLONE

(5 gallons/19 L, partial mash)
OG = 1.058 FG = 1.007
IBU = 28 SRM = 7 ABV = 6.8 %

INGREDIENTS

3.3 lbs. (1.5 kg) Briess light, unhopped malt extract
2 lbs. (0.9 kg) light, dried malt extract
1 lb. (0.45 kg) 2-row pale malt
9 oz. (0.25 kg) Munich malt
6 oz. (0.17 kg) white wheat malt
4 oz. (0.11 kg) Caravienne malt (20 °L)
4 oz. (0.11 kg) Victory® malt
3 oz. (85 g) Carapils® malt
9.2 oz. (0.26 kg) beet sugar (10 min.)
7.1 AAU Brewers Gold hop pellets (60 min.) (1 oz./28 g at 7.1% alpha acids)
2 AAU Hallertau hop pellets (30 min.) (0.5 oz./14 g at 4% alpha acids)
1 AAU Hallertau hop pellets (10 min.) (0.25 oz./7 g at 4% alpha acids)
½ tsp. Irish moss (30 min.)
½ tsp. yeast nutrient (15 min.)
White Labs WLP566 (Belgian Saison II) or Wyeast 3711 (French Saison) or Lallemand Belle Saison yeast
¾ cup of corn sugar (if priming)

STEP BY STEP

Steep the milled grain in 2.5 gallons (9.5 L) of water at 148 °F (64 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (2 L) of hot water. Add the malt extracts and boil for 60 minutes. While boiling, add the hops, Irish moss, yeast nutrient and beet sugar as per the schedule. When the boil is complete add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top 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 66 °F (19 °C). Hold at that temperature until fermentation is complete. This may take 10–14 days. Gently transfer to a carboy, avoiding any splashing to prevent aerating the beer. Allow the beer to condition for an additional week. Prime and bottle condition or keg and force carbonate to 2.7 volumes CO_2. Allow the beer to age for two more weeks to fully develop the flavors. Bottle or keg as normal.

BYO READER PROJECT

TYLER HAYMOND • JOLIET, ILLINOIS

A couple years ago I was gifted three established crowns of Nugget, Willamette and Sunbeam hops from a fellow homebrewer and friend who is a brewer for Lagunitas in Chicago. I left them in large 10-gallon (38-L) pots as they grew the year before. I used some eyelets on the roof to string a line from the yard to the roof, giving my hops 25 feet (7.6 m) of growth space. The Nugget plant reached the top and the others weren't far behind. After seeing their success, I decided to buy more hops in the varieties I enjoy.

I liked that I was able to get a lot of growth from my plants, but I wanted to try to contain the space. So in problem solving my dilemma of a bine plant that can grow 30+ feet (9+ m). I went to the design of the helix in order to achieve maximum growth in minimum space. I worked with a 6-foot (1.8-m) fence. I found a neat design that allows for 20+ feet (6+ m) of growth, but limits the height to 8 feet (2.4 m). I ran with it and came up with my design.

The cage design allows the bines to zigzag up one foot (0.3 m) for every 4 feet (1.2 m) of diagonal growth using ⅛-inch eyelet screws.

I primarily used 2x4 studs with ⅛-inch eyelet screws. I first spent an afternoon assembling the 4x4 raised beds and cutting the 2x4 studs into 6 foot (1.8 m) lengths. I used 2x2 furring strips to add the square shape to the top of the cage and give the vertical 2x4 support.

As you can see in the bottom left picture, I planted two hop rhizomes in the center of each box. The cage design allows the bines to zigzag up one foot (0.3 m) for every 4 feet (1.2 m) of diagonal growth using ⅛-inch eyelet screws. It allows up to eight bines growing in different directions (two per line), and over 30 feet in diagonal growth.

I ran through several hundred feet of tomato jute in a diagonal design. From last year's harvest I wound up with nearly 5 lbs. (2.3 kg) of dried CTZ (Columbus, Tomahawk, Zeus), Nugget, Cascade, and Chinook hops. I'm looking forward to refining the design this upcoming year with stronger twine and a refined watering and fertilizing system. As you can see in the bottom right picture, however, the hops grew like weeds last year and the design worked perfectly!

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BSG HandCraft is proud to introduce new packaging for our hops in conjunction with our new hop processing facility. BSG has made a significant investment in a new hop processing facility in the Yakima Valley area of Washington. This new facility means that BSG has complete control of the entire supply chain from bale receipt and storage to shipping of finished goods in one location. Atmospheric controls within packaging are ensured by real time monitoring of the residual oxygen in the packaging machine, that will automatically adjust the nitrogen volume to meet designated residual limits, and ensure that every single package contains minimal residual oxygen.

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BY DAWSON RASPUZZI

PAIRING YOUR BEER AND FOOD

Optimize your tasting experience

For a long time, a wine that is served with a meal has been selected based on the foods they are accompanying. While beer used to be overlooked in many high-end dining establishments, the nuances and diversity available in beer has made it increasingly available at restaurants. And, like wine, it's important to consider what foods you are eating so that you can emphasize characteristics that will accentuate and improve both the beer and food.

You have to get past simple rules and think about all the flavors you'll encounter while eating the dish.

Photo by Johnny Knight

Ray Daniels began homebrewing in 1989 and continues to brew in 2015. Along the way he has participated in the hobby as a brewer, judge, organizer, and advisor. He is the author of Designing Great Beers *and several other books on brewing. In 2007, he founded the Cicerone Certification Program (www.cicerone.org), which has become the de facto standard for beer sommeliers.*

The basic rule of beer and food pairing is to match the flavor intensities of the food and the beer. Then you want to think about the key flavors of the beer from malts, hops, and fermentation. What sorts of food flavors will they connect with in a sympathetic and harmonic way? You have to have some common connections between the beer and food to make it all work. Then we also want to consider the "contrast" or "cut" elements of the beer: Carbonation, bitterness and roast flavors, in particular. These elements can help to cleanse the palate between bites, lifting away fat and umami flavors on the tongue to help prepare you for the next bite. In addition to the main food ingredient, you should consider the rest of the dish, namely preparation, sauces, garnishes and sides. To say that beer X pairs with pork loin would be silly. So that's another fundamental: You have to get past simple rules and think about all the flavors you'll encounter while eating the dish.

One trick you can use comes from the wine world where they sometimes say, "If it grows together, it goes together." For example, since saison is a Belgian farmhouse beer, the rustic cuisine of Belgium is always a good call – they come from the same place, have the same roots and often call on related ingredients. I have done mussels and even crab cakes at home that played nicely with saisons; bloomy rind cheeses are always a great starter – or dessert – with that as well. And then you have things like roast chicken with potatoes or root vegetables and even Italian fish stew – cioppino – that can work as well.

Another trick is to cook with the beer you are going to taste with. I recently had a roast quail served with Unibroue Trois Pistoles (at the iconic beer bar Hopleaf in Chicago) and part of what made it work was the fact that the quail was garnished with stout-braised greens, Trois Pistoles-soaked figs and even kriek-pickled cherries. Probably any of those beers would have been OK with the dish, but the Trois Pistoles really rang the bell – in large part due to the great flavors introduced by the special sides and condiments added to the dish.

Bitterness is the live wire when it comes to pairing. While it can do good things in cutting richness in many foods, it can also become harsh and unpleasant with metallic or mineral flavors that most people don't like. An example would be pairing a high bitterness beer with an oily fish like lox. Bitterness also has a tendency to accentuate capsaicin or chili pepper-type heat in foods. This is also true to an extent with high-ABV beers because any sense of "heat" from alcohol in a beer will also boost the burn from chilies as well. This is not to say bitterness is always a problem in pairing of course. With all the super hoppy beers out today, we have found things that work with them from salads with bitter greens to mashed potatoes rich with cream and butter and carrot cake piled with cream cheese frosting.

Raised in Canby, Oregon between a filbert orchard and an egg farm, Deschutes Brewery Executive Chef Jill Ramseier started her passion for cooking high volume comfort food at le Bistro Montage in Portland, Oregon. She followed many adventures, from catering bite-sized morsels on historic trains, to Cleveland, Ohio where she worked a fine dining line at night and pastry during the day, working her way from pasta to wedding cakes to artisan breads. She eventually helped open the Portland Deschutes Brewery. After setting up a 24/7 scratch baking program that turns out 36,000 delicious pretzels a year, she became Executive Chef of Portland Deschutes Public House in 2013.

To come up with foods to pair a beer with, I like to taste the beer alone, make a list of aromas and flavors I get from it, and then a make list of what I think will go well with it. I follow that with tasting those foods with it, as well as a few foods I didn't put on the list. This allows me to really test my assumptions and instincts.

There are certainly generalizations with beer and food pairing that can be and are often made (IPAs with spicy foods, dark beers with desserts and cheese, wit and saison with seafood), but honestly sometimes I am surprised what goes together and what doesn't. My favorite pairings are when the pronounced flavor in the food is so similar to a certain note in the beer that they cancel each other out, revealing flavors beneath that you don't notice as easily. One of my favorite examples of this is pairing Abyss, an imperial stout with deep licorice notes, with licorice really allows the bourbon barrel to come through with a complex combination of vanilla and nuttiness that was spectacular when also paired with peanut butter and smoked sea salt.

When people sit down to dinner, they pay for great food and they pay for great beer. If one or the other doesn't taste good together that value is compromised. That's why Black Butte Porter is one of my favorites, it's a solid beer on its own, but it complements nearly everything I've ever tasted it with.

I think for people who love all types of beer it's a little easier to find good pairings since most of the flavors that will be enhanced are typical of various beer styles. Someone who is not a fan of IPA is not going to enjoy a pairing that enhances the perceived bitterness or hops, whereas that person might really enjoy it if the pairing accentuated the caramel malt profile.

A couple of examples of my favorite pairings are sour ales with something rich and cheesy (even a simple grilled cheese sandwich with sharp cheddar, and a tangy fresh goat cheese or a raw kraut), stouts with big meaty meals (braised short ribs, smoked brisket, lamb with nettle and mint pesto), and lighter hoppy styles with spices, citrus and often cream (my current fave: Sear your favorite seafood or a chicken breast with a minced chili, a squeeze of orange or lime, a hint of ginger and a splash of beer until cooked through. Finish it with some coconut milk, salt and a hunk of sourdough).

Alex Carballo is Operations Partner at El Cajon, California's URBN Brewing Co. A graduate of San Diego State University and the National Culinary &Baking School, Alex has manned the helm in some of San Diego's most prestigious kitchens (Crosby Country Club, Indigo Grill, Brigantine and The Fishery), and was the General Manager/Executive Chef at Stone Brewing World Bistro & Gardens in Escondido, California for five years.

Like wine, there are some basic rules when pairing beer and food, but beer is a bit more forgiving since they're all effervescent. The bubbles cleanse your palate after every drink. Darker beers for grilled meats and lighter beers with spicy and salty foods are usually safe.

When thinking about pairings, I start by considering the beer style; for example high-alcohol beers pair great with sweet foods — like pairing bourbon stout with chocolate or coffee. Just like wine, your sense of smell is extremely important too because you taste with your nose. Look for easily recognizable smells like sweetness, bitterness, and herbal notes.

Food and beer pairings are important, and you'll notice right away if a beer flavor disagrees with your food. Hoppy beers tend to be harder to pair because of their bitterness and strong hoppy aroma, so I would start with simple, less complex beers. There are certain foods that are hard to pair well with beer too. For example, asparagus can really throw your palate off. I would not recommend that pairing unless you have tried a few times with different beers. Some say foods rich with butter can cause problems too since brewers use it when checking their beers for off-flavors like diacetyl.

When it comes to pairings that do work, some of my favorites are IPAs and carrot cake (don't knock it until you try it), Flanders red with dark chocolate, saison with sausage, and Pilsner with ceviche. That said, always try things on your own since everyone's palate tastes things a bit differently. BYO

BY ASHTON LEWIS

HOP UTILIZATION IN A HOP SPIDER

Prepping a bourbon barrel, yeast washing

Q I USE A HOP SPIDER TO REDUCE THE AMOUNT OF DEBRIS IN MY CHILLED WORT PRIOR TO TRANSFERRING IT INTO MY CARBOY FOR FERMENTATION. THE HOP SPIDER IS A 5-GALLON (19-L) PAINT NETTING ATTACHED TO A 3-INCH (7.6-CM) PVC PIPE AND SUSPENDED INTO THE KETTLE BY LEGS. THE HOP PELLETS MOSTLY STAY IN THE BAG RATHER THAN ROLL IN THE BOIL.

IS THERE LESS HOP UTILIZATION FOR THE PELLETS IN THE HOP SPIDER? WHAT ABOUT THE HOPS AT HOT BREAK? DO THEY IMPART LESS AROMA/BITTERNESS THAN HOPS FREE FLOATING IN THE FINAL WHIRLPOOL?

MICHAEL FLOREZ
CINCINNATI, OHIO

The primary factors that influence hop utilization are boil time, wort density, and wort pH.

A The name hop spider is peculiar to me since these devices don't resemble any spider I have ever seen! But they are effective in retaining hops and minimizing carryover of hop debris after the boil. They can also reduce wort loss for brewers who stop wort transfer when debris is seen in the line to the fermenter. So in general, I think hop spiders make sense and are a very useful tool for the homebrewer.

Your question is primarily about hop utilization. The primary factors that influence hop utilization are boil time, wort density, and wort pH. Secondary variables include hop type (pellet versus cone), kettle geometry, kettle size, and contact between hops and wort. The latter is the variable of concern with hop spiders. If hops are not able to fully hydrate and/or have limited contact with wort, then a reduction in utilization is likely to occur. This is pretty easy to address by simply making the netting large and non-restrictive, which it sounds like is not a problem in your case. In a crude sense you could line your kettle with a grain bag that could be removed after the boil to lift all of the hops out of the kettle similar to the inner portion of a lobster pot.

I don't know how hops that end up in the trub pile in a whirlpool differ in their contribution of aroma and bitterness compared to hops that may be floating around in the whirlpool. In commercial brewing operations, even relatively small ones, pellet hops intended for late hop character are added to the kettle at the end of the boil and the wort is either pumped to a separate whirlpool vessel or it is pumped back into the kettle to cause the wort to swirl. Following this step the wort is allowed to rest for about 20 minutes. This rest period is long enough for wort movement to effectively stop and for the trub pile to form, and the total time from hop addition to the beginning of wort cooling is at least 30 minutes, usually closer to 40 minutes. This is ample time for aroma extraction and my guess is that hop aroma would not differ if an experimental beer were brewed with the same contact time with the aroma hops and no whirlpooling, and hence

less hops in the trub pile.

There is a very real practical consideration with this question, however, and that has to do with the contribution of bitterness with aroma hop additions. Back in the days before ultra-hoppy beers many brewers, both homebrewers and commercial brewers, either ignored the contribution of bitterness of late hop additions or assigned a fairly low utilization rate for the addition. This made sense for most beers where the last addition was typically less than or equal to the other hop additions. A mistake in the assumed utilization was not a big deal because the last addition was not large enough to contribute much bitterness.

The truth is that aroma additions can significantly contribute to bitterness because the utilization of this addition can be much higher than assumed when pellet hops are used. Just check out some of the current tables about hop utilization and you will find that almost all of these tables relate utilization to boiling time, where late hop additions typically have predicted hop utilization rates around 5% based on a few minutes of boiling. The problem with this is that most of these tables show the utilization to be 0% with no wort boiling. While this is true of dry hopping, it is not true when hops are added to hot wort, as is the case with hops added at the end of the boil and hops added to the whirlpool.

My guess is that this mindset began before hop pellets became so prominent in the world of brewing. Some breweries still add pretty large, sometimes massive, late hop additions to the kettle using cone hops and almost immediately transfer the wort to a whirlpool or hot wort tank. During the transfer the cone hops are removed and the contact time with hot wort is greatly minimized. Instead of being in contact with hot wort for 20 minutes during transfer to the whirlpool, followed by a 20 minute whirlpool rest followed by up to 60 minutes during transfer to the fermenter (these are typical commercial brewery times) the contact time is about 20 minutes; a full 80 minutes less. This is a very significant difference as the utilization associated with the late hop addition increases from somewhere around 5% up to about 20%, depending on wort gravity and contact time with hot wort. Add this threefold difference in utilization to the sometimes incredible increase in late hop addition rates and the result is beers with a lot of bitterness directly related to late hop additions.

The truth is that aroma additions can significantly contribute to bitterness because the utilization of this addition can be much higher than assumed when pellet hops are used.

The cool thing about the hop spider is better control over your bitterness, if you are so inclined to want to nerd out! I am that sort of brewer who likes knowing how my beer is affected by what is done in the brewery. With the hop spider you can make those massive late hop additions, using pellets or cones, extract the aroma from the hops and pull the hops out from the wort before contributing bitterness that is not so easy to calculate. Hop on Spider Man!

Q I JUST RECEIVED AN 8-GALLON (30-L) BOURBON BARREL, BUT I REALIZED I DON'T KNOW WHAT I NEED TO DO TO PREPARE THE BARREL. MY BEER WON'T BE READY FOR 30 DAYS, AND THE BARREL "HAS BEEN FRESHLY EMPTIED," ACCORDING TO THE SUPPLIER I BOUGHT IT FROM. IS THERE ANYTHING I NEED TO DO TO THE BARREL IN THE MEANTIME OR CAN I JUST SIPHON THE BEER INTO IT WHEN IT'S READY?

BILL BARTMAN
PORTLAND, OREGON

A Bourbon barrels can be used to produce some really great beers. At Springfield Brewing Company, like many craft breweries, we use bourbon barrels for some of our beers. Our anniversary beer for the last few years has been a fruited stout partially aged in bourbon barrels and our Little Barrel of Nectar is a stout we produce when the stars are aligned using 8-gallon (30-L) bourbon barrels from Woodinville Whiskey. And most recently we aged our Tsarry Night, a Russian imperial stout, in rum barrels to produce Arrghy Night. So my answer below will come from my experience with these beers.

When we purchase freshly emptied barrels they arrive with the bung in place and sometimes wrapped in plastic. We leave these barrels alone until we are ready to use them because nothing good comes from opening these barrels to smell them and "ooh" and "ah" about what will be. Patience is required when you have the barrel in your possession but no beer to put into the barrel.

Let's talk about the beer for a moment. Beers that are destined for bourbon barrel aging need to have enough girth to carry the flavor intensity of the bourbon. You can surely make a great bourbon beer that is not a monster, but you may need to blend the barrel-aged component in order to achieve a beer with balance. Many brewers have followed the lead of the tinkerers of this style of beer and have

chosen big stouts to put into bourbon barrels. This works for a number of reasons, including the compatible flavor hooks between stout and bourbon barrels, similar flavor intensities, and the way strong beers respond to oxidation. I want to hit on these points one by one.

Bourbon barrels may seem rough and gruff on the surface, but they do have lots of nuance. If you are lucky you will have coconut, vanilla and caramel notes from the bourbon barrel marry with the flavor notes of your base beer. This is why, in my opinion, stouts work so well for bourbon beers. Matching the intensity of the beer with the intensity of the barrel is also something to consider. Since bourbon barrels have a loud and dominant voice they can easily overpower the whispers of subtle ales, such as brown ale. This is where blending can be used to temper the boisterous barrel flavor if you desire something more subtle. And then there is oxidation. Barrels are porous and beer aged in wood is exposed to oxygen. So choosing a style that benefits from slight oxidation is something that I strongly suggest until you have a few of these brews under your belt. Chances are you will find that this is the best type of beer to age in your bourbon barrel.

Let's go back to the barrel. When your brew is finished it is very important that you do nothing to increase the level of carbon dioxide. If you want to chill your brew to drop yeast, do it in an atmospherically vented container like a carboy or a conical fermenter that is not pressurized. To prep your barrel, all you need to do is remove the bung, pour out and reserve any bourbon that resides in the barrel and rack your beer into it. This is where homebrewing and commercial brewing diverge. If you want to leave this bourbon in the barrel there is nothing stopping you. The commercial world brings in tax compliance rules that are involved and, luckily, out of the scope of your question. Most beer aged in freshly emptied barrels will have extracted most of the bourbon notes in about 3 weeks. From this point forward you should treat this beer no differently than green, still beer following

HELP ME, MR. WIZARD

primary fermentation except that you will need to add yeast if you plan on bottle conditioning.

Rewind the tape, if you will for a moment. Not all barrels are freshly emptied. Some were used for aging bourbon (or some other variant of whiskey, wine, or spirit) and permitted to dry out a bit. And others were used to age beer once before. What is a brewer to do?

If you have a dry barrel you need to be concerned about leaks and will want to fill the barrel with very hot water to help the wood hydrate, swell and seal. Dry barrels also lack the residual bourbon of wet barrels and the bourbon is pretty darn important when it comes to imparting bourbon flavor. At home you can hydrate your dry barrel and fill that wooden sponge back up with bourbon. Just buy a good bottle of the brown stuff, pour into your hydrated barrel, hammer in a bung and roll the barrel for several days to let the wood soak up the bourbon. You should pour out the excess to prevent overwhelming the beer.

And if you have a barrel that has been used once for beer you probably can use it again and extract more bourbon flavor without any help from a bottle (as described above). This is a good time to barrel age a tamer beer. Or you can use this second run from the barrel to blend with the first run. Barrel aging is not rocket science. It works very well for certain beers and you will produce a great beer if you stick to the fundamentals!

Q I HAVE ALWAYS WONDERED ABOUT THE DESIRE OF MANY BREWERS TO YEAST WASH. IT SEEMS TO ME THAT IF YOU ARE TRYING TO SAVE YEAST THAT YOU SHOULD SIMPLY MAKE MORE YEAST STARTER THAN YOU NEED AND SAVE THE EXCESS STARTER FOR THE NEXT BATCH. THIS SEEMS EASIER AND MORE LIKELY TO MAINTAIN THE INTEGRITY OF THE STRAIN. WHAT AM I MISSING?

MICHAEL MILLER
POWAY, CALIFORNIA

Al too question the desire of many brewers to acid wash their yeast. But before diving into why yeast washing is used I want to touch on another topic raised in your question. The idea of growing a large starter, using what is needed for today's brew and saving the remainder is an appealing idea. The problem with doing this, however, is that the viability of a yeast slurry declines over time and it is really advisable to use fresh slurry within one to two weeks following propagation, assuming that the slurry is stored right around 32 °F (0 °C). Most commercial breweries with a yeast propagation program would rather not use yeast that is stored more than a few days. The bottom line is that when yeast viability drops during storage the likelihood of fermentation problems increases.

And this is why most breweries harvest yeast from a batch that just completed primary fermentation, store the yeast for as short a time period as possible and pitch it into a fresh batch of wort. It is this method that can benefit from washing. Since yeast from a previous fermentation can become contaminated with bacteria and wild yeast, the practice of re-pitching can be problematic. I think this problem is not as common today as in the past because of improvements in process control, especially tank cooling, process technology, specifically closed fermentation vessels and hygienically designed pipe and valve systems and overall improvements in cleaning methods. But not all breweries have the latest and greatest technology, especially older ones. So yeast washing is alive and well today.

Yeast washers come in two basic camps. One camp sees yeast washing as something that can be done in a pinch. These brewers monitor yeast and beer in microbiological labs looking for potential problems and/or simply wash after a certain number of generations that coincides with problems (this is brewery specific and requires sufficient data to establish a routine that makes sense). If they pick up certain bacteria (usually lactics are the beasts of interest) on their test

media and really need to use the yeast related to the sample, acid washing can be used as a form of chemotherapy to reduce the lactic acid bacteria population without harming the yeast too much.

Make no mistake, reducing the pH of yeast slurry to 2.2 to 2.4 and holding it for about two hours is not super friendly on the yeast. If the temperature warms up above about 40 °F (4 °C), the pH is errantly lower than 2.2 or the time extended beyond two hours, damage will occur more than the method already permits.

There are other washing methods used that are not as harsh, but the phosphoric acid method is still common among brewers who like to acid wash. Chlorine dioxide is a much gentler washing solution, has gained popularity in recent years and is equally, if not more, effective in reducing bacterial populations than phosphoric acid (note that these methods are not effective at reducing the population of wild yeast strains).

The other camp always acid washes yeast after cropping. These brewers have a pragmatic and fairly logical thought process. Since it takes time to determine if there is a problem, always acid washing cuts out the lab time that may simply indicate that a problem exits. Washing the yeast every time is a way of being safe rather than sorry. The other part of this camp's philosophy is that acid washing and chlorine dioxide washing reduces yeast viability, and reduced viability will change the way yeast behaves compared to yeast that has not been acid washed, so in order to have predictable yeast and predictable fermentation performances the yeast should always be acid washed.

This is a pretty big topic and I only scratched the surface. Yeast can also be water washed, although I don't know of any breweries still practicing this method. Yeast can also be harvested and passed through a tight screen to remove trub. And there are as many ideas on how and when to crop yeast from the fermenter as methods to screen, store and wash. Most craft brewers that I communicate with crop, store and re-pitch without any screening or washing steps. I hope this gives some insight into your question. BYO

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- With the numerous benefits of using a hop spider, what's stopping you from building your own? Here's how: http://byo.com/story2427

- Want more tips about brewing with and caring for barrels? Check this link out: http://byo.com/story3076

- Whether you are brewing small batches or large quantities, raise the right amount of happy, healthy yeast cells for your wort by making a yeast starter. Here's how: http://byo.com/story1083

BY GORDON STRONG

THE EVERYDAY CZECH PALE LAGER

The newest addition to the BJCP Style Guide

If you're in the mood for a lower-alcohol beer, Czech pale lager is a nice alternative to making session IPAs or English bitters.

CZECH PALE ALE
BY THE NUMBERS

OG: 1.032–1.044
FG: 1.008–1.014
SRM: 3–6
IBU: 25–35
ABV: 3.0–4.1

Photo by Charles A. Parker/Images Plus

In the United States, about half the beer consumed is light lager, a relatively bland, lower alcohol product mass marketed to a wide audience. In the Czech Republic, there is also a consumer preference for a lower alcohol beer; however, that's where the comparison ends. The Czech pale lager is lower alcohol, but high in flavor. Think of it as a session version of its big brother, the Czech premium pale lager (also known as Bohemian Pilsner or Czech Pilsner in export markets). In fact, both the Czech pale lager and Czech Pilsner were initially brewed by Josef Groll around 1842-1843.

SENSORY PROFILE

The Czech pale lager is a new style added to the 2015 Beer Judge Certification Program (BJCP) Style Guidelines. Its defining characteristics are similar to the more well known (and widely exported) Czech premium pale lager – a smooth, hoppy, pale lager with a bitter balance and a rich supporting malt character with the grainy, sweet flavors of Pilsner malt. Often showcasing the spicy-herbal-floral Czech Saaz hops, this style has a bit more body and color than equivalent products from Germany.

While called a pale lager, the actual color is more golden (light gold to deep gold) rather than straw or yellow. The deep gold color can almost touch the amber range. A white, persistent head is characteristic, and the clarity is normally good (maybe not quite as clear as German Pils examples). The body is in the medium-light to medium range, again a bit more than German counterparts.

One of the aspects of Czech lager that separates it from German lager is the attenuation. German lagers are typically fully attenuated (i.e., all fermentable extract has been converted into alcohol, leaving the beer completely dry). Czech lagers, on the other hand, often have a little bit of unfermented extract remaining in the beer. This gives it a little more body and mouthfeel, and increases the malty flavors. In a less bitter beer, this might be seen as adding sweetness, but it's not really perceived that way.

The water used in brewing Czech beers typically has a very low mineral content, which allows a high hopping rate to give a clean bitterness without harshness. The little bit of unfermented extract and extra body, along with a generally more robust flavor profile, gives Czech beers a more balanced taste than the dry and often minerally German versions. This is a picky detail that many beer drinkers will not notice; they might just say that the Czech versions seem a bit more complex, malty, and rich when compared to their German cousins.

The strength is in the 3.0 to 4.1% ABV range, with additional variations based on starting gravity. Czechs typically categorize their beer by color and strength, so this style is a *světlé* (pale) lager with an original gravity (OG) from 1.032 to 1.043 (7 to 10.9 °P). The gravity ranges for the different categories of beer are a legal requirement in the Czech Republic.

In the Czech Republic, a beer in this lower gravity range is known as *výčepní* (draft beer, which is also the Czech word for bartender). To my ear, this sounds like "vih-CHEP-nee" in English. "Normal" or "full" strength beers (1.044 to 1.051/11 to 12.9 °P, roughly 4.5 to 5.5% ABV) are called *ležák* (lager), so there is a similarity between these beers and the categorization of American light lagers. As a draft product, this beer style is rarely seen outside its local region. I'm not aware of any export versions, so don't bother looking

CZECH PALE LAGER

(5 gallons/19 L, all-grain)
OG = 1.042 FG = 1.011
IBU = 29 SRM = 3.8
ABV = 4.1%

by Petr Bachan • Minneapolis, Minnesota

INGREDIENTS

7.5 lbs. (3.4 kg) German Pilsner malt
7 oz. (0.2 kg) Caravienne malt (22 °L)
6 oz. (0.17 kg) German wheat malt
5 oz. (0.14 g) German acidulated malt (sauermalz)
3 AAU Magnum hops (first wort hop) (0.25 oz./7 g at 12% alpha acids)
2 AAU Czech Saaz hops (30 min.) (0.75 oz./21 g at 2.6% alpha acids)
2.6 AAU Czech Saaz hops (10 min.) (1 oz./28 g at 2.6% alpha acids)
3.6 AAU Magnum hops (10 min.) (0.3 oz./9 g at 12% alpha acids)
1 oz. (28 g) Czech Saaz hops (0 min.)
Wyeast 2633 (Oktoberfest Lager Blend) yeast
¼ cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. The water salt treatments are minimal; add 5 g calcium chloride ($CaCl_2$) to the mash and 3 g $CaCl_2$ to the sparge water. The acidulated malt is used to reach the desired mash pH; do not omit this ingredient unless you acidify your mash water. Do not add additional water salts to lower the pH; a minerally water character is inappropriate for this style.

Two or three days before brew day, make a 2-qt. (2-L) yeast starter, aerating the wort thoroughly (preferably with oxygen) before pitching the yeast. On brew day, mash in at 156 °F (69 °C) in 14 qts. (13 L) of water and hold this temperature until converted, 30 to 45 minutes. Pull a thick decoction of at least half the mash, then boil the decoction until it changes color and consistency, about 25 minutes. Stir the decoction frequently to avoid scorching. Return the decoction to the main mash and hold at 168 °F (76 °C) for mash out. Recirculate until clear, fly sparge with 168 °F (76 °C) water until 6.5 gallons (25 L) of wort is collected.

Boil the wort for 90 minutes, adding the hops at times indicated in the recipe. First wort hops are added to the kettle before the wort is run off. After adding the final hops when the heat is turned off, immediately begin chilling the wort. Chill to 43–45 °F (6–7 °C). Chilling to this low temperature may take two cooling stages or the use of an ice bath to reduce the temperature of the cooling water.

Oxygenate, then pitch the yeast starter. Allow fermentation temperature to rise to no more than 50 °F (10 °C) until desired final gravity (FG) is achieved. Then rack and slowly chill to lagering temperature. Lager for 4 to 6 weeks at 33 °F (1 °C). Prime and bottle condition, or keg and force carbonate to 2.4 volumes.

The original recipe used Best Malz for the base malt, a fully modified malt. If using an undermodified malt (such as Weyermann Floor-Malted Bohemian Pilsner malt), a true double decoction mash schedule can be used as described in the article. If using the Weyermann malt, you can also substitute the Weyermann Carabohemian® malt for the Caravienne. These products are malted specifically for making Czech-style beers.

CZECH PALE LAGER

(5 gallons/19 L, extract with grain)
OG = 1.042 FG = 1.011
IBU = 29 SRM = 3.8 ABV = 4.1%

INGREDIENTS

5.5 lbs. (2.5 kg) liquid Pilsner malt extract
4 oz. (0.11 kg) Caravienne malt
4 oz. (0.11 kg) German caramel wheat malt (45 °L)
3 AAU Magnum hops (60 min.) (0.25 oz./7 g at 12% alpha acids)
2 AAU Czech Saaz hops (30 min.) (0.75 oz./21 g at 2.6% alpha acids)
2.6 AAU Czech Saaz hops (10 min.) (1 oz./28 g at 2.6% alpha acids)
3.6 AAU Magnum hops (10 min.) (0.3 oz./9 g at 12% alpha acids)
1 oz. (28 g) Czech Saaz hops (0 min.)
Wyeast 2633 (Oktoberfest Lager Blend) yeast
¼ cup corn sugar (if priming)

STEP BY STEP

Use 6 gallons (23 L) of RO water in the brew kettle; heat to 158 °F (70 °C). Add 3 g calcium chloride to the water. Place the Caravienne and caramel wheat malt in a mesh bag, and steep in the hot water for 30 minutes. Remove the mesh bag, then turn the heat off.

Add the liquid malt extract and stir thoroughly to dissolve the extract completely. You do not want to feel liquid extract at the bottom of the kettle when stirring with your spoon. Turn the heat back on and bring to a boil. Boil the wort for 60 minutes, adding the hops at the times indicated in the recipe.

After adding the final hops when the heat is turned off, immediately begin chilling the wort. Chill to 43–45 °F (6–7 °C). Chilling to this low temperature may take two cooling stages or the use of an ice bath to reduce the temperature of the cooling water. Oxygenate the wort, then pitch the yeast starter. Allow the fermentation temperature to rise to no more than 50 °F (10 °C) until the desired FG is achieved. Taste the beer for diacetyl; if noticeable diacetyl is present, raise the temperature to 65 °F (18 °C) for two days. Rack and slowly chill to lagering temperature. Lager for 4 to 6 weeks at 33 °F (1 °C). Prime and bottle condition, or keg and force carbonate to 2.4 volumes.

for this on your local retailer's shelf.

BREWING METHODS

Czech beers are traditionally produced using decoction mashes, a practice that has largely been replaced in Germany with step mashes. Czech malts are often a bit undermodified, but Czech brewers will still perform decoction mashes with highly modified malts because of the flavor advantages. Czechs feel the mash program will improve the drinkability, flavor, and body of the beer while improving mash efficiency and creating a smooth beer with individual character and increased stability. Decoction mashing involves removing a portion of the mash (called the *decoction*) and boiling it in a separate vessel, often with mash rests along the way. Double decoction is the most common Czech method, with Pilsner Urquell being the beer most commonly associated with a triple decoction. The multiple decoction methods simply mean that more than one decoction is pulled during the mash schedule. A traditional Czech double decoction mash might look like this:

1. Mash in at 122 °F (50 °C) and hold for 10 minutes.

2. Pull a thick decoction (one-third to one-half the mash), continuing to hold the main mash at 122 °F (50 °C).

3. Step the decoction (raise the rest temperature via direct heating or an infusion of boiling water) to 144–147 °F (62–64 °C) and hold for 10 minutes.

4. Step the decoction to 158 °F (70 °C) and hold for 10 minutes.

5. Step the decoction to boil, and boil for 20 minutes.

6. Remix the decoction into the main mash, raising the main mash to 144–147 °F (62–64 °C) and holding.

7. Pull a second thick decoction, bring to a boil, and boil for 10 minutes.

8. Remix the decoction into the main mash, raising the main mash to 158 °F (70 °C) and hold for 30 minutes.

The color and flavor development in a decoction program comes from the Maillard reaction, which is a non-enzymatic browning process where amino acids and reducing sugars in malt and wort react in a moist, high temperature environment to create rich flavors and deeper colors typically associated with roasted or seared foods that have developed a rich, brown color. It's a complex chemical reaction that can produce hundreds of flavor compounds as well as brown-colored melanoidins.

Czech malts are traditional, but German malts can certainly be used; a grain bill of mostly Pilsner malt (95% and up) is common, often with a small bit of caramel-type or color malt. Extract brewers should use a Pilsner

malt extract.

Czech hops (especially the Saaz variety) are characteristic for the style, particularly in the flavor and aroma. Pilsner-type beers normally are brewed using water with a very low mineral content; sulfates in particular are typically avoided. A Czech or a clean, malty German yeast strain works best, as Czech beers often have a very small bit of residual unfermented extract.

The hop character of the beer should be evident in the bitterness, flavor, and aroma. Three hop additions or more are common, but dry hopping is not a traditional method. The fermentation profile is relatively clean, but not as clean as German beers. Low background levels of diacetyl and esters might be present, but aren't required; they should not adversely affect the flavor balance in any event.

HOMEBREW EXAMPLE

In January I judged at the Upper Mississippi Mash Out in St. Paul, Minnesota, which is a large (1,000 entry) homebrew competition. This year the Best of Show beer was a Czech pale lager, entered as a "Specialty Beer" under the 2008 BJCP Style Guidelines. The brewer was local, so I was able to interview him as well as the best of show judges. He also provided me with his score sheets from the competition, and his complete recipe.

Petr Bachan is a native Czech now living in Minneapolis. He wanted to produce an everyday beer typical of his little hometown, Hluk in Moravia, that he can no longer find now that he lives in the United States. He called his beer *Hlučan desítka*, which translates as a 10 °P beer from his hometown. He said the word *desítka* translates as "tenner," as in, "hey bartender, I'll have a tenner." He also said that if you were in your local pub where everyone knew you, you'd probably just order *jedno* (one). A more generic name for this beer would be *výčepní desítka* (draft 10).

Petr said his goal for the beer was to create a malty profile with more flavor and aroma from hops, with a medium body and high head retention. His recipe is based on methods he found that worked well on his Recirculating Infusion Mash System (RIMS) equipment. He said that with this system he isn't able to use a traditional decoction mash program when using highly modified malt since he isn't able to raise temperatures fast enough to avoid fully converting the malt. His workaround is to use a higher temperature rest (156 °F/76 °C) to promote body, followed by a single decoction mash to add color and flavor. Petr said Czech homebrewers call this a "false decoction" since it isn't used as part of the conversion.

His recipe (generously provided by him on page 31) uses 87% Pilsner malt, with 5% Caravienne, 4.5% wheat malt, and 3.5% acid malt with Czech Saaz and German Magnum hops. The Caravienne (sometimes called Belgian Cara 20) is a crystal malt of around 20 °L color. The wheat is for head retention and the acid malt is to help

hit a proper mash pH (5.2 to 5.3, measured at room temperature). He uses first wort hopping and a whirlpool hop addition to increase hop flavor and aroma.

Petr's yeast choice was Wyeast 2633 (Oktoberfest Blend), but he was reusing yeast from a prior batch. He said any clean malty German or Czech yeast would work, including White Labs WLP833 (German Bock Lager), WLP800 (Pilsner Lager), WLP830 (German Lager), or Wyeast 2124 (Bohemian Lager). He starts his fermentation cold, then allows it to rise to a typical lager fermentation temperature. He uses a diacetyl rest if necessary, but warns against allowing the beer to attenuate completely as a little bit of residual extract is necessary for the right flavor profile.

I spoke to Al Boyce, a BJCP Grand Master IV judge, who was on the Best of Show panel. He said the beer was presented as a "Czech half-Pilsner, a lower-gravity (3.5%) version of a Czech Pilsner." He said his first impression was of a very strong Saaz hop aroma, and a very clean, sweet Pils malt flavor. The bitterness was assertive, yet scaled down and perfectly balanced with the lower level of malt and alcohol. It was bright yellow and brilliantly clear, with a half-inch white head that slowly dissipated. Al closed by remarking "in short, it was a session Bohemian Pils; I wish it were on tap at my local tap room!" OK, I'm sold.

When I asked Petr about his recommendations for homebrewers to produce a proper Czech pale lager, he provided these tips:

1. Convert the mash at a high rest temperature (156 °F/69 °C).

2. Use a single false decoction with highly modified malt (most German malts), or a double decoction with undermodified malts (Czech malts, or the Weyermann Floor-Malted Bohemian Pilsner malt, for example).

3. Experiment with late and whirlpool hopping to enhance hop flavor.

4. Experiment with arresting the fermentation to keep the beer from being

Pilsner-type beers normally are brewed using water with a very low mineral content; sulfates in particular are typically avoided.

too dry, too thin, or with an overly accentuated bitterness. He suggests trying to stop the beer about 2 gravity points (0.002) above the completely fermented level. Cold crashing and racking the beer can be used; a slight diacetyl character may remain.

Depending on your preferences and your homebrew equipment (as well as your available time on brew day), you can brew this style using Petr's method or the more traditional decoction mash process I described. I like his use of the modern hopping methods to boost the hop profile.

This style of beer is perfect for homebrewers since it is not available to most people. If you want to drink it, you'll have to either travel to the Czech Republic or make it yourself. The production methods are fairly unique to Czech beers, so if you're looking for something different than your normal brew session, this could be for you. If you're in the mood for a lower-alcohol beer, Czech pale lager is a nice alternative to making session IPAs or English bitters. The ingredients used are widely available, so why not Czech it out? BYO

Related Links:

• The Czech pale lager is the lower alohol little brother of the Czech Pilsner, or Bohemian Pilsner. Learn about that style, and how to brew it at home: http://byo.com/story1929

• Decoction mashing is the traditional way to brew Czech lagers. Find more information on decoction mashing, including the pros and cons of it: http://byo.com/story537

FATHER'S DAY GIFT GUIDE

Sunday, June 21st is Father's Day. Let's face it, your dad already has a closet full of ties, a glovebox overflowing with roadmap atlases and a cupboard full of #1 Dad mugs from Father's Days past. Doesn't he deserve to get some gifts this year that he'll really enjoy?

This Father's Day give him something he'll really use. Imagine his surprise when you show up with some of the fine beer and brewing related items on the next several pages to make him feel extra special. How about also bringing a six-pack, or better yet – a fresh Corney keg, of homebrew to let him know how much he means to you. If you're the homebrewing dad of the family, leave your copy of BYO on your wife's desk open to these pages or put them up on the refrigerator. Don't be shy – it's your day. Make sure your family knows what you'd really like to get this year that'll say, "Thanks, Dad," more than anything they might think you want.

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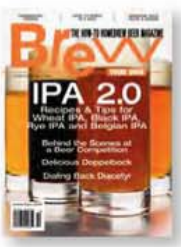

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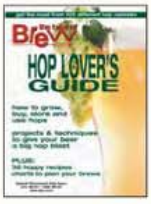

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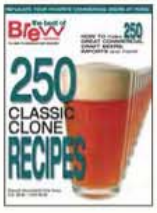

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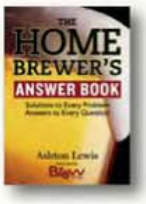

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____	Mar./April 11	____	May/June 14
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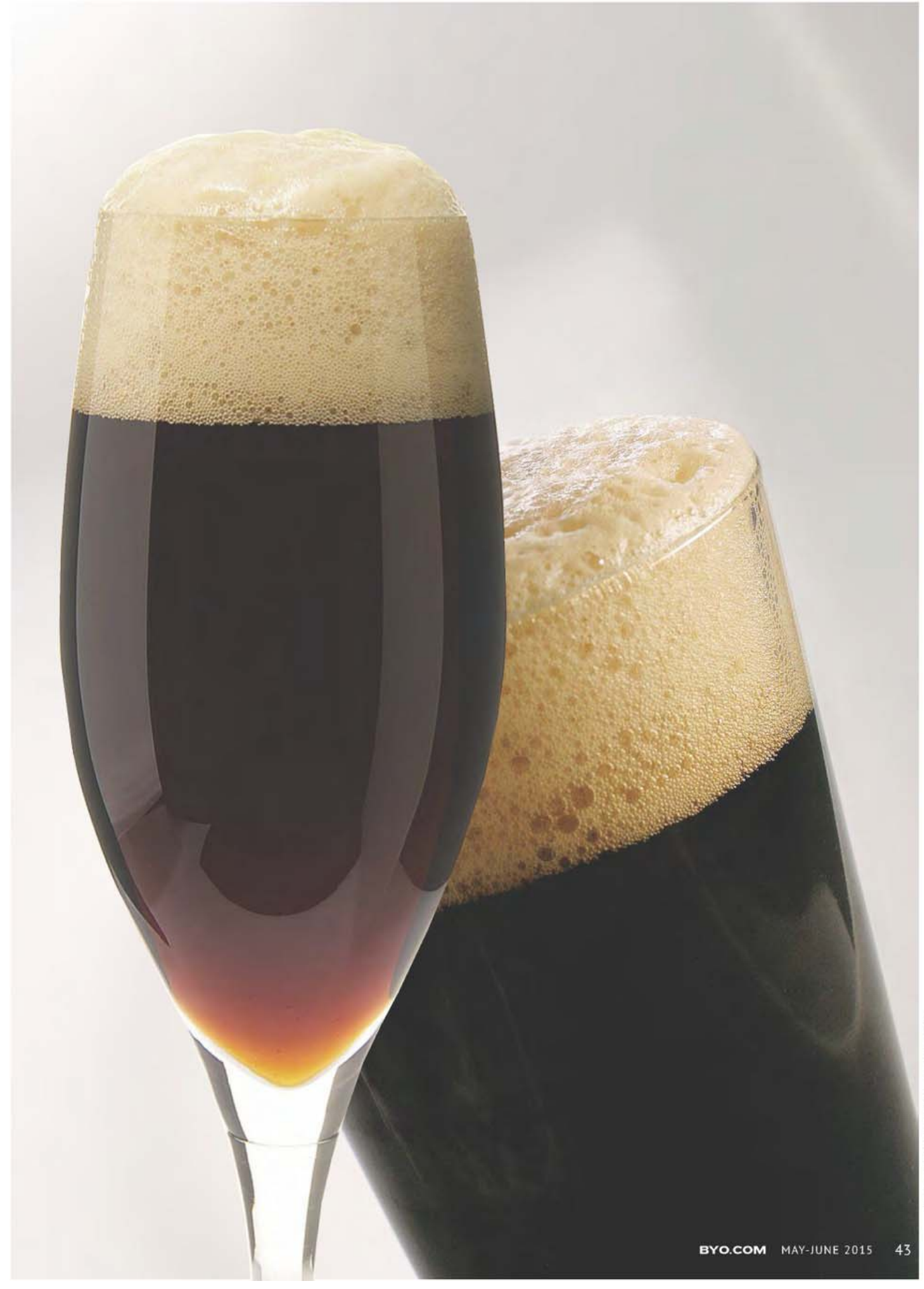
5 Unique Porters & Stouts

by Terry Foster

The recipes in my new book *Brewing Porters and Stouts* (Skyhorse Publishing, 2015) are all for beers that conform to our modern porter and stout guidelines. But as a result of my readings on porter, I have attempted to brew versions of eighteenth- and nineteenth-century porters and stouts that do not always fit our modern definitions, but are simply good beers in their own right. In other words, you might find it rewarding to brew one or more of them. Although I have tried hard to reconstruct these beers as close to the original as possible, the new versions can never be completely authentic for a variety of reasons. Chief among these are that these old recipes are often obscure about details of the process, and that modern ingredients are different from their predecessors. This has meant that Jeff Browning (of BrüRm@BAR in New Haven, Connecticut) and I have had to interpret old recipes in the light of our modern knowledge of brewing procedures, and of the properties of modern ingredients, in order to achieve satisfactory results. We make no apology for the fact that, as always, our main aim is to produce good beer!

Photo courtesy of Skyhorse Publishing

The reproduction beers were all produced in my own homebrewery, and some were then scaled up to ten barrels and brewed at BrüRm@BAR. The others are not "reproductions," but are based on modern craft-brewed beers. As was the case with the earlier recipes, these are all based on a 5-gallon (19 L) batch size and are presented assuming a brewhouse efficiency of 65 percent. All of the other normal *BYO* assumptions also apply, including 25 percent utilization of hop-acids. Of course, the latter is based on guesswork as to what bittering levels the old beers might have had, which is something we shall never know, just as the brewers then never knew about hop-acids!



Photos by Charles A. Parker/Images Plus

1. *This brew is based on a nineteenth-century book (Amsinck, 1868). I throw it in here because it is a very simple recipe that reflects what an English brewer thought of as Irish stout at a time when Guinness had become the world's major brewer of stout and porter. I had to guess at the mash temperature, because the brewer only measured it at the run-off taps at the end of the mash! It drinks very much like a dry stout, quite dry with substantial bitterness from the black malt and high hop rate. Indeed, the IBU level actually puts it in the region of a modern American stout.*

AMSINCK NO. II DUBLIN STOUT

(5 gallons/19 L, all-grain)
OG = 1.085 FG = 1.026
IBU = 86 SRM = 30 ABV = 8.4%

INGREDIENTS

17 lbs. (7.7 kg) Maris Otter 2-row pale malt (4 °L)
0.75 lb. (340 g) Bairds black malt (550 °L)
23 AAU Target pellet hops (90 min.) (2.3 oz./65 g at 10% alpha acids)
White Labs WLP004 (Irish Ale) or Wyeast 1084 (Irish Ale) yeast (as a 1.5-qt./1.4-L yeast starter)
⅔ cup corn sugar (if priming)

STEP BY STEP

Mash at 151 to 153 °F (66 to 67 °C) with 22 quarts (21 L) of water, and add all of the hops at the start of the boil. Boil the wort for 90 minutes.

When the boil is complete, chill the wort rapidly to yeast pitching temperatures. Pitch an appropriate amount of yeast using a yeast starter of 1.5 quarts (1.4 L), ferment, and mature for three to six weeks.

AMSINCK NO. II DUBLIN STOUT

(5 gallons/19 L, extract with grain)
OG = 1.085 FG = 1.026
IBU = 86 SRM = 30 ABV = 8.4%

INGREDIENTS

12 lbs. (5.4 kg) Maris Otter liquid malt extract
0.75 lb. (340 g) Bairds black malt (550 °L)
23 AAU Target pellet hops (90 min.) (2.3 oz./65 g at 10% alpha acids)
White Labs WLP004 (Irish Ale) or Wyeast 1084 (Irish Ale) yeast (as a 1.5-qt./1.4-L yeast starter)
⅔ cup corn sugar (if priming)

STEP BY STEP

Steep the black malt separately in a muslin bag with 1.5 quarts (1.4 L) of water at around 160 °F (71 °C). Strain off the black malt and rinse the grains with two lots of 1.5 quarts (1.4 L) hot water and use this wort to dissolve the extract. Boil for 90 minutes, adding the hops at the beginning of the boil.

When the boil is complete, chill the wort rapidly to yeast pitching temperatures. Pitch an appropriate amount of yeast using a yeast starter of 1.5 quarts (1.4 L), ferment, and mature for three to six weeks then bottle or keg.

Photo by Istockphoto

2. *This is my version of this beer, but another version is given by the Durden Park Beer Circle (1991). For the sake of uniformity, I have kept the batch size to 5 gallons (19L); however, because of the large quantities of malt involved, you may well find it more practical to reduce it to 3 gallons (11.4L). I have used an "unauthentic" American hop, simply because I wanted to use a high-acid hop, so as to limit the amount of trub in the boiler. The figure of 100 IBU I have given is a calculation, and it will probably be less than that, because of limits on the solubility of iso-alpha acids in this high gravity wort.*

The significance of this beer is that it was one of (if not the) original Russian imperial stouts, exported by Barclay to Russia from London. The recipe here gives an excellent imperial stout, very full-bodied and chewy with background notes of toffee, licorice, roast coffee, and raisin, backed up by firm hop bitterness. I recently tried a 7-year-old sample, and it had lost nothing in the keeping!

Incidentally, we did not brew a version of this at BAR, because it was just too big a beer to cope with, with the combination of production pressures and vessel capacities. Size does matter! Equally, an extract version is not practical, because the large proportion of brown malt would mean too great a scale for a partial mash to be carried out.

BARCLAY'S IMPERIAL BROWN STOUT

(5 gallons/19 L, all-grain)
OG = 1.109 FG = 1.040
IBU = 100+ SRM = 56 ABV = 10.4%

INGREDIENTS

13 lbs. (5.9 kg) Maris Otter 2-row pale malt (4 °L)
6.5 lbs. (2.95 kg) Crisp brown malt (65 °L)
3 lbs. (1.36 kg) Crisp amber malt (29 °L)
1 lb. (0.45 kg) Bairds black malt (550°L)
36 AAU Columbus pellet hops (90 min.) (3 oz./85 g at 12% alpha acids)
Wyeast 1098 (British Ale) or White Labs WLP007 (Dry English Ale) yeast (as a 3-qt./3-L starter)
½ cup corn sugar (if priming)

STEP BY STEP

Mash at 150 to 151 °F (66 °C) with 29 quarts (27 L) of water; you will probably need to sparge to collect at least 7 gallons (26.5 L) and boil down to 5 gallons (19 L) to obtain the target gravity. If so, add the bittering hops for the last 90 minutes of the boil. At the end of the boil, chill the wort rapidly to fermentation temperatures and pitch the yeast. Ferment using a yeast starter of 3 quarts (2.8 L) from three packs of yeast, and mature six months minimum then bottle or keg.

3. *This is here for a couple of reasons, the first being that it comes from a book published for Americans in America in 1815. The author, Joseph Coppinger, was an Englishman, but had lived in America for some years. It is not clear whether he actually brewed in the United States, however, and he makes a plea for the "citizens of the town" to set up a brewery, presumably in New York, as that was where the book was published. The second reason is that it cites the use of Essentia Bina, or porter coloring. This enabled him to offer a recipe for a beer based only on pale malt, and using no brown or porter malt at all. But do note that Coppinger referred to Essentia Bina as also being made from molasses, which would have been a very American approach, although he stated that using*

molasses gave a product inferior to that made from Muscovado sugar.

What of the beer itself? Well, my version was not the best beer I have ever drunk, although it was quite pleasant. Despite the numbers I have estimated for color above, this was relatively light-colored for a porter, although still with a nice warming red hue to it. It was quite malty, with some roasted/burnt notes from the Essentia Bina, and backed with very definite hop bitterness. Which leaves open the question as to how it might have tasted if I hadn't been too much of a wimp to set my caramelized sugar alight, doesn't it?

PALE PORTER

(5 gallons/19 L, all-grain)
OG = 1.092 FG = 1.018
IBU = 90 SRM = 37 ABV = 10.7%

INGREDIENTS

17 lbs. (7.7 kg) British 2-row pale malt (2 °L)
1.5 lbs. (0.68 kg) brown sugar as Essentia Bina* (see step by step)
24 AAU Columbus pellet hops (90 min.) (2 oz./57 g at 12% alpha acids)
White Labs WLP004 (Irish Ale) or Wyeast 1084 (Irish Ale) yeast (as a 2-qt./1.8-L starter)
⅔ cup corn sugar (if priming)

STEP BY STEP

*Prepare the Essentia Bina as follows: Take the sugar (use the darkest form you can find) and dissolve it up with about ¼ pint of water in a shallow saucepan; boil the mixture until it starts to caramelize and bubble. Continue heating until a sample taken solidifies immediately when placed on the back of a cold spoon, and turn the heat off. Immediately add ½ pint of cold water, stirring vigorously so the whole mixture takes on the consistency of a syrup, adding more cold water if necessary. Note that Joseph Coppinger (1815) recommends setting fire to the mixture as the heat is turned off, and allowing it to burn for several minutes, and I have seen similar suggestions in several English references. You can try this if you want to; I did not, as I have seen how quickly sugar can burn, and I did not want a fire in my kitchen! I had no way to determine what the color of my Essentia Bina was, so the numbers given above are a pure guess, in which I assumed 100 °L for it (by visual examination). Note that the OG may be a little higher than I have given, depending upon how far you have taken the caramelization of the Essentia Bina.

Mash at 152 to 154 °F (67 to 68 °C) with 21 quarts (20 L) of water; add all hops at the start of the boil, and the Essentia Bina at the end of the wort boil. At the end of the boil, chill the wort rapidly to fermentation temperatures and pitch the yeast. Ferment using a yeast starter of 2 quarts (1.9 L) from two packs of yeast, and mature three to six weeks then bottle or keg.

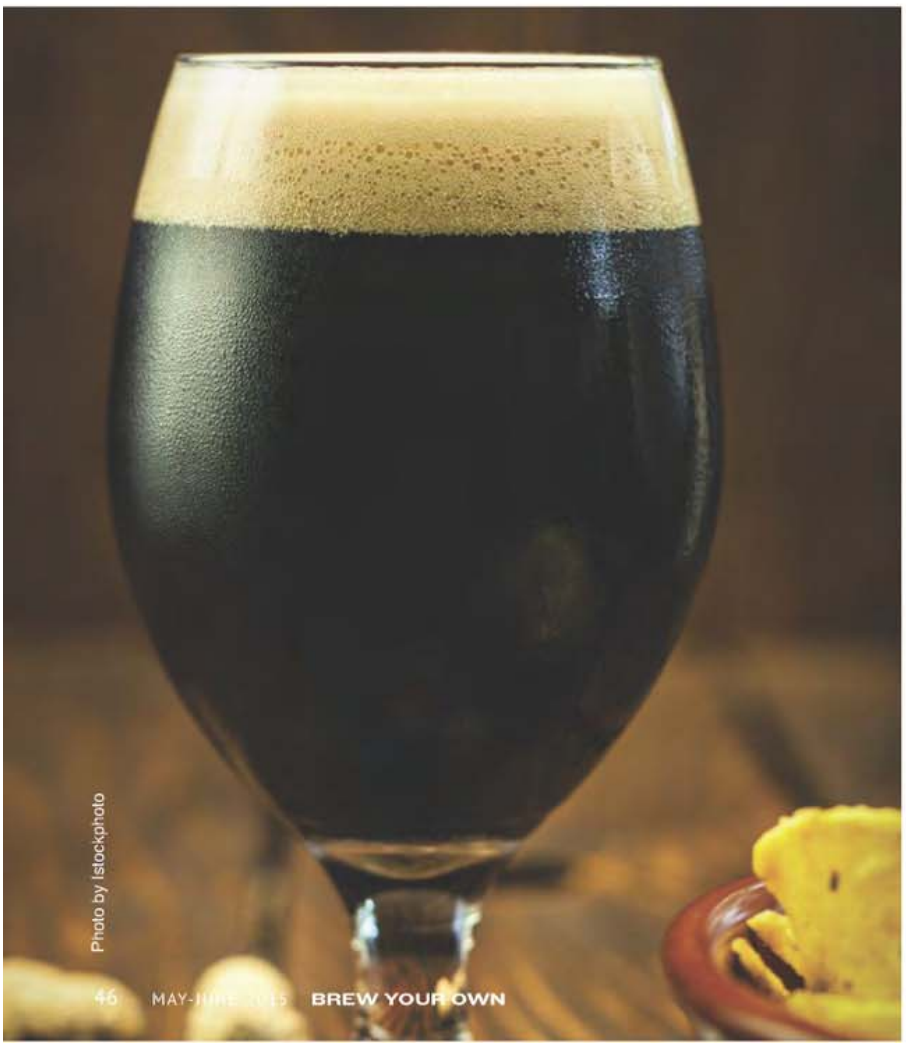


Photo by Istockphoto

4. *This is not a re-creation from the past, but an American beer brewed at BrüRm@BAR and designed by assistant brewer and fireman Dave Wood (hence the title). Dave thinks of it as being a porter, but it could be described as an oatmeal stout also. I prefer to call it a brown porter, because the black malt flavors are quite soft and not harsh, so that it has only background roast flavor, with chocolate and coffee hints and a malty licorice character up front, together with slight spiciness from the late-added Goldings hops.*

Big Wood Porter

(5 gallons/19 L, all-grain)
OG = 1.064 FG = 1.016
IBU = 53 SRM = 50 ABV = 6.4%

INGREDIENTS

9 lbs. (4.1 kg) Briess Ashburne® mild ale malt (5 °L)
2.75 lbs. (1.25 kg) Crisp brown malt (65 °L)

1 lb. (0.45 kg) Briess Blackprinz® malt (500 °L)
0.5 lb. (227 g) Simpson chocolate malt (410 °L)
0.5 lb. (227 g) rolled oats
12 AAU Northern Brewer pellet hops (1.4 oz./40 g at 8.5% alpha acids) (90 min.)
2.5 AAU East Kent Golding pellet hops (30 min.) (0.5 oz./14 g at 5% alpha acids)
1 oz. (28 g) East Kent Golding pellet hops (0 min.)
White Labs WLP002 (English Ale) or Wyeast 1968 (London ESB Ale) yeast (as a 3-qt./2.8-L starter)
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in at 150 to 152 °F (66 to 67 °C) with 17 quarts (16L). Boil for 90 minutes, adding Northern Brewer hops at start, the first portion of Goldings at thirty minutes before the boil is finished, and the second portion at the end of the boil. At the end of the boil, chill the wort rapidly to fermentation temperatures and pitch the yeast. Mature two to four weeks then bottle or keg.

5. *This is my homage to Igor Sikorsky, the helicopter manufacturer whose factory sits at the bottom of the hill at the top of which I live. It was inspired by Stratford's new commercial enterprise, Two Roads Brewing, and their imperial stout, Igor's Dream. It is not a match for their recipe (Phil Markowski wouldn't give it to me!), but is simply something I put together after tasting the beer. Phil did emphasize the rye character of their beer, which was enhanced by aging it in rye whiskey barrels. That may not be practical for you, unless you want to experiment by adding a little (very little!) rye whiskey to your beer. A key to this beer is good attenuation, because it should definitely not finish sweet, or the rye malt spiciness will not come through on the palate. For that reason, I went for a low roast chocolate and no black malt in the grist, so the roast flavors sit in the background and do not dominate everything else.*

Russian Émigré Imperial Stout

(5 gallons/19 L, all-grain)
OG = 1.101 FG = 1.020
IBU = 78 SRM = 39 ABV = 11.8%

INGREDIENTS

12 lbs. (4.3 kg) US 2-row pale malt (2 °L)
2 lbs. (0.91 kg) Briess Munich malt (10 °L)
2 lbs. (0.91 kg) Briess rye malt (4 °L)
2 lbs. (0.91 kg) Fawcett crystal rye malt (75 °L)
2 lbs. (0.91 kg) Briess Carabrown® malt (55 °L)
1.5 lbs. (0.68 kg) Fawcett pale chocolate malt (200 °L)
21 AAU Magnum pellet hops (90 min.) (1.5 oz./43 g at 14% alpha acids)

White Labs WLP007 (Dry English Ale) or Wyeast 1098 (British Ale) yeast (as a 3-qt./2.8-L starter)
¾ cup corn sugar (if priming)

STEP BY STEP

Mash at 150 to 152 °F (66 to 67 °C) with 27 quarts (26 L) of water. You will need to sparge to collect 7 to 8 gallons (26 to 30 L) of wort, and then boil down to 5 gallons (19 L) in order to achieve your target gravity. Add the hops only for the last ninety minutes of the boil. After the boil cool and use a yeast starter of at least 3 quarts (2.8 L) made from three packs of yeast, and preferably to oxygenate the wort before pitching the yeast. At the end of the boil, chill the wort rapidly to fermentation temperatures and pitch the yeast. Mature three to six months then bottle or keg.

Russian Émigré Imperial Stout

(5 gallons/19 L, extract with grain)

OG = 1.101 FG = 1.020
IBU = 78 SRM = 39 ABV = 11.8%

INGREDIENTS

3.3 lbs. (1.5 kg) extra light dried malt extract
3.3 lbs. (1.5 kg) Munich liquid malt extract
3.3 lbs. (1.5 kg) rye liquid malt extract
1.25 lbs. (0.57 kg) Fawcett crystal rye malt (75 °L)
1.25 lbs. (0.57 kg) Briess Carabrown® malt (55 °L)
1.5 lbs. (0.68 kg) Fawcett pale chocolate malt (200 °L)
21 AAU Magnum pellet hops (90 min.) (1.5 oz./43 g at 14% alpha acids)
White Labs WLP007 (Dry English Ale) or Wyeast 1098 (British Ale) yeast (as a 3 qt./2.8-L starter)
¾ cup corn sugar (if priming)

STEP BY STEP

Steep the crushed malt separately in a large muslin bag with 2 gallons (7.6 L) of water at around 160 °F (71 °C). Strain off the grains and rinse them with two lots of 1 gallon (3.8 L) hot water and use this wort to dissolve the extract. You will need at least 6 gallons (23 L) of wort to boil down to 5 gallons (19 L) in order to achieve target gravity. Boil the wort for 90 minues. Add the hops at the start of the boil. At the end of the boil, chill the wort rapidly to fermentation temperatures and pitch the yeast. Ferment using a starter of at least 3 quarts (2.8 L) made from three packs of yeast, and preferably to oxygenate the wort before pitching the yeast. Mature three to six months then keg or bottle. BYO

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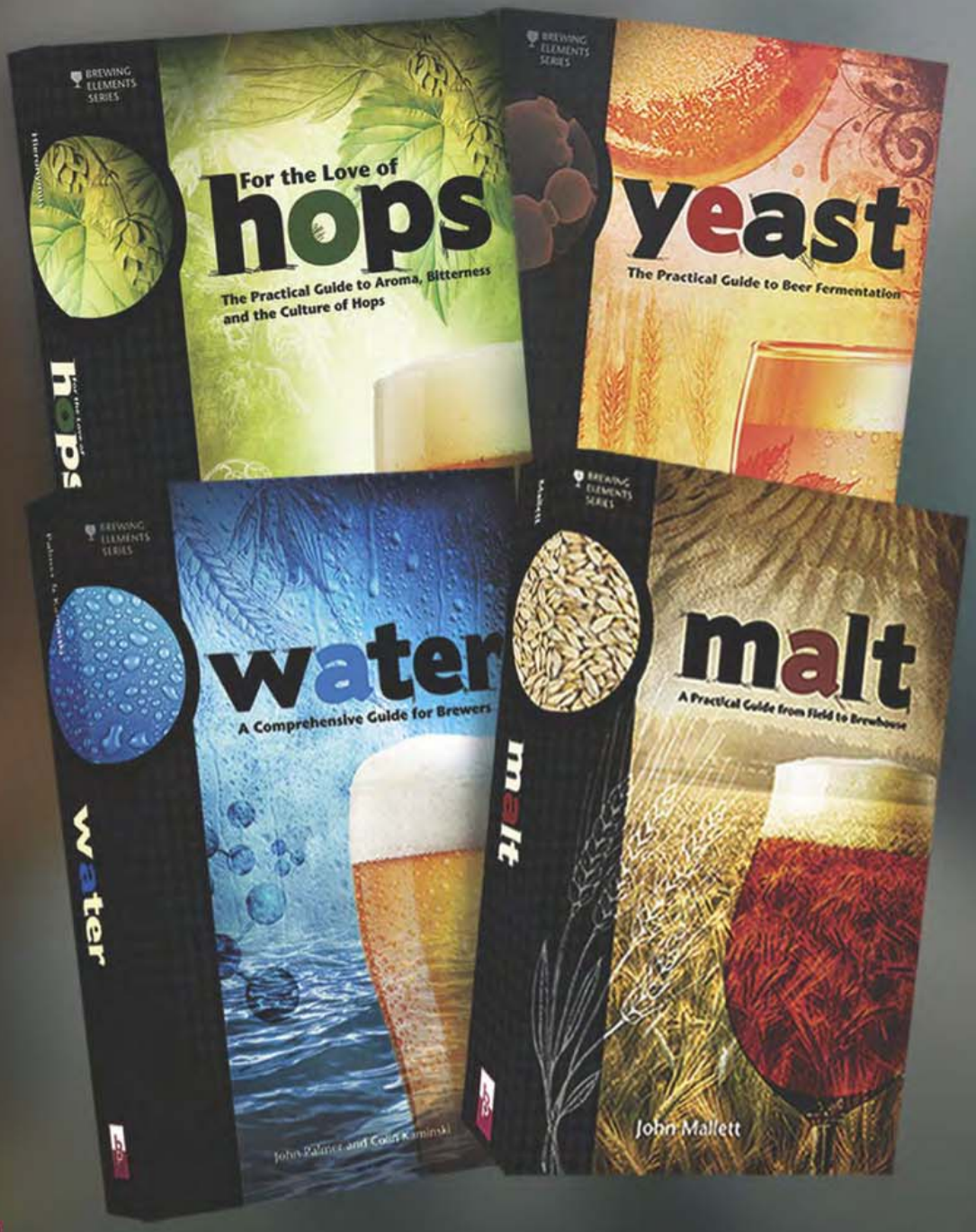

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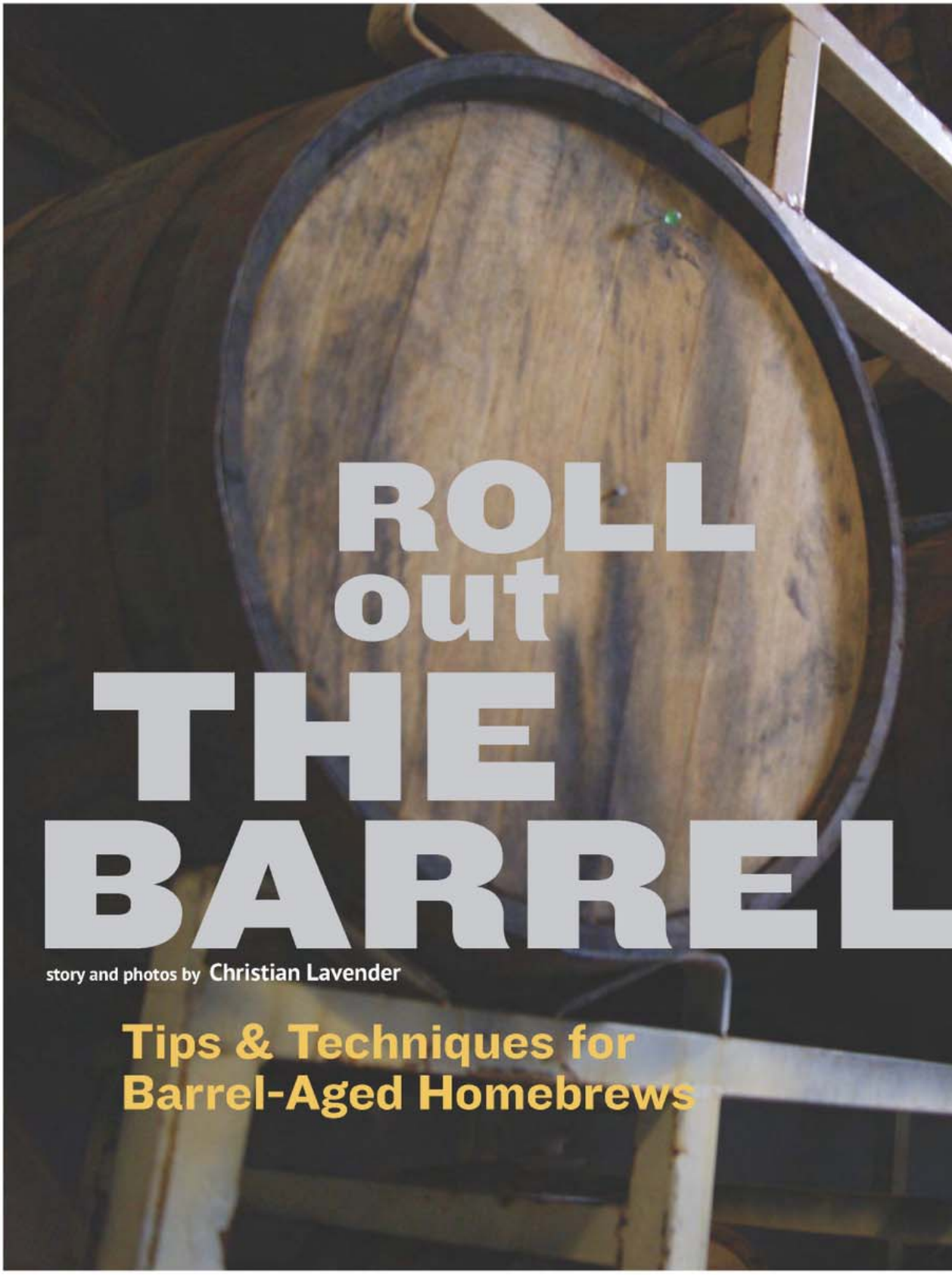


ROLL out THE BARREL

story and photos by Christian Lavender

Tips & Techniques for Barrel-Aged Homebrews

I started barrel aging beer over a decade ago after attending a National Homebrewers Conference. It is amazing to watch the trend start up again with the little guys and trickle up to large production breweries. Now every big brewery has some variation of a whiskey stout this or a double bourbon barrel aged that.

Barrel aging beer is not a new trend, but it does seem to be one that goes in and out of fashion. Simply put, making beer in barrels sounds cool, but it is not as easy as just putting beer in a barrel. The easier route, especially on a small scale, is to add wood cubes, chips, planks, or spirals to achieve similar flavors (read more about these alternatives on page 55). But there is something about working with a real wooden barrel that makes a beer exciting.

Barrels are fickle objects and must be dealt with quickly after a distiller, vintner, or brewer has dispatched its contents. The fresher the barrel, the more moisture content is locked in the wood. That liquid (wine or spirit) is what keeps a liquid-tight seal on the barrel and also contributes its own flavor to the beer.

The wood adds additional aromas and flavor components such as vanillin, tannins, spice, and toast that homebrewers can use to their advantage. Many craft breweries have barrel programs dealing in wine and liquor barrel-aged brews. The barrels they use usually range from 55 to 65 gallons (208 to 246 L) and are sourced from major liquor distilleries, barrel brokers and vineyards from across the country. These larger barrels are normally too large for homebrewers, unless you are having a club brew session to help fill it up (which is a very fun group project by the way. Read a column about a club that did this at http://byo.com/story3150).

The increasing availability of (5- to 15-gallon/19- to 57-L) American and French oak barrels are making it easier for homebrewers to create an authentic barrel-aged beer at home. You can find these smaller barrels on various homebrew websites, as well as some larger or better-stocked local homebrew retailers. Many distillers across the country are choosing to age their whiskey, rum, and bourbon in smaller barrels because of the higher surface-to-volume ratio. Distillers can age their spirits for six months instead of 12 months and achieve the similar flavor profiles. This is advantageous for the brewer also, as the rate at which the beer absorbs the flavors from the oak in smaller barrels is much greater than the rate in larger barrels. As a result, beer aged in smaller oak barrels may become over-oaked if not watched (tasted) often to achieve the perfect balance.

BARREL ANATOMY

There are a few parts that make up a wooden barrel. The wood slats (staves) are cut to specific shapes in order for the wood worker (cooper) to be able to form the barrel's shape. The staves are put on their ends in a temporary hoop and toasted over a burning bucket of wood.

The wood is heat steamed by applying water to the interior and exterior then bent slowly until it reaches the desired shape. Barrel caps (heads) are assembled using staves and cut into their circular shape. The heads and riveted metal ring (hoops) are then put into place with special coopering tools. Finally a hole is drilled through a strong stave for a cork (bung).

The wood chosen for making barrels must be mature, straight, and knot-free. Wood that is low in sap is also ideal. White oak is traditionally used due to its pliability and tight grain composition.

Once the barrels have been assembled, the cooper will sand, plane, and polish the exterior. The barrels are filled with water to check

OAK TYPES

There are many types of oak barrels and alternatives, though the three most popular varieties are American, Hungarian, and French. French oak provides the mildest flavor including some sweet vanilla hints, while American oak gives the strongest oak flavor. Hungarian oak provides a middle ground. The flavor of oak also can be changed by toasting your oak. Dark toasted oak has a more carbonized or carmelized flavor while lightly toasted or untoasted oak has a much more mild flavor. Toasting is usually graded on a light-medium-heavy scale and you can also purchase wood chips toasted at these different levels.

~ Brad Smith

If when you find that your barrel is dried out, which can lead to leaking between the staves, submerge it in water for 24 hours and the wood should swell back up.

for leaks, and after passing inspection the barrels are ready.

PREPARATION FOR USE

Barrels are an ideal breeding ground for wild yeast and bugs (bacteria), so when a new barrel arrives at your doorstep, especially one used for winemaking or brewing, you need to hit it with hot water as soon as possible to keep the microorganisms under control. The hot water bath will kill off some surface bacteria and wild yeast, but not those found deep in the porous wood.

FIRST USE BARREL PREP LIST:

1. Inspect the barrel for damage or leaks
2. Fill barrel with 140–185 °F (60–85 °C) water
3. Soak barrel for 60 minutes
4. Clean exterior of barrel with Powdered Brewery Wash (PBW)
5. Dump barrel contents and fill with fresh wort

Just like fermenting in carboys, when fermenting in barrels you need to keep your homebrew protected with an airlock and bung to prevent exposure to air.

DRY BARRELS

If your barrel is dried out, and you find after filling it that it is leaking, you can submerge the barrel in water for 24 hours and the wood should swell back up (see photo at left). Ratchet straps can come in handy for holding together loose staves and heads during the re-swelling process.

FERMENTING IN BARRELS

Once your wort has been inoculated in the barrel it is best to keep it fitted with an airlock or barrel blowoff assembly (see photo below). Beer fermenting in wooden barrels gets very active causing high kräusens, and some beer will go through the airlock or blowoff and beer will be lost. You will need to top off the barrels after the initial round of fermentation to reduce exposure to airborne contaminants and oxygen in the barrel headspace. It helps to brew an additional round of wort, or a larger initial batch (fermenting the rest in a carboy), for topping barrels off. If you find yourself without additional wort for topping off, you can use sterilized marbles to displace the beer and reduce air exposure inside the barrel.

Barrels can be fermented in a large range of temperatures. You can cold ferment barreled beer or ferment barreled beer at high temperatures. Most beers are fermented at cellaring temperatures, but this is not necessary for all styles.

SAMPLING

As your beer ferments you should taste it periodically. Don't open the bung and pull a sample with a wine thief (a tube winemakers use to extract a sample from a barrel). This opens the barrel up to oxygen (which causes oxidation in beer).

Instead, use a stainless steel nail (Vinnie Nail) in the barrel head to create a sampling port. (Pre-drill the hole before filling, so you don't split the wood.) See the photo at the top of page 54 for an example.

Drill a hole using a $^{7}/_{64}$-inch drill bit on the bottom of the barrel head

To prevent exposing your homebrew to air when sampling, drill a small hole and use a stainless steel nail to make a sampling port that you can easily open and close.

The best way to store barrels is to not store them at all — just keep filling them with beer. If you can't, however, clean them well and periodically inject a blanket of CO_2.

(6 o' clock position). Have two sizes of stainless steel nails on hand from McMaster-Carr:

- 1-½-inch 4d smooth common nail-316 stainless steel #97990A102
- 2-inch 6d smooth common nail-316 stainless steel #97990A104

AGING IN BARRELS

After primary and secondary fermentations have finished, depending on the style, it is time to barrel age your homebrew. Beer can be aged for varying times depending on the beer style and maturation period needed.

As the brewer, you can age anywhere from two weeks to many years. The smaller homebrew-style barrels tend to impart oak flavor much quicker due to the surface ratio, so a few weeks to a month is usually enough. It takes at least six months for the *Brettanomyces* (wild yeast) to show any signs of the work it has been doing, and *Lactobacillus* and *Pediococcus* (bacteria) are not much faster, depending on the strain. Some of the most common beer styles for barrel aging include:

Wild ale
Double IPA
Imperial porter
Imperial stout
Barleywine
Strong ale
Belgian blonde
Belgian quad
Belgian tripel
Belgian dubbel
Grand cru
Imperial brown
Imperial pumpkin
Lambic/gueuze
Saison/farmhouse
Imperial red ale
Winter warmer
Holiday/spiced ale
Doppelbock

TRANSFERRING BEER

You can use gravity and auto-siphon beer out of a barrel and into bottles or kegs, but you expose the beer to more oxygen. I made a small gas barrel transfer tool for a true closed transfer with limited exposure to O_2. With just a few parts you can transfer beer from barrel to bottle or keg using CO_2. See sidebar at the top of page 66 for details on building your own.

CLEANING AND STORING BARRELS

Once you have transferred the beer out of the barrel it is time for cleaning. The best way to keep an oak barrel clean is to always have it filled with beer. It is a good idea to plan your barrel aged beer program schedule in advance so you always have a new beer ready to fill the barrel as soon as you empty it.

Flush the barrel with warm water to remove the left over trub and fill it immediately with a new beer. Flushing the barrel with hot water should kill off a good portion of the microbial flora that coats barrel walls and outer barrel surfaces.

OAK METHODS AND ALTERNATIVES

The use of oak and other woods in flavoring beer has enjoyed a resurgence recently among homebrewers and some craft breweries. Oak is commonly used in winemaking, and was once widely used to barrel beer. If a whole barrel is not an option for you, there are other ways of getting oak into your homebrew.

OAK CHIPS - These are the most popular form used in homebrewing. Typically the chips are sold in a bag and look like wood shavings. The small chips have a large surface area that delivers the oak flavor to the beer quickly. The only disadvantage is that the small chips can be hard to separate from the finished beer, so you should use a bag with them.

OAK CUBES - Packages of cubes are also widely available from homebrewing supply shops. They work similarly to chips but take longer to impart their flavor as they have much less surface area than oak chips. However the advantage of cubes is that they can easily be separated from the beer when you are finished aging.

SPIRALS - Though less common than cubes or chips, spiral-cut oak is a product that offers a large surface area similar to chips, but are still easy to remove like cubes. Therefore they still impart flavor to the beer quickly but allow for easy removal. Their only disadvantage is that they are more expensive than chips or cubes.

OAK ESSENCE AND OAK POWDER - Oak essence (such as Sinatin 17) is a liquid flavor extract that can be stirred in at bottling time to taste. Oak powder is similar - essentially it is a powdered oak flavor stirred into the beer. Both work instantly and can be added in small amounts to taste.

OAK FLAVORING METHODS

Three major methods are available to homebrewers when using oak:

OAK AGING - The simplest method, which involves adding the oak chips/spirals/cubes after fermentation while aging the beer. Also this is the method used with barrels, since you store the beer in the oak barrel. I recommend sanitizing the chips/spirals/cubes first by steaming them for 15 minutes to reduce the risk of infection (don't use sanitizing solution as it is absorbed by the chips). Most homebrewers add their oak shortly after fermentation completes and before bottling (i.e. in the secondary) and leave the oak in there until they achieve the desired taste, sampling every day or two. Some homebrewers with keg systems also add the oak chips/cubes in the keg itself, containing it in a bag so it will not block the keg's dip tube. Oak aging can take anywhere from a few days to several months depending on the oak used and desired flavor level.

OAK TEA - You can boil the oak to make an oak tea. Simply drop your chips/spirals/cubes in enough water to cover them fully and bring it to a boil for 10–15 minutes. Once the tea is complete you can add it a bit at a time to the finished beer until you achieve the overall beer flavor you desire. Making a tea is much faster than aging with oak, and also lets you more closely control the flavor.

LIQUOR TEA - If you are looking to add bourbon, whiskey, or your favorite liquor flavor to the beer you can make a tea using liquor instead. In this case you add the chips/cubes/spirals to a small amount of your favorite liquor (possibly diluted a bit with water) and let it sit for a week. Then mix the liquor in with your beer in small amounts until you achieve the desired overall flavor. Alternatively, you can add just the soaked chips/cubes/spirals to your beer. Obviously moderation is important here as the liquor can easily overpower the flavor of the beer or wood chips.

~ Brad Smith

Photos by MoreFlavor!

STORAGE

If you do not have a new beer ready to fill the barrel then you should fill the barrel with hot water and let it soak for an hour. Dump the water, cap (bung) and store the barrel in a cool dark place.

If you have the ability, inject a CO_2 blanket into the barrel to retard microbial growth. As barrels breathe the CO_2 will dissipate, so repeat the process as necessary during long storage sessions.

Most professional brewers do not recommend storing empty barrels. It is just a matter of time before the barrels dry out or become overrun with wild yeast or bacteria. Some professional brewers use a hot steam system to sanitize their barrels, but this is not very practical on a homebrew scale.

Do not store barrels filled with water for an extended period of time. This is a breeding ground for barrel bacteria like *Acetobacter*. I also don't recommend using chemicals for storage purposes.

SEPARATE EQUIPMENT

Remember that any piece of equipment that comes in contact with a sour beer in your homebrewery should be isolated from any "clean" brewing in the future. *Brett*, *Lacto* and *Pedio* are very resilient and are difficult to completely sanitize off equipment. If you don't do this you may end up with every beer you make being a sour beer. Isolate plastic transfer hoses, airlocks, bungs, connectors, glass/plastic carboys, transfer gaskets and siphons. Basically any soft rubber parts should not be used again for clean brewing in the future.

A great book on brewing with barrels, wild yeast, and microorganisms is *Wild Brews: Beer Beyond the Influence of Brewer's Yeast* by Jeff Sparrow (Brewers Publications, 2005). There is a nice chapter on how to manage a barrel and more than enough information for a homebrewer to be successful making their own barrel aged beer at home. Another book that I recommend is

American Sour Beers: Innovative Techniques for Mixed Fermentations (Brewers Publications, 2014), written by The Mad Fermentationist (and new *BYO* "Advanced Brewing" columnist), Michael Tonsmeire.

A free barrel basics guide is also available for download on my website (http://www.homebrewing.com/articles/barrel-basics.php) for homebrewers looking for more information about brewing beer in wood barrels.

BARREL QUESTIONS AND ANSWERS WITH PROFESSIONAL BREWERS

For a larger scale perspective on barrel aging, I sat down with Josh Hare of Hops & Grain Brewing and Joe Mohrfeld of Pinthouse Pizza Brewpub (both in Austin, Texas) to discuss their barrel programs, and got some insight from these two passionate homebrewers turned pro.

The first is Josh Hare, the founder of Hops & Grain Brewing, who has been homebrewing beer since he was 17, and came to Austin via Boulder, Colorado where he trained and competed as a triathlete. He opened the brewery, which focuses on sustainable practices, in Austin in 2011.

"CREATE A BEER FOR THE BARRELS, NOT THE OTHER WAY AROUND."
- JOSH HARE, HOPS & GRAIN BREWING

Q: How can a first-time barrel user get good results from a barrel?

A: A homebrew recipe you may have

success fermenting/aging in steel or plastic could curtail or amplify flavors you weren't expecting in a barrel, so I recommend that you taste as you go. Whether you are going for a clean or sour beer it is always good to keep some type of flavor stage journal. We (Hops & Grain) created a series of flavor stages for our sour (*Brettanomyces*) barrel program that includes descriptors of taste and aroma. It has really helped us identify where the beer is at any point during the aging process.

Once you get familiar identifying the stages fermenting wild yeast goes through you will quickly know where your beer is in the aging/souring process. *Brett* (wild yeast) goes through many phases, during which some kick off horrible aromas like wet barnyard and dirty diapers. This is what I call the rank stage. Wait a few more months and it all changes.

Q: How long should a beer be aged in a barrel?

A: Patience is key in any barrel project. Most beers are put in the barrels and sealed off for four to six months. Some beers finish quicker than others, so it is just a matter of tasting the beers and determining if they are finished.

Q: Can an oak barrel be used more than once?

A: Oh yeah, two to three times for clean beers and then infinite sours. If souring with wild yeast and bacteria in a barrel, keep all your transfer equipment separate from equipment used for clean beer transfers. A wild barrel can never be fully cleaned for brewing a regular brewer's yeast beer again.

Q: Is fermenting in a barrel ok?

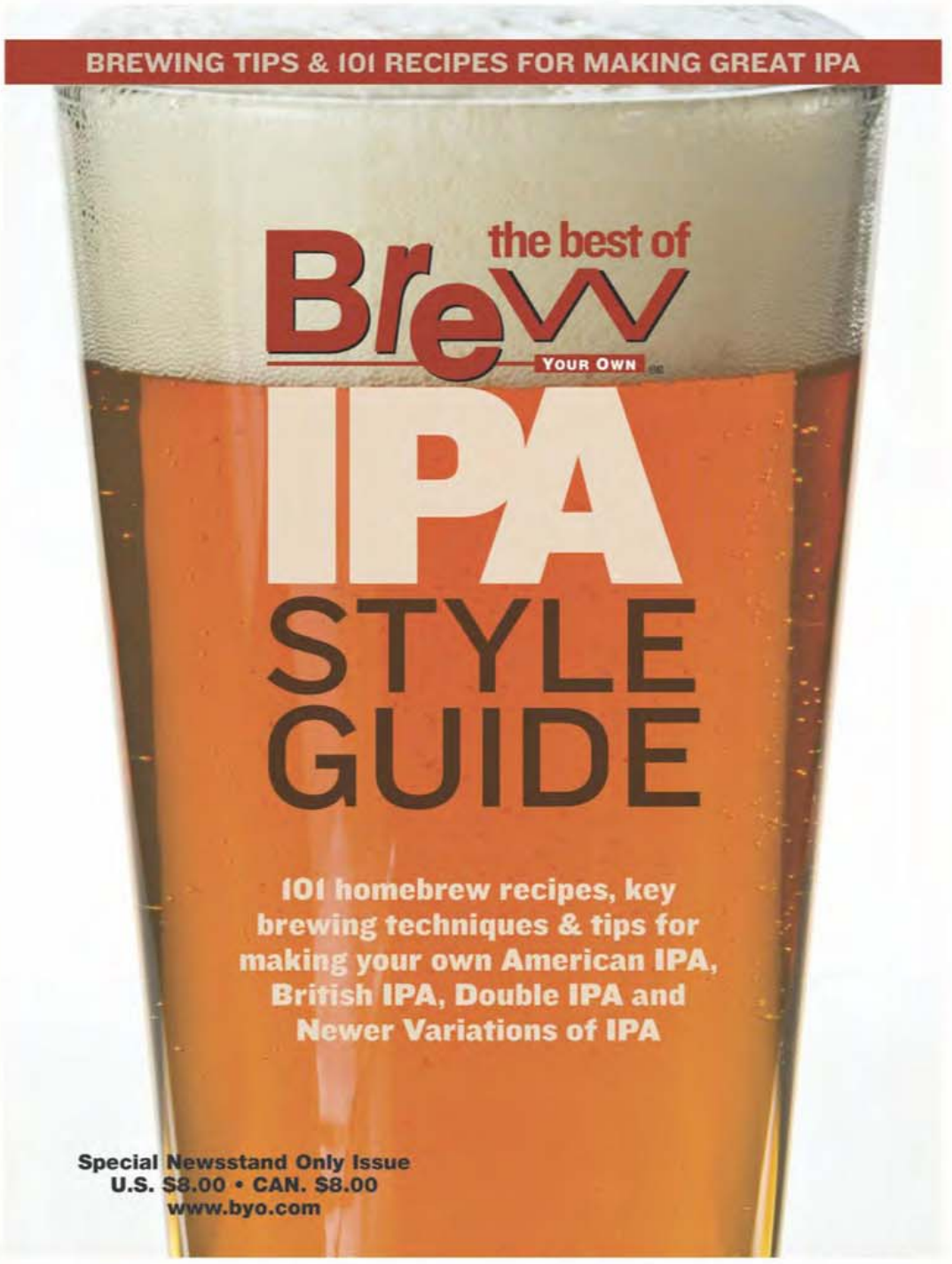
A: Use a tight fitting blow off tube if you are fermenting in the barrel and run it into something like a bucket of sanitizer and you should be alright.

Q: What else should a homebrewer do before bottling or kegging barrel beer?

A: With barrel beers I find that carbonation only intensifies the barrel aromatics. Sometimes I think an aroma or flavor is low-key until I carb up the beer and then POW. Just remember that when you are doing your sampling. You can try ratio blending a small sample with CO_2 when doing your final tasting, so you don't ruin a whole batch.

Now on to Joe Mohrfeld. A transplant from the Odell Brewing Company in Colorado, Joe recently set up shop in Austin, Texas as the Head Brewer at Pinthouse Pizza Brewpub. Joe is no stranger to brewing beer in barrels. At Odell he managed their ever changing

COMING SOON!



The newest addition to the Best of Brew Your Own special issue series. Keep an eye on byo.com/store or sign-up for the BYO e-newsletter on the Byo.com homepage to be notified when the new *IPA Style Guide* is released!

***Retailers – contact us at dave@byo.com or 802-362-3981 ext. 107 to be the first to carry the *IPA Style Guide* for your homebrewing customers.**

BARREL CLONE RECIPES

"Curieux is a fairly simple recipe starting with our Tripel, which is then aged in bourbon barrels and blended with another batch of fresh Tripel. The vast majority of brewers here started out homebrewing so we all get excited anytime we get to do anything homebrew-related."

– Michael O'Connor, Allagash Brewing Company

ALLAGASH BREWING COMPANY CURIEUX CLONE

(5 gallons/19 L, all-grain)
OG = 1.073 FG = 1.006
IBU = 30 SRM = 4 ABV = 9.3%

INGREDIENTS

12 lbs. (5.4 kg) 2-row pale malt or Pilsner malt
1.7 lbs. (0.77 kg) granulated sugar (10 min.)
3 AAU German Perle hops (75 min.) (0.8 oz./23 g at 8% alpha acids)
3 AAU German Spalt hops (10 min.) (0.9 oz./26 g at 4.2% alpha acids)
0.9 oz. (26 g) Styrian Golding hops (0 min.)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc® tablet (10 min.)
Bourbon soaked oak chips or spirals
Wyeast 3787 (Trappist High Gravity) yeast or White Labs WLP530 (Abbey Ale) or Wyeast 1214 (Belgian Abbey) or White Labs WLP550 (Belgian Ale) or yeast harvested from Allagash White yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash at 149 °F (65 °C) for 45 minutes using 3.75 gallons (14.2 L) of strike water. You can perform a mash-out if you'd like but it's not necessary. Run off and boil the wort for 90 minutes adding hops at times indicated in the ingredients list. Add the sugar, yeast nutrients, and Whirlfloc® with 10 minutes remaining in the boil.

After the boil, chill the wort to 65 °F (18 °C) and oxygenate. Rack to your fermenter and pitch healthy yeast. Allagash has their our own proprietary strain of yeast. The ingredients list contains several great strains readily available to homebrewers. O'Connor recommends, "if you're feeling adventurous and practice excellent sanitation, you can propagate the Allagash house yeast from a bottle of Allagash White. Our other beers contain an additional yeast strain added just before packaging so a bottle of white is the only way to procure the house strain. You can allow the temperature to rise after a couple days of fermentation. The beer's terminal gravity should be around 1.006."

For wood-aging and blending, O'Connor states, "we generally age Tripel in bourbon barrels for six to eight weeks at 55 °F (18 °C). It is then blended to taste with fresh Tripel before packaging. Curieux should have a subtle bourbon character with hints of vanilla and coconut. To replicate this at home, try soaking 1–2 oz. of oak chips or spirals in your favorite bourbon for a couple weeks. Then when fermentation is complete, rack into a secondary vessel on top of the bourbon soaked oak. I recommend tasting the beer every two to three days. It probably wont take long for the beer to develop the subtle flavors that you're looking for. Oak cubes are also an option but be aware that the entire process may take much longer- when both soaking the oak in bourbon and aging the beer on the cubes.

"Package the beer as soon as it has developed the desired character. Allagash bottles/keg conditions, but feel free to package the beer any way you choose." If the beer has been aging for several months, you can opt to add extra yeast if you plan to bottle condition this beer.

ALLAGASH BREWING COMPANY CURIEUX CLONE

(5 gallons/19 L, extract only)
OG = 1.073 FG = 1.006
IBU = 30 SRM = 4 ABV = 9.3%

INGREDIENTS

6.5 lbs. (3 kg) Pilsen dried malt extract
1.7 lbs. (0.77 kg) granulated sugar (10 min.)
3 AAU German Perle hops (75 min.) (0.8 oz./23 g at 8% alpha acids)
3 AAU German Spalt hops (10 min.) (0.9 oz./26 g at 4.2% alpha acids)
0.9 oz. (26 g) Styrian Golding hops (0 min.)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc® tablet (10 min.)
Bourbon soaked oak chips or spirals
Wyeast 3787 (Trappist High Gravity) yeast or White Labs WLP530 (Abbey Ale) or Wyeast 1214 (Belgian Abbey) or White Labs WLP550 (Belgian Ale) or yeast harvested from Allagash White yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 6.5 gallons (25 L) water in your brew pot up to a boil. Add the dried malt extract when the water approaches a boil. Stir well then bring it to a boil. Boil the wort for 75 minutes adding hops at times indicated in the ingredients list. Add the sugar, yeast nutrients, and Whirlfloc® with 10 minutes remaining in the boil.

When the boil is complete, chill the wort to 65 °F (18 °C) and oxygenate well. Rack to your fermenter and pitch lots of healthy yeast. Follow the all-grain recipe at left for yeast recommendations and the fermentation and wood-aging instructions. Allagash bottles/keg conditions, but feel free to package the beer any way you choose. If the beer has been aging for several months, you can opt to add extra yeast if you plan to bottle condition this beer.

BARREL CLONE RECIPES

"This is a recipe for Devil's Heart of Gold, a whiskey barrel-aged wheat wine. The base beer, Heart of Gold, won a silver medal at the Great American Beer Festival in 2012. We've only released Devil's Heart of Gold one time, but we plan to do yearly releases from here on out."
– Phil Wymore
Perennial Artisan Ales

PERENNIAL ARTISAN ALES DEVIL'S HEART OF GOLD CLONE

(5 gallons/19 L, all-grain)
OG = 1.104 FG = 1.024
IBU = 60 SRM = 8 ABV = 11.7%

INGREDIENTS

8.5 lbs. (3.9 kg) 2-row pale malt
8.5 lbs. (3.9 kg) wheat malt
3 lbs. (1.4 kg) golden liquid malt extract
18.9 AAU Magnum hops (60 min.) (1.5 oz./43 g at 12.6% alpha acids)
0.83 oz. (24 g) Columbus hops (0 min.)
Whiskey soaked oak chips or cubes
2.5 g Yeastex® (or equivalent yeast nutrient) (15 min.)
1 g Whirlfloc® (or similar kettle fining) (5 min.)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) or Safale US-05 yeast (2-qt./~2-L yeast starter)
¼ cup corn sugar (if priming)

STEP BY STEP

Mash the 2-row and wheat malts at 150 °F (66 °C) for 45 minutes. Use about 6.25 gallons (24 L) of mash liquor. Sparge with enough hot water until you lauter a total of 6.5 gallons (25 L) of wort to the kettle. Add the liquid malt extract to the kettle and mix well to avoid scorching while the wort comes up to a boil. Boil for 60 minutes adding hops at times indicated in the ingredients list. Add the Yeastex® (or equivalent yeast nutrient) with 15 minutes left in the boil and Whirlfloc® (or equivalent kettle fining) at five minutes left in the boil.

When the boil is complete, chill the wort rapidly to yeast pitching temperature and oxygenate well. Rack the wort to your primary fermenter, allowing for plenty of head space. Pitch the yeast (as a 2-qt./2-l yeast starter) and ferment at 68 °F (20 °C) for three weeks.

For wood-aging, Wymore states, "you can use whiskey-soaked oak chips or cubes to your preference and aging time. Purge the headspace in the bucket or carboy with CO_2 in between samplings. If you can get your hands on a freshly dumped whiskey barrel from a distillery, brew this recipe scaled up and split over several brew sessions or among brewing companions, enough to fill the barrel. Purge the head space in the barrel with CO_2 if there is any elapsed time between racking batches to the barrel. Despite your temptations, let the beer age for at least 10–12 months and don't rack it out until you feel it tastes right."

When oak aging is finished, force carbonate the beer in kegs or bottle with priming sugar and fresh pitched yeast such as Lallemand's CBC-1.

PERENNIAL ARTISAN ALES DEVIL'S HEART OF GOLD CLONE

(5 gallons/19 L, extract only)
OG = 1.104 FG = 1.024
IBU = 60 SRM = 8 ABV = 11.7%

INGREDIENTS

9 lbs. (4.1 kg) wheat dried malt extract
3 lbs. (1.4 kg) golden liquid malt extract
18.9 AAU Magnum hops (60 min.) (1.5 oz./43 g at 12.6% alpha acids)
0.83 oz. (24 g) Columbus hops (0 min.)
Whiskey soaked oak chips or cubes
2.5 g Yeastex® (or equivalent yeast nutrient) (15 min.)
1 g Whirlfloc® (or similar kettle fining) (5 min.)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) or Safale US-05 yeast (2 qt./~2 L yeast starter)
¼ cup corn sugar (if priming)

STEP BY STEP

Heat 6.5 gallons (25 L) water in your brew pot up to a boil. Dump in the liquid and dried malt extract and stir until all the extract has dissolved. Boil the wort for 60 minutes adding hops at times indicated in the ingredients list. Add the Yeastex® (or equivalent yeast nutrient) with 15 minutes left in the boil and Whirlfloc® (or equivalent kettle fining) at 5 minutes left in the boil.

When the boil is complete, chill the wort rapidly to yeast pitching temperature and oxygenate well. Rack the wort to your primary fermenter, allowing for plenty of head space. Pitch the yeast (as a 2-qt./2-l yeast starter) and ferment at 68 °F (20 °C) for three weeks.

For wood-aging, Wymore states, "you can use whiskey-soaked oak chips or cubes to your preference and aging time. Purge the headspace in the bucket or carboy with CO_2 in between samplings. If you can get your hands on a freshly dumped whiskey barrel from a distillery, brew this recipe scaled up and split over several brew sessions or among brewing companions, enough to fill the barrel. Purge the head space in the barrel with CO_2 if there is any elapsed time between racking batches to the barrel. Despite your temptations, let the beer age for at least 10–12 months and don't rack it out until you feel it tastes right."

When oak aging is finished, force carbonate the beer in kegs or bottle with priming sugar and fresh pitched yeast such as Lallemand's CBC-1.

BARREL CLONE RECIPES

"Das Uberkind is our most used and versatile barrel-aged beer. We blend it with fresh, hoppy beer to make Das Wunderkind! We use it as the base beer for most of our fruit refermentation beers, and we also package it as a standalone beer."
– Garrett Cromwell, Jester King Brewery

JESTER KING BREWERY DAS UBERKIND CLONE

(5 gallons/19 L, all-grain)
OG = 1.038 FG = 0.999
IBU = 12 SRM = 3 ABV = 5%

INGREDIENTS

6.8 lbs. (3.1 kg) 2-row pale malt or Pilsner malt
0.66 lb. (300 g) unmalted wheat
0.33 lb. (150 g) dark Munich malt
0.33 lb. (150 g) flaked oats
3 AAU Golding hops (60 min.) (0.6 oz./17 g at 5% alpha acids)
Wine soaked oak staves or cubes (prior use is preferred)
Wyeast 3711 (French Saison) yeast
Wyeast 3724 (Belgian Saison) or White Labs WLP565 (Belgian Saison I) yeast
Wild inoculated bugs from local fruits or flower
¾ cup corn sugar (if priming)

STEP BY STEP

Mash at 154–158 °F (68–70 °C) for 45 minutes using 3 gallons (11.3 L) strike water. Boil for 60 minutes adding hops at the beginning of the boil. After the boil is finished, chill the wort and oxygenate well. Rack to your fermenter. Pitch the yeast and bacteria and ferment at 78 °F (26 °C) for two weeks. For wood-aging Jester King generally primary ferments in either stainless or an oak foudre before sending it to smaller, 225-L barrels. Mostly they use neutral wine barrels and find that very subtle oak character complements this delicate beer. You can try to simulate this at home by using oak cubes or staves that have been used once or twice and that have also been soaked in wine. Secondary fermentation takes place at 55–62 °F (13–17 °C). Average fermentation/aging for Das Uberkind is eight to 24 months. Then keg or bottle as you normally would.

JESTER KING BREWERY DAS UBERKIND CLONE

(5 gallons/19 L, partial mash)
OG = 1.038 FG = 0.999
IBU = 12 SRM = 3 ABV = 5%

INGREDIENTS

3 lbs. (1.36 kg) Pilsen dried malt extract
1 lb. (3.1 kg) 2-row pale malt or Pilsner malt
0.66 lb. (300 g) unmalted wheat
0.33 lb. (150 g) dark Munich malt
0.33 lb. (150 g) flaked oats
3 AAU Golding hops (60 min.) (0.6 oz./17 g at 5% alpha acids)
Wine soaked oak staves or cubes (prior use is preferred)
Wyeast 3711 (French Saison) yeast
Wyeast 3724 (Belgian Saison) or White Labs WLP565 (Belgian Saison I) yeast
Wild inoculated bugs from local fruits or flower
¾ cup corn sugar (if priming)

STEP BY STEP

Mash crushed grains at 154–158 °F (68–70 °C) for 45 minutes using 1 gallon (3.8 L) water. Wash the grains with 1 gallon (3.8 L) hot water. Top off to 6 gallons (23 L) and add the dried malt extract. Stir well then bring to a boil. Boil the wort for 60 minutes adding hops at the beginning of the boil. After the boil is finished, chill the wort and oxygenate well. Rack to your fermenter. Pitch the yeast and bacteria and ferment at 78 °F (26 °C) for two weeks. For wood-aging, Jester King generally primary ferments in either stainless or an oak foudre before sending it to smaller, 225-L barrels. Mostly they use neutral wine barrels and find that very subtle oak character complements this delicate beer. You can try to simulate this at home by using oak cubes or staves that have been used once or twice and that have also been soaked in wine. Secondary fermentation takes place at 55–62 °F (13–17 °C). Average fermentation/aging is eight to 24 months. Keg or bottle as normal.

TIPS FOR SUCCESS:

Head Brewer Garrett Cromwell has the following bits of advice to add to the mix: "The specialty malts like Munich, and then flaked oats, rotate based on what we have around the brewery. Sometimes we'll use spelt, or Maris Otter, or malted wheat etc. For the hops, lately we've been adding aged hops for about 30% of our total hop volume with great results. Also we use 100%, unaltered well water for all of our beer. It's pretty high in bicarbonates, but we absolutely love it. For yeast, we use a mixed culture of different yeast and bacteria for all fermentations. These include Dupont yeast, and Thiriez saison yeast, along with a multitude of yeast and bacteria from flowers around our brewery, spontaneous fermentation slurries, etc. These were all blended together one time, and have been evolving as a cohesive culture since being used in our brewery. We maintain this culture in-house. Bottle dregs from any of our beers would be best to approximate the fermentation character we achieve."

BARREL CLONE RECIPES

"Fistful of Hops is a quarterly rotating seasonal IPA, which means every three months the hops change. We usually combine two to three varieties of hops together for each new release. The same varieties and proportion of hops are used all the way through the recipe including dry hopping."
– Dave Colt
Sun King Brewery

SUN KING BREWING CO. TEQUILA BARREL-AGED FISTFUL OF HOPS CLONE

(5 gallons/19 L, all-grain)
OG = 1.058 FG = 1.010
IBU = 78 SRM = 13 ABV = 6.4%

INGREDIENTS

11 lbs. (57 kg) 2-row pale malt
10 oz. (283 g) flaked rye
8 oz. (227 g) Weyermann Caraaroma® malt (130 °L)
12.5 AAU Warrior® hops (70 min.) (0.75 oz./21 g at 16.6% alpha acids)
2.4 AAU Mosaic™ hops (20 min.) (0.2 oz./6 g at 12% alpha acids)
2.6 AAU Nelson Sauvin hops (20 min.) (0.2 oz./6 g at 13% alpha acids)
1.9 AAU Amarillo® hops (20 min.) (0.2 oz./6 g at 9.4% alpha acids)
4.2 AAU Mosaic™ hops (5 min.) (0.35 oz./10 g at 12% alpha acids)
4.5 AAU Nelson Sauvin hops (5 min.) (0.35 oz./10 g at 13% alpha acids)
3.3 AAU Amarillo® hops (5 min.) (0.35 oz./10 g at 9.4% alpha acids)
6 AAU Mosaic™ hops (0 min.) (0.5 oz./14 g at 12% alpha acids)
6.5 AAU Nelson Sauvin hops (0 min.) (0.5 oz./14 g at 13% alpha acids)
4.7 AAU Amarillo® hops (0 min.) (0.5 oz./14 g at 9.4% alpha acids)
0.5 oz. (14 g) Mosaic™ hops (dry hop)
0.5 oz. (14 g) Nelson Sauvin hops (dry hop)
0.5 oz. (14 g) Amarillo® hops (dry hop)
Tequila soaked oak chips (light toast)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and target a mash temperature of 150 °F (66 °C). Hold at this temperature for 60 minutes. Sparge to collect about 6.5 gallons (25 L). Boil for 90 minutes, adding the hops at the times indicated. After the boil is complete, turn off the heat and stir in the flameout hop addition and begin a vigorous whirlpool in your kettle. Let settle for 15 minutes. Chill the wort, aerate thoroughly, and then pitch the yeast. Ferment at 68 °F (20 °C) until primary fermentation is complete. Add dry hops for 4-7 days.

To approximate tequila barrel aging at home, Colt suggests, "get the lightest toasted oak chips you can find and soak them in the tequila of your choice. Now add them to the beer. Taste the beer weekly and pull it off of the chips when it has reached the state where you can taste the wood, the spirit, and beer in harmony. Better still, get a 5-L oak barrel and fill it with tequila and let it age a few weeks to a month at a minimum. Next enjoy the tequila you aged and fill it back up with beer. Make sure to purge out any oxygen from the barrel before filling it with beer." After aging, bottle or keg as normal.

SUN KING BREWING CO. TEQUILA BARREL-AGED FISTFUL OF HOPS CLONE

(5 gallons/19 L, partial mash)
OG = 1.058 FG = 1.010
IBU = 78 SRM = 13 ABV = 6.4%

INGREDIENTS

6.6 lbs. (3 kg) light liquid malt extract
1 lb. (0.45 kg) 2-row pale malt
10 oz. (283 g) flaked rye
8 oz. (227 g) Weyermann Caraaroma® malt (130 °L)
12.5 AAU Warrior® hops (70 min.) (0.75 oz./21 g at 16.6% alpha acids)
2.4 AAU Mosaic™ hops (20 min.) (0.2 oz./6 g at 12% alpha acids)
2.6 AAU Nelson Sauvin hops (20 min.) (0.2 oz./6 g at 13% alpha acids)
1.9 AAU Amarillo® hops (20 min.) (0.2 oz./6 g at 9.4% alpha acids)
4.2 AAU Mosaic™ hops (5 min.) (0.35 oz./10 g at 12% alpha acids)
4.5 AAU Nelson Sauvin hops (5 min.) (0.35 oz./10 g at 13% alpha acids)
3.3 AAU Amarillo® hops (5 min.) (0.35 oz./10 g at 9.4% alpha acids)
6 AAU Mosaic™ hops (0 min.) (0.5 oz./14 g at 12% alpha acids)
6.5 AAU Nelson Sauvin hops (0 min.) (0.5 oz./14 g at 13% alpha acids)
4.7 AAU Amarillo® hops (0 min.) (0.5 oz./14 g at 9.4% alpha acids)
0.5 oz. (14 g) Mosaic™ hops (dry hop)
0.5 oz. (14 g) Nelson Sauvin hops (dry hop)
0.5 oz. (14 g) Amarillo® hops (dry hop)
Tequila soaked oak chips (light toast)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a large muslin bag. Heat 1 gallon (3.8 L) water and target a mash temperature of 150 °F (66 °C). Add the grain bag and hold the mash at 150 °F (66 °C) until enzymatic conversion is complete, about 60 minutes. Remove the grain bag and slowly wash the grains with 1 gallon (3.8 L) hot water. Add the liquid malt extract and top off to 6.5 gallons (25 L) in the brewpot. Total boil time is 90 minutes, adding the hops at the times indicated. Follow the all-grain recipe for the boiling, fermenting and wood-aging instructions.

BARREL CLONE RECIPES

The specifications below are all pre-barrel numbers. This beer is to be released nationally later in 2015 and post-barrel aging, the beer is now 12.5% ABV. Special thanks to The Bruery's Experimental Brewer Andrew Bell for these guidelines and detailed ingredients.

THE BRUERY MASH CLONE

(5 gallons/19 L, all-grain)
OG = 1.092 FG = 1.016
IBU = 30 SRM = 30 ABV = 11%

INGREDIENTS

17 lbs. (7.7 kg) Great Western 2-row pale malt
1.9 lbs. (0.86 kg) Briess Bonlander® Munich malt (10 °L)
0.4 lb. (181 g) Castle Abbey® malt (17 °L)
0.3 lb. (136 g) Castle chocolate malt (340 °L)
13.5 AAU UK Challenger hops (60 min.) (1.4 oz./40 g at 9.6% alpha acids)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc® tablet (10 min.)
Bourbon soaked oak cubes
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 150 °F (66 °C). Hold the mash at 150 °F (66 °C) until enzymatic conversion is complete. Sparge slowly with 170 °F (77 °C). water, collecting wort until the pre-boil kettle volume is 7 gallons (26.5 L).

Total boil time is 120 minutes, adding the hops 60 minutes into the boil. Add Whirlfloc® and yeast nutrient with 10 minutes left in the boil.

When the boil is complete, chill the wort rapidly to 65 °F (18 °C). and aerate thoroughly. The yeast pitch rate is 1,000,000 cells per mL per degree Plato. On a homebrew scale, this is approximately three packages of liquid yeast.

For the wood aging, Bell says, "after primary fermentation is finished, rack the beer to a CO_2 purged, first-use bourbon barrel (or as an alternative, add bourbon soaked oak cubes to the beer in a secondary fermenter). Age the beer on the oak until a refined bourbon character is achieved (approximately one year on a commercial scale, usually less on a smaller scale depending on the surface area of your oak source). After aging, bottle or keg as normal, carbonating the beer to around 2.5 volumes of CO_2 (forced carbonation would be easier with this high ABV beer)." If you plan to bottle condition, you may consider pitching some fresh yeast at bottling.

THE BRUERY MASH CLONE

(5 gallons/19 L, partial mash)
OG = 1.092 FG = 1.016
IBU = 30 SRM = 30 ABV = 11%

INGREDIENTS

10 lbs. (4.5 kg) golden liquid malt extract
2 lbs. (0.91 kg) 2-row pale malt
1.9 lbs. (0.86 kg) Briess Bonlander® Munich malt (10 °L)
0.4 lb. (181 g) Castle Abbey® malt (17 °L)
0.3 lb. (136 g) Castle chocolate malt (340 °L)
13.5 AAU UK Challenger hops (60 min.) (1.4 oz./40 g at 9.6% alpha acids)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc® tablet (10 min.)
Bourbon soaked oak cubes
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale)
Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a large muslin bag. Heat 2 gallons (7.6 L) water and target a mash temperature of 150 °F (66 °C). Add the grain bag and hold the mash at 150 °F (66 °C) until enzymatic conversion is complete, about 60 minutes. Remove the grain bag and slowly wash the grains with 2 gallons (7.6 L) hot water. Add the liquid malt extract and top off to 7 gallons (26.5 L) in the brewpot. Total boil time is 120 minutes, adding the hops 60 minutes into the boil. Add Whirlfloc® and yeast nutrient with 10 minutes left in the boil.

When the boil is complete, chill the wort rapidly to 65 °F (18 °C). and aerate thoroughly. The yeast pitch rate is 1,000,000 cells per mL per degree Plato. On a homebrew scale, this is approximately three packages of liquid yeast.

For the wood aging, Bell says, "after primary fermentation is finished, rack the beer to a CO_2 purged, first-use bourbon barrel (or as an alternative, add bourbon soaked oak cubes to the beer in a secondary fermenter). Age the beer on the oak until a refined bourbon character is achieved (approximately one year on a commercial scale, usually less on a smaller scale depending on the surface area of your oak source). After aging, bottle or keg as normal, carbonating the beer to around 2.5 volumes of CO_2 (forced carbonation would be easier with this high ABV beer)." If you plan to bottle condition, you may consider pitching some fresh yeast at bottling.

wood-aged beer list and wood cut series. He is growing the Pint House Pizza wood-aged beer list with his latest barrel offering, Jaguar Shark — an imperial stout aged in Wild Turkey barrels. Joe was kind enough to share some of his best practices when it comes to brewing with barrels.

"JUST BECAUSE BEER GOES IN A BARREL DOESN'T MEAN IT'S GOING TO BE GOOD."
- JOE MOHRFELD, PINTHOUSE PIZZA BREWPUB

Q: Most important step when brewing with barrels?

A: A clean barrel inside and outside is important, but the date you get the barrel really determines how you should treat it.

If the barrel is wet then it's probably ok. I like to get a barrel within two weeks of it being dumped. I flush the barrel with 180 °F (82 °C) water for 45 minutes and clean the outside of the barrel with PBW.

Q: Do you ever have to store any barrels unfilled?

A: I really don't store barrels unused, but if I had to then I would not keep them full of water. I would store them closed after a steam or hot water flush and possibly hit it with a CO_2 blanket.

Q: A barrel is falling apart or leaking. What do you do?

A: Ratchet straps are your friend. Have loose staves? Ratchet strap. Using the barrel as a pressurized cask for serving? Ratchet strap the heads. You can use the straps to hold a barrel together if you need to re-swell it too.

Q: How long do you normally age beer in barrels and how long before retiring or making it a permanent sour barrel?

A: Most information circulating on aging time is never true and is a big generalization. To be really good at this you have to actively manage the barrel. I taste the beer one week after filling to see where we are and leave beer in the barrel for two to two and a half months on average. Just because beer goes in a barrel doesn't mean it's going to be good when it comes out, so I use the barrels one or two times on clean fermentations and then five or six times for sours. BYO

BARREL TRANSFER TOOL

PARTS LIST

Double drilled #6.5 stopper
Stainless racking cane
¼-inch flare/barb fitting for gas
Hose clamps
Gas line
Beer line

STEP BY STEP

1. Clean and sanitize all parts of the barrel transfer assembly (tool), exterior of the barrel and whatever you are transferring into.
2. Purge receiving vessel with CO_2 to reduce oxygen exposure.
3. Insert barrel assembly tool into barrel and secure stopper.
4. Attach CO_2 line to the inlet on the stopper.
5. Adjust PSI to 1-2 PSI or just until beer/wort starts to flow at a slow pace.
6. Fill receiving vessel(s).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story and photos by **Dawson Raspuzzi**

BEYOND BUDWEISER

The Experimental Pilot Program of Anheuser-Busch InBev

First up was Brewmaster Rod Read's initial crack at brewing a light India pale lager. Read referred to the bottle in front of me as a "chip beer," meaning it had just finished lagering for 21 days on Beechwood chips and had not yet been filtered or blended at a 40-60 ratio with carbonated water (resulting in a "light" IPL that was coming in near 6.5% ABV instead of the 4% it was destined for). With a generous variety of domestic and imported hops added in the kettle and a dry hop addition of Cascade, the nose of grapefruit and citrus was detectable as the beer poured from bottle to glass and formed an off-white lace of foam at the top.

Next in line was a "molé" stout inspired by the Mexican molé sauce. This exotic beer had a wide range of flavors that teased the palate — hints of hot pepper, cocoa, cinnamon, vanilla, and anise. Read acknowledged he would add more lactose for a fuller body and cut back on the anise if he were to rebrew this experimental batch, as the licorice flavor overpowered the cinnamon.

A traditional English pale ale was then proceeded by an imperial oatmeal stout fermented with a lager yeast strain at 55 °F (13 °C). Dark and rich, with a creamy mouthfeel and a roasty chocolate taste on the backend, the 8% ABV was well disguised.

Also unrecognizable if sampled in a blind tasting by astute beer geeks or Budweiser loyalists alike is all of these beers were brewed by Anheuser-Busch InBev (A-B). Not at the main brewery in St. Louis, but in the same complex at the (much smaller) Anheuser-Busch Research Pilot Brewery — a brewer's paradise where Read and a small team of brewers spend their days brewing batch after batch to test ingredients, techniques, and whatever crazy idea one comes up with.

A-B's Research Pilot Brewery (RPB) is not a secret, per se, but it also isn't well publicized or promoted because it is not open to the public. In fact, it is not even open to many of A-B's employees, as Read, the 30-year-old brewmaster of the RPB who is seven years removed from the UC-Davis Master Brewers Program, said less than 100 people have clearance into the nine-story brewhouse.

I, along with a couple other members of the beer media, recently took A-B up on the

Rod Read, Brewmaster of Anheuser-Busch's Research Pilot Brewery, pours hops into the brew kettle. Less than 100 people have clearance into the experimental nine-story brewhouse.

rare opportunity to spend a day with Read, tour the facility, and even brew our own recipe on its 15-barrel system (more on that later). What I found inside was mostly what I expected — state of the art brewing equipment and a lot of people who are passionate about their jobs — but the beers coming out of there were eye-opening. None of them were anything I have ever associated with the world's largest brewing company — meaning they were not brewed for the mass market, gently tip-toeing around flavors that may offend anyone. No, these were brews that craft beer lovers (and most of the homebrewing crowd) would admire, and the overwhelming majority of beer drinkers who prefer the American light lagers A-B is known for would pass on.

RESEARCH PILOT BREWERY

After being led beyond a tall, black steel gate that wraps around the greater part of the Anheuser-Busch estate, our group walked for about five minutes to the other side of the monstrous campus. Across railroad tracks, which the brewery still utilizes to receive shipments of brewing ingredients, we took a turn and walked between a couple of towering brick buildings. A wooden door to the RPB decorated only with a Michelob sign offers little indication that behind these walls is the hub of Anheuser-Busch's innovation.

Nearly every new Anheuser-Busch recipe that has hit market shelves since 1981 when the RPB was first established was created, tested, or refined at the RPB. Those, however, are just a tiny fraction of the recipes that have been created there. At any time, there may be 30 to 50 different beers in various stages of the brewing process at the RPB — most of which will be sampled by only a small handful of people and then discarded. The recipes and brewers' notes, however, are saved for eternity in case they should ever be revisited.

The purpose of the RPB is threefold: Raw material testing to maintain the core brands such as Budweiser and Bud Lite, to be utilized as a training fa-

cility for the company's future brewmasters, and for innovation brewing.

RAW MATERIAL TESTING

All three branches of the RPB are valuable, but testing raw materials is the most important. It is this effort that ensures all of the A-B brand beers are consistent day after day and year after year. As homebrewers, consistency is nice, but not of nearly the same importance — if we brewed a great brown ale using Kent Golding and Fuggle last year and want to repeat the brew now but the alpha acid of Fuggle is 5 instead of 6 as it was last year, we probably aren't going to bat an eye. That change would be tremendous, however, for a known commodity that customers have come to expect consistency from.

So, instead of a beer like Budweiser changing in a reflection of the characteristics of its ingredients, what A-B has to do is tweak the recipe — be it the ingredient, technique or procedure — with every variable. These tweaks are not taken lightly, and it is Read who is largely responsible for showcasing each ingredient every time there is a variable.

"The raw material testing is very critical to the brand management because making a consistent product every year and at every location with variable inputs — hop crop years are different and we use various hopping schedules — we have to understand how they're going to change year to year. And the same with barley, there's less variability but we have to understand how the crops are going to be year to year," Read said.

This is done through making one minor adjustment in the Budweiser brewing process batch after batch.

"We'll do single-hop specials in a Budweiser base just with that one hop, just to understand how that would come through in a crisp lager base," Read said. (I had the opportunity to taste an example of what Read was talking about with an over-hopped Budweiser brewed using only Galaxy hops, and as expected the citrus, kiwi and passion fruit from the Australian hop variety came through clear.)

These hop experiments are not just done in consideration of the present, but also with one eye on the future as some varieties that brewers have relied on for years are showing signs of less resistance to disease and may one day need to be replaced.

Of course, for these tests to mean anything Read has to be able to brew the exact same Budweiser that is produced at A-B's 12 breweries across the US and nearly 50 worldwide. As you would imagine, there's a test for that. Actually, there are a lot of them. Every Friday an expert group of up to a dozen tasters (internally known as the 220 Panel, a reference to the phone extension to the room the taste tests used to be held in) gathers to sample a Budweiser from each of the 19 North American breweries and the RPB. Everyone on the panel is either a current or former brewer of Budweiser who knows exactly what to look for and can detect the slightest off-flavor. "Everybody who tastes knows what the profile is and if they pick up something they think might be slightly out of profile, they know what part of the process will impact that taste characteristic," explained Dave Maxwell, A-B's Director of Brewing for the North American plants.

The panel grades each beer on a 10-point scale and brewers hope to be above a seven, Read said, as an eight or better is "almost flawless." If the Budweiser brewed at the RPB were below the standard, it would be treated the same way as if a production brewery were off the mark — which is not a situation anyone wants to be in.

"If I can make a Budweiser that can sit up at the 220 Panel and be up there with the rest of the production facilities' Budweisers, I know that I can make a beer here that they can make at their brewery," Read said.

INNOVATION

While ingredient testing is the most important part of Read's job, the most fun comes from the innovation side of things. Concepts for new recipes can come from a handful of places such as brand management, consumer insight groups, or someone just "having a wonderful lightning strike to the head about some new flavor, or new spice, or new hop that has not been used," Read said. "Maybe they go to a dinner and have a flavor that is interesting. I think that's probably how molé made it into a beer. It's wonderful in Mexican foods and the concept made sense in a stout base so give it a shot. There's inspiration that comes from all different directions but the innovations get vetted at this facility. We can be as flexible as possible."

(We have) access to procure any hop that we can think of that's out there. New wheats, new barleys, new malting styles, spices, fruit, whatever it may be.

And when inspiration strikes, the options are limitless. Assisted by "flavor chemists," when he wants to bring a taste to a beer Read is sure to find what he is looking for in a walk-in cooler (a few ingredients I noticed on the shelves during our tour that left my brewing curiosity racing were ghost peppers, hawthorn berries, apple pie spice and poppy seeds). Taking up the majority of the walk in fridge, however, were sealed bags of dozens of hop varieties wrapping around one set of shelves to another (and another).

"(We have) access to procure any hop that we can think of that's out there. New wheats, new barleys, new malting styles, spices, fruit, whatever it may be," Read said.

And it isn't just beer that Read and his team are brewing with these in-

A-B PILOT RECIPES

MOLÉ

(5 gallon/19 L, all-grain)
OG = 1.054 FG = 1.015
IBU = 2 SRM = 30 ABV = 5.3%

INGREDIENTS

8.6 lbs. (3.9 kg) 2-row pale malt
1.15 lbs. (0.52 kg) flaked barley
13.6 oz. (0.39 kg) roasted barley
6.4 oz. (181 g) caramel malt (20 °L)
5.6 oz. (159 g) black malt
0.4 AAU Hallertau hops (60 min.) (0.1 oz./3 g at 4% alpha acids)
1 oz. (28 g) cocoa powder (alkaline processed) (5 min.)
0.1 oz. (3 g) chili powder (5 min.)
0.15 oz (4.2 g) chipotle powder (5 min.)
0.25 oz (7 g) ground cinnamon (5 min.)
4 mL rose water (5 min.)
4 oz. (113 g) lactose powder (5 min.)
0.1 oz. (3 g) anise (5 min.)
1 oz. (28 g) vanilla beans (5 min.)
3 cinnamon sticks (post fermentation)
Wyeast 2035 (American Lager) or White Labs WLP840 (American Lager) yeast
⅓ cup corn sugar (if priming)

STEP BY STEP

This is a single step infusion mash. Mix grains with 4.3 gallons (17 L) strike water to achieve a mash temperature of 146 °F (63 °C). Hold at this temperature until starch conversion is complete. Raise temperature up to mash out at 168 °F (76 °C) then begin to lauter. Boil for 60 minutes adding a pinch of hops at the beginning of the boil just to control the foam. With 5 minutes remaining, add all the spices with the exception of the cinnamon sticks. Chill the wort down to yeast pitching temperature. Aerate the wort and pitch the yeast. Hold at 50 °F (10 °C) for the duration of primary fermentation. After primary is complete, add the cinnamon sticks and hold for 10 days. Slowly chill to 45 °F (7 °C) over 24 hours then bottle or keg.

MOLÉ

(5 gallon/19 L, partial mash)
OG = 1.054 FG = 1.015
IBU = 2 SRM = 30 ABV = 5.3%

INGREDIENTS

3.5 lbs. (1.6 kg) extra light dried malt extract
2 lbs. (0.91 kg) 2-row pale malt
1.15 lbs. (0.52 kg) flaked barley
13.6 oz. (0.39 kg) roasted barley
6.4 oz. (181 g) caramel malt (20 °L)
5.6 oz. (159 g) black malt
0.4 AAU Hallertau hops (60 min.) (0.1 oz./3 g at 4% alpha acids)
1 oz. (28 g) cocoa powder (alkaline processed) (5 min.)
0.1 oz. (3 g) chili powder (5 min.)
0.15 oz (4.2 g) chipotle powder (5 min.)
0.25 oz (7 g) ground cinnamon (5 min.)
4 mL rose water (5 min.)
4 oz. (113 g) lactose powder (5 min.)
0.1 oz. (3 g) anise (5 min.)
1 oz. (28 g) vanilla beans (5 min.)
3 cinnamon sticks (post fermentation)
Wyeast 2035 (American Lager) or White Labs WLP840 (American Lager) yeast
⅓ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a large muslin bag. Mix grains with 2 gallons (7.6 L) strike water to achieve a mash temperature of 146 °F (63 °C). Hold at this temperature until starch conversion is complete. Raise temperature of the mash up to 168 °F (76 °C) then place the grains in a large colander. Slowly pour about 2 gallons (7.6 L) of 168 °F (76 °C) water over the grains to wash the sugar out. Bring the wort up to a boil, then turn off heat and stir in the dried malt extract. Return the wort to heat and boil for 60 minutes adding a pinch of hops at the beginning of the boil just to control the foam. With 5 minutes remaining, add all the spices with the exception of the cinnamon sticks. Chill the wort down to yeast pitching temperature, then transfer to your fermenter and top off to 5 gallons (19 L). Follow the remainder of the instructions in the all-grain recipe.

IMPERIAL OATMEAL STOUT

(5 gallon/19 L, all-grain)
OG = 1.088 FG = 1.032
IBU = 30 SRM = 70 ABV = 8%

INGREDIENTS

14.2 lbs. (6.4 kg) 2-row malt
2.1 lbs. (0.52 kg) chocolate malt
1.5 lbs. (0.68 kg) flaked oats
1.15 lbs. (0.52 kg) Briess Blackprinz® malt
1.75 AAU Cluster hop pellets (first wort hop) (0.25 oz/7 g at 7% alpha acids)
3.5 AAU Cluster hop pellets (60 min.) (0.5 oz./14 g at 7% alpha acids)
3.5 AAU Cluster hop pellets (30 min.) (0.5 oz./14 g at 7% alpha acids)
5 oz. (142 g) lactose powder (0 min.)
Wyeast 2035 (American Lager) or White Labs WLP840 (American Lager) yeast
⅓ cup corn sugar (if priming)

STEP BY STEP

Ramp mash bed up through conversion, looking to target 55% real degree of fermentation (RDF). When the grain bed reaches mash out temperature of 168 °F (76 °C), begin the lauter. During the sparge phase, add the first wort hops to the brewpot. This is a 60-minute boil adding the hops at the times indicated and the lactose at the end of the boil. Ferment at 55 °F (13 °C) with lager yeast. After primary fermentation is complete, rack the beer to a secondary and condition for one month. At RPB, the Imperial Oatmeal Stout was then split and aged on varying amounts of vanilla beans and cocoa beans in bourbon barrels for six months. Bottle or keg as normal.

IMPERIAL OATMEAL STOUT

(5 gallon/19 L, partial mash)
OG = 1.088 FG = 1.032
IBU = 30 SRM = 70 ABV = 8%

INGREDIENTS

8 lbs. (3.6 kg) golden liquid malt extract
2 lbs. (0.91 kg) 2-row pale malt
2.1 lbs. (0.52 kg) chocolate malt
1.5 lbs. (0.68 kg) flaked oats
1.15 lbs. (0.52 kg) Briess Blackprinz® malt
1.75 AAU Cluster hop pellets (first wort hop) (0.25 oz/7 g at 7% alpha acids)
3.5 AAU Cluster hop pellets (60 min.) (0.5 oz./14 g at 7% alpha acids)
3.5 AAU Cluster hop pellets (30 min.) (0.5 oz./14 g at 7% alpha acids)
5 oz. (142 g) lactose powder (0 min.)
Wyeast 2035 (American Lager) or White

Labs WLP840 (American Lager) yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Mix the 2-row pale malt and flaked oats in a large muslin bag and place it in a large brew pot with 4.5 qts. (4 L) water. Heat the grains mixture slowly until the temperature reaches 168 °F (76 °C) over the course of 45–60 minutes.

While the mash is heating, begin heating a separate pot with 3 gallons (11.4 L) water up to 168 °F (76 °C). Add an additional gallon (3.7 L) of water plus the crushed chocolate malt and Blackprinz® malt in a separate muslin bag once the mash has reached 168 °F (76 °C). After roasted grains have steeped for 10 minutes at this temperature, remove both grain bags and place in a colander. Slowly pour the remaining 2 gallons (7.8 L) over the grains to wash out the sugars. Bring to a boil, adding the liquid malt extract and first wort hops off heat just prior to reaching a full boil. Stir until extract is fully dissolved. This is a 60 minute boil, adding the hops at the times indicated and the lactose at the end of the boil. Chill the wort and top off the fermenter to 5 gallons (19 L) then aerate the wort heavily and pitch the yeast. Ferment at 55 °F (13 °C) with lager yeast. After primary fermentation is complete, rack to a secondary and condition for one month. At RPB, the Imperial Oatmeal Stout was then split and aged on varying amounts of vanilla beans and cocoa beans in bourbon barrels for six months. Bottle or keg as normal.

DOODLE

(5 gallon/19 L, all-grain)
OG = 1.052 FG = 1.022
IBU = 3 SRM = 10 ABV = 4%

One of the fun things about the RPB is the ability to brew very unique beers. This recipe is Brewmaster Rod Read's attempt to brew a beer that tastes like a snickerdoodle cookie.

INGREDIENTS

7.75 lbs. (3.5 kg) 2-row pale malt
3.25 lbs. (1.5 kg) Briess Victory® malt
0.1 oz. (3 g) Saaz hop pellets (60 min.)
3.5 oz. (10 g) ground cinnamon (5 min.)
Wyeast 2035 (American Lager) or White Labs WLP840 (American Lager) yeast
½ cup corn sugar (if priming)

STEP BY STEP

Ramp the mash temperature through conversion. You will probably want a very short or high temperature mash in order to conserve residual starches and help the breadiness (58% RDF).

Boil the wort for 60 minutes adding just a few hops at the beginning of the boil. Cold ferment the wort at 50 °F (10 °C) for 7–14 days or until the gravity stabilizes. Chill to 45 °F (7 °C) over 24 hours to drop yeast, then bottle or keg. Add corn sugar (if priming) and bottle or keg as normal.

TIPS FOR SUCCESS:

Fresh Victory® malt will help give that biscuity/bready note that you need to accentuate the "cookie-ness". We added the hops just to control the boil, but not for bittering.

Fermentation should take seven days at 50 °F (10 °C) with no maturation time (you want elevated diacetyl to give a buttery aroma, reminiscent of a cookie). A-B packaged Doodle unfiltered with low CO_2 (2.3%v/v).

LEDE LAGER

(5 gallon/19 L, all-grain)
OG = 1.060 FG = 1.014
IBU = 62 SRM = 13 ABV = 6.2%

INGREDIENTS

9 lbs. (4.1 kg) 2-row pale malt
2.5 lbs. (1.13 kg) Best Malz Red X (12 °L)
1.25 lbs. (0.57 kg) crystal malt (60 °L)
10.5 AAU Galaxy hops (60 min.)
(0.75 oz./21 g at 14% alpha acids)
21 AAU Galaxy hops (1 min.)
(1.5 oz./43 g at 14% alpha acids)
18.8 AAU Citra® hops (1 min.)
(1.5 oz./43 g at 12.5% alpha acids)
0.67 oz. (19 g) Galaxy hop pellets (dry hop)
0.67 oz. (19 g) Citra® hop pellets (dry hop)
Wyeast 2035 (American Lager) or White Labs WLP840 (American Lager) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

If your homebrew shop does not stock Best Malz Red X, you can substitute a Munich malt (~9-10 °L) in its place. Color will be slightly different.

Single infusion mash at 148 °F (64 °C) until starch conversion is complete. Bring wort to a boil and boil for 60 minutes adding hops at times indicated. After the boil is complete, give the wort a long stir to create a whirlpool and let the wort settle for about 20 minutes. Rapidly chill the wort to yeast pitch temperature. Ferment at 55 °F (13 °C) until primary fermentation is complete and then lager 21 days. For the last week of lagering, raise temperature up to 55-60 °F (13-16°C) and to add the dry hops. Add corn sugar (if priming) and bottle or keg as normal.

On a tour of A-B's Research Pilot Brewery, Brewmaster Rod Read takes a group of beer journalists through the lagering room that houses dozens of eight-barrel lagering tanks.

gredients. Everything from traditional and experimental ales and lagers to *Brettanomyces*- and *Lactobacillus*-infected sours to hard ciders and meads, and even the Lime-A-Rita malt beverage drinks were created at the RPB. There are also a couple of bourbon barrels on the top floor of the brewery that, when I visited, were filled with coffee stout aging on Bing cherries.

The endless possibilities are fun, but that doesn't mean this part of the job isn't taken just as seriously as any of Read's other responsibilities. Every batch that comes from the RPB is brewed with purpose and the possibility (although slim in many cases) that it could wind up being marketed. "Everything we make has a possibility of being launched," Read said.

Even when a recipe doesn't strike gold, or even get adjusted and brewed a second time, what the brewers learn from every batch is important. "It's not always exactly going to be whatever product we made but we may get some inspiration from it, like 'oh this is a cool clove note that came through really well in the saison that you made, how did you get it?' Well we used different yeast strains and this is how it turned out," Read explained.

Around this point you may start wondering, if so much beer is being produced at the RPB, where does it all go? Sometimes these experimental beers end up at beer festivals, but because they cannot legally be sold, more often than not the majority of this beer gets poured out. From what starts in a 15-barrel fermenter, and ends in an 8-barrel lagering tank, usually just four cases of beer are bottled for the purpose of evaluation.

"That's the price of innovation," Read said. "We brew at a 15 barrel scale because we need a larger system if we want to scale recipes developed and perfected at the RPB for our larger breweries. It would be difficult to demonstrate the ability to scale a recipe brewed on a 1-barrel system to a 1,000 barrel system; the RPB is a more accurate representation of our US breweries."

Unfortunately, it also means there is a lot of excess beer brewed, and

dumped, there. Dumping the beer isn't a total waste, though, as the plant has an anaerobic digester to help reclaim energy from the waste that produces about 10 percent of the energy for the St. Louis brewery.

MY BREW DAY

Part of the hook in our invite to St. Louis was that we would get to brew our own batch of beer at the RPB. When the time came, I sat with two other journalists at a conference table discussing the style we'd like to brew and Read called up a brewing spreadsheet in an Excel file on his computer. The simplicity struck me — given that this is A-B we are talking about — but Read said an Excel file is what he generally uses when developing recipes. In fact, the process we went through was very similar to what he and his assistant brewers do on a regular basis, and what homebrewers do when they set out to make a new recipe.

The grain bill was selected for us as it was prepared the night before to save time. It consisted of 2-row, caramel 60 °L, and Best Malz Red X malt, a base malt that is relatively new on the market and contributes an intense reddish hue. Considering the grain bill, and a cumulative appreciation of the citrusy flavors and aromas of hops from down under, we decided to brew an IPA targeting an IBU around 60 with Galaxy and Citra® hops added in three steps.

The real fun with our brew, which we named Lede Lager drawing from our collective journalism backgrounds, came with fermentation. Querying Read earlier in the day about legend of the ability of the Budweiser yeast to ferment at ale temperatures got us thirsty for an experiment. So, at fermentation we split the batch — half to be fermented with the Budweiser yeast strain at its ideal temperature of 55 °F (13 °C) and the other to be fermented with the same strain at an ale temperature of 68 °F (20 °C).

Working with pounds of hops and hundreds of pounds of malt had our heads spinning trying to convert what we were doing to a 5-gallon (19-L) recipe. Fortunately, Read was able to lend a hand, which wasn't surprising, considering he does the same thing at home. Even with the creative flexibility he is granted, brewing up to three batches of beer a day at work, Read has never abandoned his roots as a homebrewer and still frequently puts use to his 10-gallon (38-L) brewing system. "There's that art and really the passion of brewing, you just can't get away from homebrewing. It's just so intimate that I think it's worthwhile doing even if you're brewing day in and day out."

We all associate craft brewers as converted homebrewers, but sometimes it is hard to think of brewers who literally brew 17,000-gallon (64,000-L) batches of beer going home to brew 5 to 10 gallons (19 to 38 L). But that is the case with most of the employees involved in A-B's brewing process (and many who work in other parts of the company). Need proof? A-B holds their own in-house homebrew competition each year, which attracted about 260 entrants last year. "We don't require people to homebrew ... but I think it's something everyone should try at least once — just to enjoy it more than anything," Read said. "It's an art, it's a science, and it's a love, and I think it's a labor of love that we have run with and that's why we've been so successful because we have people who are truly passionate about making beer."

LESSONS FOR THE HOMEBREWER

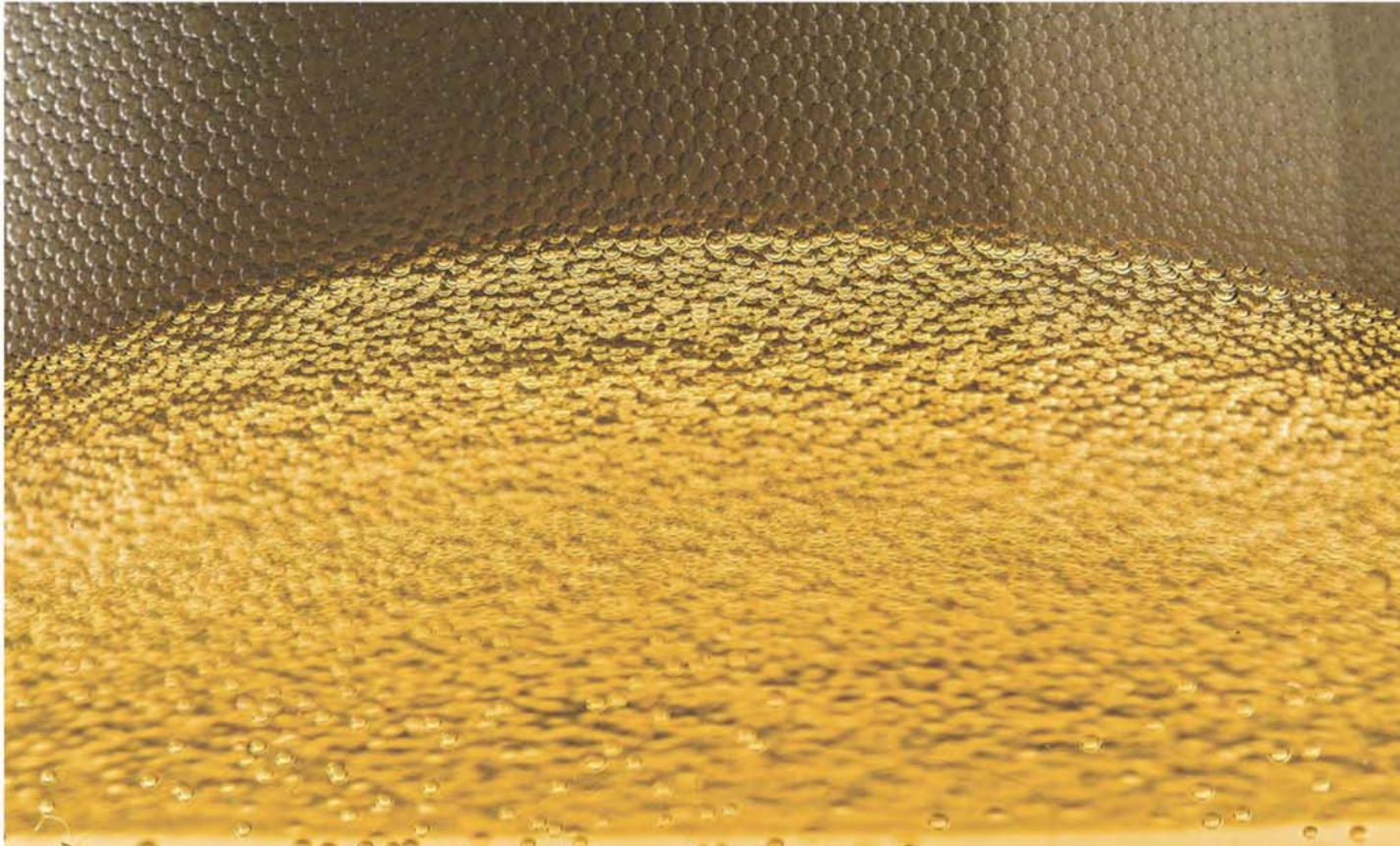
At home, the brewing process and principles aren't any different than at the RPB. "The first and most important thing; cleanliness, in homebrewing, I think is just as important as cleanliness is here. Next is quality of ingredients," Read said. "There's better controls here with temperature and whatnot, so I'll probably make a better product here, but the inspiration and how we go about it, I'm going to use the same principles."

Homebrewers can glean a lot of other useful advice from the RPB too. For instance, homebrewers can probably relate to the experience of that saison that largely missed the mark except for the clove note. Homebrewers know that not every batch turns out great, but with careful and honest evaluation every batch should be a learning opportunity. If you don't take anything away from a brew, you aren't trying to, Read believes.

There's that art and really the passion of brewing, you just can't get away from homebrewing. It's just so intimate that I think it's worthwhile doing even if you're brewing day in and day out.

Inspiration is another example. Who would have thought of a molé beer? Well, someone who had a molé sauce who had an open mind and a passion for brewing. Sounds like a homebrewer. And just like small homebrewers who soak up inspiration at beer festivals and homebrew competitions, Read does as well. In fact, the recipe we brewed was Read's first exposure to Red X malt after he learned about it months earlier. In a conversation about his desire to get a deeper red hue in a recipe, a coworker said he had homebrewed with an ingredient that would work perfectly. "He had said there is this Red X that has this really nice red hue," Read said. "So a couple weeks later I made an order and we got the Red X in and now we're brewing with it today."

A-B likely isn't the first commercial brewery that comes to mind when homebrewers consider sources for inspiration for their craft — but like Read says, "inspiration can come from anywhere." BYO



by Brad Smith

SOLVE the PRIMING PUZZLE

Photos by Charles A. Parker/Images Plus

Photos by Charles A. Parker/Images Plus

CALCULATE HOW MUCH SUGAR YOU NEED FOR CARBONATION

Joining a few friends for a nice cold beer with a bright frothy head is a time-honored tradition, here in the US and around the world. In fact the carbonation, foam, and bubbles are critical to the appearance, flavor and appeal of beer.

Any serious brewer or beer aficionado knows when a beer is properly carbonated. It has the perfect appearance, right flavor and the correct mouthfeel. Under-carbonated beers look and taste flat, and can be unappealing to drink. Over-carbonated beers gush from the bottle or tap, instantly filling the glass with foam, and for many styles can be as unappealing as flat beer.

Most people know that carbonation comes from carbon dioxide (CO_2) dissolved in the beer, just as CO_2 is injected in your soda to give it carbonation. CO_2 gas is an interesting compound, as it interacts with the "trigeminal" senses in your mouth. Trigeminal senses are a combination of pressure, position, and pain. These are the same receptors that detect painful chemical irritants in your mouth, so they produce a complex feeling of both pleasure and pain — enhancing the mouthfeel, body, aroma, and flavor of the beer.

THE HISTORY OF CARBONATION

There is general agreement that beer was uncarbonated or very lightly carbonated for most of its 4,000+ year history. To produce carbonated beer, you need a pressure vessel of some kind such as a bottle or tightly sealed keg. While some cask-aged beer likely had light carbonation, much like a modern real ale, beer was not carbonated as it is today.

Carbonated beer is closely tied to the introduction of bottling. The first bottled beer goes back 440 years in Hertfordshire, England. A forgetful rector named Dr. Alexander Nowell filled a bottle with beer, left it by a river bank and found it later to be well carbonated (recorded in Thomas Fuller's *History of the Worthies of Britain*). Reportedly, "he found no bottle, but a gun, such was the sound at the opening thereof; and this is believed the original of bottled ale in England."

Whether Fuller's tale is true or not, bottled beer was still not widely available until much later. Some brewers experimented with bottling in the 1600s but the glass at the time was thin, weak and expensive. In the 1700s and through to the early 1800s commercial brewers started producing

bottled beers, primarily for export markets. Glass was still expensive, but they were often able to sell both the beer and the used bottle on the export market at a profit. Bottles were still blown, filled, and corked by hand, and the long trip and unattenuated fermentation often led to high carbonation rates.

Not until the late 1800s did we see large-scale bottle production and bottling operations. Whitbread in London launched one of the first large -scale bottling operations in 1870, though the bottles were still hand corked. The screw top bottle was invented in 1879 by Englishman Henry Barrett, and Louis Pasteur's invention of "pasteurization" to preserve beer in the 1870s paved the way for modern distribution and long term storage of bottled beer. The addition of refrigeration also made it possible to serve highly carbonated kegged beer, as well as allowed lagers to be fermented and produced year round.

MEASURING CARBONATION

As I mentioned earlier, carbonation is simple CO_2 gas dissolved in the finished beer. Most homebrewers measure the carbonation level in "volumes." One volume of CO_2 is simply the amount of CO_2 gas dissolved in the same amount of liquid at 20 °C (68 °F), at atmospheric pressure. So you can think of a liter of CO_2 dissolved in a liter of beer as being one volume. Two volumes would be two liters of CO_2 dissolved in one liter of beer.

Photo by http://labelpeelers.com

Corn sugar is the most commonly used priming sugar for carbonating homebrew.

Carbonation rates for different beer styles vary widely. An English cask ale might have only 0.75–1.3 volumes and be flat by American standards, while a typical American lager would be in the 2.6–2.8 volume range. A highly carbonated Bavarian wheat beer could be in the 3.6–4.4 volume range, but is actually poured in several stages to prevent it from foaming over the glass. These are some extremes, but in general most US beers are served in the 2.4–2.9 volume range.

Another popular measure used by many professional brewers and researchers is grams of CO_2 per liter of beer. If you do the math, you will find that approximately 2 grams/liter is 1 volume of CO_2, so you can get a good approximation by taking the number of volumes and doubling it. If you want to be more precise, one volume is 1.926 grams/liter of CO_2.

CARBONATION AND FERMENTATION

There are two ways to carbonate your beer. The first is forced carbonation, which is done with many commercial beers, and also by homebrewers using kegs. In forced carbonation, the beer is put in a keg or other pressure vessel or line and then CO_2 gas is added under pressure. This forces the CO_2 to dissolve into the beer, typically carbonating it within a few days.

The second method, which we will cover in more detail here, is natural carbonation. For natural carbonation a sugar or other fermentable is added to the beer when it is bottled or kegged, and then sealed. The yeast remaining in the beer consumes the sugars, producing CO_2 as a byproduct. This CO_2 provides carbonation in the sealed bottle or keg. The key is getting the right level of sugars to achieve the desired carbonation level, and also making sure you still have some healthy yeast in the beer.

CALCULATING CARBONATION SUGAR NEEDED

Start by calculating the weight of corn sugar needed to bottle 5 gallons (19 L) of beer. It's important to calculate the weight, as sugars have varying densities depending on how they are milled. Though you may find recipes that say "add ⅔ cup of sugar" in the instructions, measuring bottling sugar by volume is not recommended — always weigh your sugar.

The following formula is for corn sugar (dextrose), but you will see that you can scale the result to calculate the weight needed for dried malt extract (DME), honey, and other fermentables used for priming.

Weight_oz = (0.5360 * Vol_gals) * ((Vols_desired - 3.0378) + (0.050 * Temp_f) - (0.0002655 * Temp_f * Temp_f))

Where:

Weight_oz = Weight of corn sugar to use when bottling

Vol_gals = The volume of the beer to be bottled in gallons

Vols_desired = The number of volumes of CO_2 you want in the finished beer

Temp_f = Temperature of the beer at bottling in degrees Fahrenheit

Note that the temperature of the beer at bottling is important as it determines how much residual CO_2 is in the beer from the main fermentation. The residual carbonation after fermentation is based on the temperature and Henry's Law. Let's calculate the amount of corn sugar needed for a 5-gallon (19-L) batch of beer that is sitting at 68 °F (20 °C) that we want to carbonate to 2.8 Volumes of CO_2:

Weight_oz = (0.5360 * 5) * ((2.8 - 3.0378) + (0.05 * 68) - (0.0002655 * 68 * 68)) = 5.1858

So the Weight_oz = 5.2 oz. In this example we would need to use 5.2 oz. of corn sugar (dextrose) by weight to achieve 2.8 volumes of CO_2 in our 5-gallon (19-L) batch of beer.

For those working in metric the equivalent calculation using temperature in centigrade, and volume in liters works as follows: First calculate the temperature of your beer at

bottling in Fahrenheit (from Celsius):

Temp_f = (9*Temp_C/5) + 32

Next calculate the weight of corn sugar needed in grams:

Weight_grams = 4.01 * Vol_liters * (Vols_desired - 3.0378 + 0.050 * Temp_f -0.0002655 * Temp_f * Temp_f)

A spreadsheet, online carbonation calculators, or beer brewing software like BeerSmith, ProMash, or Beer Tools, can also calculate this for you.

USING SUGARS OTHER THAN CORN SUGAR

You don't have to use corn sugar for carbonation. You can use just about any fermentable to carbonate your beer. Popular options include dried malt extract (DME), table (white cane) sugar, and honey. Each of these provide the sugar needed for carbonation, but each is fermentable to a different degree. For example, DME provides about 65% of the priming effectiveness of corn sugar, so you would need to use 1.0/0.65 = 1.54 or 54% more DME than corn sugar to prime the beer. The table on the top right of this page shows some popular options. To use the table, start with the corn sugar calculation covered earlier and multiply the weight by the percentage shown in the third column. Using the example from earlier (5 gallons of 68 °F beer carbonated to 2.8 volumes) we calculated 5.2 oz. of corn sugar was needed. If we want to use honey at bottling, we take the 110.5% number and multiply it by 5.2 oz. to get: 5.74 oz. of honey. So we would use 5.74 oz. of honey to carbonate our batch of beer. Note, however, that honey takes much longer to ferment and carbonate than other sugars.

PRIMING AND CARBONATING BOTTLES

Once you have calculated the amount of sugar for bottling, you can prime and bottle the beer. I recommend transferring your beer from its fermenter into a bottling bucket, and then mixing the priming sugar in gently. This will give you a consistent carbonation level across the batch of beer and is much simpler than trying to measure a few grams of sugar to add to each bottle individually. You can also use priming tablets in your bottles if you don't want to measure

Fermentable	Effectiveness	Multiply Corn Sugar Weight By
Dry Malt extract	65%	153.8%
Table Sugar	110%	90.9%
Honey	90.5%	110.5%

Photos by Charles A. Parker/Images Plus

Beer can be primed with other fermentable sugars other than corn sugar, including maple syrup (left), rice syrup (right), or honey (pictured on 77). Some take longer to prime, however.

the priming sugar (which is great if you are bottling a small batch of homebrew). Priming tablets are single, measured doses of priming sugar that are added one to a bottle.

When bottling, it is customary to leave about an inch to inch and a half (2.5–3 cm) of headspace at the top of the bottle. The headspace provides a bit of oxygen for fermentation, but more importantly provides some relief for pressure in case the bottle becomes overly carbonated.

Once all of the bottles are filled and capped, store them at fermentation temperature for a week or two (more for honey) to allow the yeast to carbonate the beer. If you are planning to cold crash your beer to aid in clearing it, open one bottle and make sure it is properly carbonated before refrigerating the bottles.

HEAD RETENTION

It is important to know that beer does not spontaneously foam. It requires some energy or a trigger to release CO_2 using a process caused nucleation. Nucleation is the same process that occurs when you drop a Mentos candy into a Diet Coke.

A rough surface or scratches in the glass is sufficient to release CO_2. Some glasses are even specially designed with scratches in the bottom to serve as nucleation sites, and provide a steady stream of bubbles to maintain the head. In fact, the widget at the bottom of a Guinness can is actually a nucleation device and not a CO_2 or nitrogen cartridge as some people believe. It serves to release the carbonation (mainly nitrogen), but does not add to it.

Temperature also induces foam; higher temperature forces more gas from the beer. Hot beer foams more than cold beer, and more CO_2 is released as your beer warms in the glass.

The foam at the top of your beer, called the head, is actually another complex chemical structure. Surface tension on the boundary between beer and air is constantly acting to break bubbles and release CO_2. However, beer has surface acting materials that hold the bubbles together and fight the surface tension.

Proteins and bitter acids are the two main components that are hydrophobic (water hating) that stick together and hold the head of the beer together. Otherwise it would collapse quickly. Proteins are derived from your malt bill, and bitter acids come from hops. Both work together to give you a creamy long lasting head.

There are also a number of foam negative materials that can be present. These include soap and detergents often used to wash glassware, as well as fats and lipids from greasy plates, foods, or even your lips or moustache that can break down the foam in your beer. Wash glassware separately from regular dishes and not using regular detergent or dish soap.

IMPROVING HEAD RETENTION

Here are a couple of ways to improve the head retention of your homebrew:

- Use body and head enhancing malts. Malts that are high in proteins and dextrins such as crystal/caramel malts, wheats, "cara" malts, flaked grains, and oats will enhance the head retention of your homebrew. Dark malts have melanoidins that also aid in foam stability. However, you do need to manage the protein content as it can also contribute to clarity problems in lighter colored beers.
- Adjust your mashing schedule. Steps that break down large proteins such as a protein rest can be detrimental. Also mashing at the higher end of the temperature range of 154–158 °F (68–70 °C) will leave more unfermentable sugars, enhancing body and head retention. A low mash pH (in the 5.2 range) can also aid in head retention.
- Use more hops. The bittering acids in hops are also hydrophobic, so a beer with more bittering units will have better head retention. This is why IPAs often have great head retention.
- Don't use household soaps on drinking glassware and brewing equipment. Also don't wash your glassware with regular dishes.
- Choose the right glass. Yes, the shape of the glass can drive both head formation and head retention. A narrow glass such as those used to serve Pilsners enhances the formation of the head, while short wide glasses do not. Tulip glasses also retain the head and aroma of the finished beer.

PRIME PROPERLY

Next time you enjoy a naturally carbonated beer with a perfect head, think about all of the amazing bits of chemistry that came together to create that white foam. Carbon dioxide, proteins, bittering acids, and melanoidins fighting off the surface tension of the beer itself; a priming agent carefully selected and measured to get just the right carbonation level. All poured into the right glass at the right time for you to enjoy! BYO

BY TERRY FOSTER

LET'S GET FIZZICAL!

Properly prime your homebrew

The level of CO_2 does affect the taste of the beer, since it can impart some fullness to beers that might otherwise taste a little thin . . .

Photo by Charles A. Parker/Images Plus

For many people today, soda is the first beverage that comes to mind when thinking of carbonation. Yet it may well be that the first such beverage was beer. That's because evidence suggests the early brewers, the Mesopotamians and later Egyptians, often drank their brews while they were still fermenting. Indeed, back in the Middle Ages when hops were not used in Britain the ale was often drunk before fermentation was complete, and a similar situation probably applied in the rest of Northern Europe. In part that was because such ales did not keep well and would quickly sour. When hops were first used in beer their advantage lay not just in taste but in their preservative effect, so that beer could be kept drinkable much longer. As a matter of fact, we now know that the presence of CO_2 helps to preserve beer somewhat by limiting the presence of oxygen, the arch enemy of fresh beer.

The notion that beer should always be carbonated took a while to catch on; since it was often the practice to let stronger beers mature in wooden casks for a year or more. During that time most of the residual CO_2 would escape and the beer would be drunk flat. That began to change in Britain in the 18th century as drinkers demanded that their beer should be drunk while fresh, or "running" rather than after long aging. Of course in Germany the discovery of bottom fermenting yeasts and the development of lagering at cold temperatures resulted in well-carbonated beers. Also, carbonating wines by priming with sugar for a secondary fermentation had been around since some time in the 16th century, and put onto a firm footing by the French monk Dom Perignon who invented a suitable closure for this wine that we call Champagne.

Carbon dioxide was discovered by a Scot, Joseph Black, in 1754. In the early 1770s Joseph Priestley made a study of what was then known as "fixed air." Fittingly, this was in a brewery in Leeds, Yorkshire, where, among other properties of the gas he found that he could produce a pleasant, fizzy drink by dissolving it in water, and soon "soda water" became a fashionable drink in Europe. For the record, Priestley discovered no less than ten gases, including oxygen. He was a religious dissenter and supporter of the French Revolution, opinions that eventually forced him to flee to America, where he lived until his death in 1804.

But this column is supposed to be about carbonating your beer to the correct level. How you do this depends upon whether you are bottling or kegging, and I'll talk about those separately. First, you need to know how much CO_2 you want your finished beer to contain. This is measured in "volumes of CO_2," or the volume the CO_2 in the beer would occupy (at standard temperature and pressure of 0 °C, 760 mm mercury) per volume of beer. Don't worry that your beer is not at this temperature and pressure, this is just the way in which it is measured. Just remember that as a recent case with certain NFL footballs showed, a lot of people do not understand the relationship between gas pressure and temperature!

The level of CO_2 does affect the taste of the beer, since it can impart some fullness to beers that might otherwise taste a little thin, such as pale lagers. At high levels the gas can break out of the beer when in your mouth and the resultant acidic "prickle" may or may not be desirable in a particular beer style. Too much conditioning in a beer that is meant to be

malt-accented, such as a brown porter, will mask some of the malt character. On the other hand, hop flavor will be accentuated by higher carbonation levels, so it is an important consideration in getting your IPA just right. It is also an important factor (though not the only one) in getting the right head on your beer so that it looks like it should when poured. Therefore, there are different levels of CO_2 that are appropriate for different beer styles. If you go to http://byo.com/resources/carbonation you will find a Carbonation Priming Chart that will do this for you, but for the sake of ease, here it is:

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

The underlying assumption here is that you are serving the beer at the correct temperature, usually 40–45 °F (4.5-7.2 °C), and remember that the solubility of the gas decreases with increasing temperature. If for some odd reason the beer is much warmer than that you may find you get nothing but foam when you pour it! Also note that the figure for "British Ales" applies to bottled and kegged ales, and is somewhat high for cask-conditioned ales, which I shall deal with later.

PRIMING FOR BOTTLING

Many writers (including me on occasion) have recommended that you add a standard amount of priming sugar when bottling, usually something like 3–5 ounces corn sugar, or ½ to ¾ of a cup. That, however, is a dangerous over-simplification, for no matter how flat your beer looks and tastes after fermentation is over, it still contains some dissolved CO_2. Just how much will depend mainly upon the temperature of your fermentation, and is practically impossible for the homebrewer to measure. But there's no need to despair, because there are plenty of sources that will give you a close approximation. Prime (no joke meant) among these is *BYO*'s Carbonation Priming Chart, but a couple of other sources, Northernbrewer.com and Tastybrew.com both give calculators that will work this out for you. I won't repeat those numbers here, but using them is simple. Let's say you were brewing a British-style bitter, and fermented it at 65 °F (18 °C) then *BYO*'s chart gives it a CO_2 content of 0.894 volumes; from the table above you would be aiming

for 1.5–2.2 volumes CO_2 in the beer after conditioning. So, through priming you need to add 0.6–1.3 volumes of the gas. But just bear in mind that these numbers do not allow for the beer that has sat around for some time at temperatures higher than that for the fermentation, and make adjustments to these numbers if that is the case.

But, how do you work out how much sugar you need to get that extra gas into your beer? Well, that depends on what you are priming with since corn sugar (glucose) comes either in the anhydrous or in a hydrated form. The former will give slightly more CO_2 for a given weight than the latter (actually 1 g of each gives 0.49 g and 0.44 g CO_2 respectively). You will see from the *BYO* chart that this means that 1 oz. (28 g) of glucose in 5 gallons (19 L) gives 0.37 volumes CO_2 while 1 oz. (28 g) of glucose monohydrate in the same volume gives 0.34 volumes of the gas. You might prefer to use cane sugar, as I do; this is very pure sucrose and 1 oz. (28 g) of this in 5 gallons (19 L) will yield 0.39 volumes CO_2.

Note that you should be weighing the sugar on a suitable scale — if you have gone through the exercise of calculating it out exactly you should weigh the sugar exactly.

So, getting back to your bitter, let's say you don't want it too highly carbonated and are going for the bottom end of the range, 1.5 volumes CO_2, which as we saw earlier means you need to add 0.6 volumes from your priming sugar. You can either read the required amount off the *BYO* chart, or simply calculate it from the figures in the previous paragraph. Glucose requires 0.6/.37 = 1.6 oz. (45 g.); glucose monohydrate 0.6/0.34 = 1.8 oz. (51 g.); sucrose needs 0.6/0.39 = 1.5 oz. (43 g.).

You can add the sugar directly to your beer and hope you do not create concentration zones where the sugar level is too high for the yeast to handle, but it is best to add it as a solution first. Just dissolve the sugar in, say, a cup of water, boil, and cool under tight cover before adding it to the beer. Note that you should be weighing the sugar on a suitable scale — if you have gone through the exercise of calculating it out exactly you should weigh the sugar exactly. And, of course, you need to have a healthy yeast in your green beer to ensure that this sugar is actually fully fermented. Ideally, a fresh yeast sample should be used at bottling, but that isn't very practical for the homebrewer, partly because if not done very carefully it can result in an undesirable yeast residue in the bottle.

There is another technique for "priming" and that is kräusening the beer — adding a portion of fermenting wort just as it comes into head formation (kräusen). You would need this addition to be a wort of similar character to the beer you are making, and would have to calculate not only how much sugar you need, but also how much sugar is in the wort. There is also a risk of forming too much residue in the bottle — when large breweries use this technique they are able to remove the yeast formed, while maintaining the required carbonation level. So, I think it is more practical for the homebrewer to stick to the simple approach of adding sugar directly.

PRIMING FOR KEGGING

You can do this exactly as if you were bottling, following the approach outlined earlier. But, of course, there is a simpler way, and that is to force carbonate the beer by applying pressure from your CO_2 cylinder. First you have to decide how many volumes of CO_2 you want in the beer and at what temperature you are going to serve it. There is an excellent article by Christian Lavender in the November 2013 issue of *BYO* that will help you here (or you can use the *BYO* Carbonation Priming Chart). Bear in mind that if you keep all your kegs in one freezer and you have different styles in them, your serving temperature may differ from the "ideal" for a particular beer styles (or you may have your own ideas as to how you want to serve your beer!).

Once you have your target volumes and temperature, go to the force carbonation chart in Christian's article. Or search for the "force carbonation chart" on the web — there are plenty of sources there, and kegerators.com is a good one. These charts list gauge pressure and serving temperature on the axes and volumes of CO_2 in the body of the chart. It may look complicated at first glance, but it is easy enough to use. Let's take the English bitter again, and assume that now we want to serve it at 50 °F (10 °C) and at a slightly higher carbonation level of 1.9-2 volumes CO_2. Just go down the left hand column to 50 °F (10 °C), then across to 1.9 and 1.98 and up to the top row read off the required applied pressure, which will be 10-11 psig. Connect to your gas cylinder, set the gauge to this level, open the valve and you will be able to serve your beer exactly as you wanted.

Or will you? Well, no actually, because it takes some time, perhaps weeks before the beer and gas come into equilibrium. Various brewers have various solutions to this. For example, I tend to want lower carbonation levels than many American brewers prefer (remember, I did start my drinking career in Britain). That means I am happy to leave the beer at target pressure for two or three weeks before drinking it. A trick favored by many is to apply a higher pressure than targeted (say 30 psig) and to shake the keg vigorously, or even roll it, over a matter of two or three days, then drop the pressure to your target value. Some like to just set gauge pressure to 30 psi for a couple of days, then drop to 15 psig for another two or three days and finally to adjust it to target. Or, a more repeatable method is to set the pressure at about 4 pounds higher than the target for about a week and then reduce the pressure to the target. This reduces the maximum deviation from the target to about 2-3 pounds since it takes a very long time to reach

equilibrium with this method.

CASK-CONDITIONED ALE

Traditionally, English ales are ideally primed and conditioned in the cask from which they are served. Although it is not so common in England as it once was, still quite a few pubs serve their beer this way. It should not be "warm" as too many Americans think, but at cellar temperature, which in England is commonly around 50–55 °F (10–13°C). Bitter, for example, as a low gravity beer (3.5-5% ABV) with distinct estery flavor notes will taste bland if served at 40 °F (4.4 °C). Its flavor can also be killed by over-carbonation, and it should not be more than 1.5 volumes CO_2, (which means priming with as little as 1–1.5 oz./28–42 g glucose to 5 gallons/19 L). The conditioning fermentation takes place in the cask, some of the gas being allowed to escape through a porous peg in the bung hole. When fermentation subsides a hard peg is inserted in the bung; this is removed when the beer is drawn off, and replaced in the intervals between serving. This means, depending upon the skill of the server, the beer will lose condition during its life in the cask, and may often be served at as little as 1 volume CO_2. That's why the myth that English beer is flat has established itself, but as I explained earlier that does not mean that it has no carbonation. It is true that it sometimes has no head when drawn off by a hand pump on the bar. That is only true if there is no restriction on the outlet of the pump, as always used to be the case in southern England. However, nowadays it is more common for pubs to use a sparkler at the end of the "goose neck" outlet. This little device simply screws onto the end of the outlet and has a number of small holes around its circumference; when the pump forces the beer through these restrictions the beer will be delivered into the glass with a head. But that is really mechanical head formation, rather than just CO_2 break out.

END PIECE

Well, that's a brief introduction as to how to bring your beer into near-perfect condition. If you still want to just add a standard 5 oz. (0.14 kg) corn sugar to all your beers, that's fine, but if you want to be in better control of serving your beer, the little extra effort will be worth it. Just give it a try – no pressure! BYO

Related Links:

• Check out the Carbonation Priming Chart referenced in this story at http://byo.com/resources/carbonation for help determing how to prime your homebrew to the right amount.

• Want to learn more about priming kräusen? Here are some tips from the brewers of Hair of the Dog Brewery and Tuckerman Brewing: http://byo.com/story1269

BY MICHAEL TONSMEIRE
& MATT HUMBARD

BREWING WITH *LACTOBACILLUS*

Overview and Evaluation

An active culture, pitched into minimally-hopped wort without competition and held warm can produce enough lactic acid to sour a beer in less than a day.

A collection of anaerobic Lactobacillus *starters:* Lactobacillus buchneri, Lactobacillus brevis, Lactobacillus delbrueckii, *and* Lactobacillus plantarum.

Why does *Brettanomyces* get all of the attention when it isn't even responsible for making sour beers sour? *Lactobacillus* can do in a week what takes *Pediococcus* a year! *Lactobacillus* needs a publicist (or maybe a hype man).

Traditional mixed-fermentation sour beers (i.e., those where a wide variety of bacteria and yeast work together) take between a few months and a couple years to reach the desired level of acidity and complexity. While sour beers are rapidly gaining popularity, many homebrewers don't have enough interest (or fermenters) to age beer that long! Enter *Lactobacillus*. An active culture, pitched into minimally-hopped wort without competition and held warm can produce enough lactic acid to sour a beer in less than a day. A slow fermentation with many microbes may result in a more interesting flavor profile, but this characteristic is often obscured when brewers produce passion fruit Berliner weisses, Amarillo® dry hopped sour blondes, and tart pink peppercorn citrus zest session ales.

BIOCHEMICAL NERDERY

Lactobacillus is a genus of bacteria, specifically Gram-positive lactic-acid-producing bacteria, often lumped together with *Pediococcus* when it comes to souring beer. Under the right conditions *Lactobacillus* can produce lactic acid quicker than its hardier cousin, and generally does not leave behind the diacetyl or exopolysaccharides ("sickness") that require cleanup by *Brettanomyces*. *Lactobacillus* is able to reproduce quickly with some species capable of doubling every 20–60 minutes (meaning that each cell at T=0 can result in offspring numbering millions or billions in just 24 hours!). Sounds pretty ideal: No unpleasant byproducts, grows quickly in a wide range of temperatures (depending on species), sours rapidly, and as an added benefit is a probiotic!

The high growth rate of *Lactobacillus* is one reason why sour mashes are possible. Given the right conditions (i.e., warmth, low oxygen, pH below 4.5) a small amount of *Lactobacillus* present on the grain can dominate all the other wild microbes living on malt. However, if these conditions aren't maintained perfectly, other far less pleasant microbes can announce their presence by making your house smell like a garbage-dump in the middle of a heat wave. Even under ideal conditions, wild *Lactobacillus* does not always produce as much acidity as the brewer wants.

Before you claim that sour mashes are a traditional part of the process, stop. You're wrong (unless you're talking about Tennessee whiskey). Sour mashing is not a common current or historic technique in Germany for producing Gose or Berliner weisse.

Most species of *Lactobacillus* are quite sensitive to hop compounds. In fact, when brewers (even lambic brewers) talk about the "protective" power of hops, *Lactobacillus* is the chief microbe they are inhibiting. Isomerized alpha acids prevent *Lactobacillus* from reproducing by damaging their cell membranes. While there are some moderately hop-tolerant strains, we suggest keeping the IBUs below 5 if you are souring with *Lactobacillus*. At that sub-flavor-threshold amount there is hardly a reason to add any bittering hops!

The trick is that most *Lactobacillus* sold for brewing produce a variety of

compounds in addition to lactic acid. Heterofermentative species (e.g., *L. brevis*, *L. buchneri*) convert carbohydrates into lactic acid, ethanol, carbon dioxide, and a small amount of vinegary acetic acid. Homofermentative species (e.g., *L. delbrueckii* – although not White Labs' WLP677 – according to Neva Parker, their Head of Laboratory Operations) are capable of producing approximately twice as many molecules of lactic acid from a given amount of carbohydrate because they do not produce ethanol or carbon dioxide. There are also facultative species (e.g., *L. plantarum*), which can switch between the two depending on the conditions. *Lactobacillus* species are a diverse group, with some better suited to the production of sour beers than others.

EXPERIMENT

In order to better understand how different *Lactobacillus* behave during solo-fermentations, we decided to measure the drop in pH produced by the most common *Lactobacillus* species available to homebrewers. The four species we selected were *L. buchneri* (Wyeast 5335), *L. brevis* (White Labs WLP672), *L. delbrueckii* (White Labs WLP677), and *L. plantarum* (one isolate from Omega Labs OYL-605 *Lactobacillus* Blend). We inoculated an equal amount of each species into unhopped wort with an original gravity of 1.040 and placed at 86°, 99°, 102°, and 108° F (30°, 37°, 39°, and 42° C). We measured the pH of each sample six times over the course of five days.

As a brief chemistry refresher: pH is a logarithmic scale that describes how acidic or basic a solution is. 7 is neutral, and anything lower than that is acidic. A pH of 3.5 (typical for a finished sour beer – Goose Island Juliet among others per http://embracethefunk.com/ph-readings-of-commercial-beers/) is 10 times more acidic than 4.5 (typical for a non-sour beer), and 100 times more acidic than 5.5 (typical for the mash).

86 °F (30 °C)

Time (Hours)	*Lactobacillus buchneri*	*Lactobacillus brevis*	*Lactobacillus delbrueckii*	*Lactobacillus plantarum*
0	5.9	5.9	5.9	5.9
6	5.57	5.13	5.59	4.81
18	4.4	3.94	4.62	3.6
24	4.2	3.78	4.6	3.45
75.5	3.88	3.44	4.46	3.27
120	3.85	3.4	4.4	3.25

99 °F (37 °C)

Time (Hours)	*Lactobacillus buchneri*	*Lactobacillus brevis*	*Lactobacillus delbrueckii*	*Lactobacillus plantarum*
0	5.9	5.9	5.9	5.9
6	5.61	5.05	5.55	5.02
18	4.15	3.74	4.54	3.22
24	4.05	3.67	4.54	3.2
75.5	3.5	3.31	4.32	3.22
120	3.5	3.29	4.3	3.21

102 °F (39 °C)

Time (Hours)	*Lactobacillus buchneri*	*Lactobacillus brevis*	*Lactobacillus delbrueckii*	*Lactobacillus plantarum*
0	5.9	5.9	5.9	5.9
6	5.45	5.02	5.5	5.11
18	4.13	3.73	4.61	3.4
24	4.06	3.6	4.58	3.29
75.5	3.72	3.33	4.47	3.23
120	3.68	3.3	4.4	3.2

108 °F (42 °C)

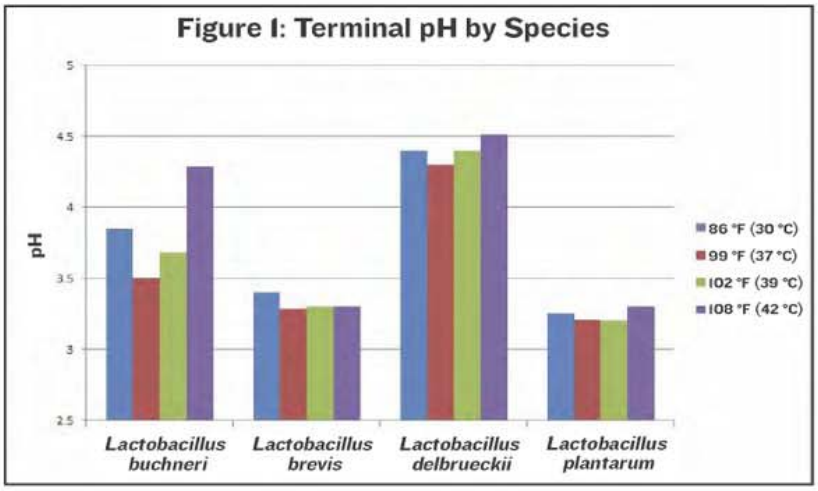
Time (Hours)	*Lactobacillus buchneri*	*Lactobacillus brevis*	*Lactobacillus delbrueckii*	*Lactobacillus plantarum*
0	5.9	5.9	5.9	5.9

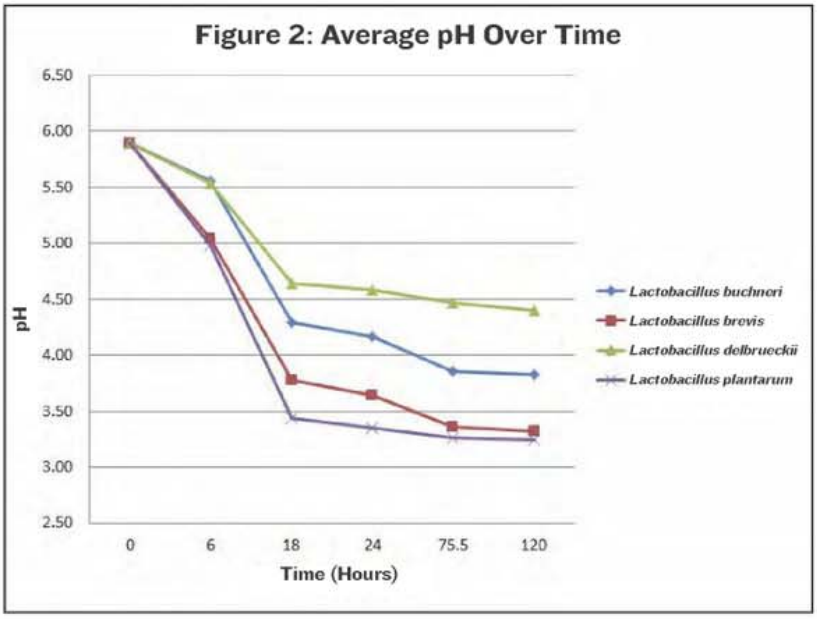
RESULTS

Each *Lactobacillus* species lowered the pH of the wort, but there were significant differences with respect to how acidic the beer became and how the species responded to the different temperatures. Having a species capable of lowering the pH quickly and over a wide range of temperatures is ideal for real-world homebrewing applications. (Refer to the results charts on this page.)

L. buchneri had the least visible growth during the experiment, but still lowered the pH more than *L. delbrueckii*. *L. brevis* and *L. plantarum* dropped the pH more than the other two species in a relatively short amount of time at every temperature tested. Despite the reputation for *Lactobacillus* benefitting from warmer temperatures, *L. plantarum* was able to lower the pH slightly more rapidly at cooler temperatures compared to higher temperatures (although even the coolest temperature was quite warm compared to most ale yeast fermentations).

While all four species were able to drop the pH of the wort, *L. plantarum* and *L. brevis* were able to get the pH of the wort to 3.2–3.4 (an ideal range for many sour beers) at a variety of temperatures. *L. buchneri* was able to adequately





sour the beer at 99° F (37° C), but struggled to do so at temperatures slightly above or below that. *L. delbrueckii* remained above pH 4 at all temperatures tested. For comparison, the final pH of many non-sour beers is in the low 4s, making *L. delbrueckii* unsuitable for sour beers produced in this way.

Figure 1 (above, top) shows the final pH at 120 hours achieved by each species at all temperatures tested.

Figure 2 (above, bottom) compares the pH drop over time averaged across all experimental temperatures to provide a general sense of how each species performed.

PUT THE RESULTS TO WORK

While some *Lactobacillus* species produce alpha-glucosidase, which allows them to ferment complex dextrins, many thrive only early in fermentation when simple sugars are available. As a result, pitching *Lactobacillus* after primary fermentation can result in only minimal souring. In the above experiment, the pH dropped the greatest amount in the first 24 hours for all four species we tested.

To quickly sour a beer your process can be as simple as: chill the wort from the boil to the target fermentation temperature in your kettle, pitch an active *Lactobacillus* culture, affix the lid, and hold the temperature as steady as you can until the desired acidity is reached. At this point you can bring the soured wort up to 150 °F (66 °C) for 30 minutes to pasteurize before chilling and pitching yeast. The advantages of kettle souring compared to sour mashing are speed, reliability, and cleaner flavors. Paired with pasteurization, kettle souring carries no risk of accidentally souring other batches. If you do not want to pasteurize, after the wort is chilled to the desired souring temperature transfer it to a fermenter. Once the desired acidity is attained pitch brewer's yeast. This does carry cross-contamination risks, so we recommend using a separate set of post-boil equipment that will not come in contact with non-sour beers.

Now that we know how to produce a beer with loads of lactic acid quickly, time to address the issues that come with souring a beer before pitching the brewer's yeast.

#1 DESTRUCTION OF PROTEINS BENEFICIAL TO HEAD FORMATION AND MOUTHFEEL.

One strategy to minimize the negative effects of protease activity by *Lactobacillus* is to lower the starting pH of the wort to around 4.5 (Sanz et al. 2001 Applied and Environmental Microbiology. http://aem.asm.org/content/67/4/1815/F2.expansion.html). This can be accomplished by the addition of a food grade lactic acid solution or through the inclusion of acidulated malt at the end of the mash. The activity of protein degrading enzymes drops off at lower pH but the growth of *Lactobacillus* is not inhibited by acidity. If the target pH for a finished beer is 3.5, reducing the pH from 5.5 to 4.5 before fermentation accounts for only 10% of the total acidity. *Lactobacillus* will take it the rest of the way.

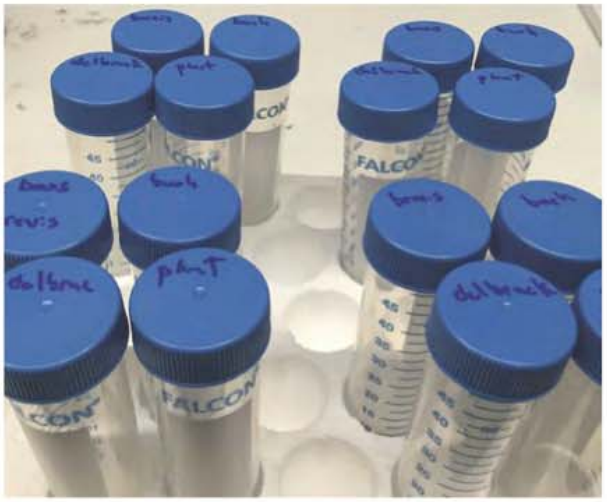
#2 UNHEALTHY PRIMARY FERMENTATION BY BREWER'S YEAST.

Monitor the pH drop and be ready to pitch a starter of brewer's yeast when

the pH approaches 3.5. Best practice also calls for dosing additional oxygen and yeast nutrient into the beer along with the pitch, as both of these have been depleted. There are some acid-tolerant brewer's yeast (Wyeast 3711 French Saison anecdotally), but no complete listing exists to quantify this characteristic. Another option is a 100% *Brettanomyces* fermentation, which tend to be acid tolerant and will produce some of the fruity and funky complexity of a mixed-fermentation sours.

CONCLUSION

By analyzing the behavior of different *Lactobacillus* species, we were able to demonstrate unique growth patterns as well as differential rates of acidification during fermentation. A beer soured over only a few days with *Lactobacillus* will not compete with the complexity of a lambic aged with dozens of microbes in oak barrels for a couple years. However, complexity may not be the goal for a refreshing summer quencher or in the base of an aggressively fruited or spiced beer. Loading pounds of fresh sour cherries into a perfect lambic is like making brownies with a bottle of aged imperial stout (delicious, but ultimately a waste). With the right species of *Lactobacillus* providing the acidity, you can devise a chameleon sour beer ready to accept whatever complementary flavors you send at it! BYO



By analyzing the behavior of different Lactobacillus *species, the authors were able to demonstrate unique growth patterns as well as differential rates of acidification during fermentation.*

Editor's Note: Matt Humbard and Michael Tonsmeire are beer buddies and members of DC Homebrewers. (Matt is the co-owner of Handsome Beer Company in Washington DC and the author of the homebrew and brewing science blog "A Ph.D. In Beer" on the web at https://matthumbard.wordpress.com/)

BY BILL STAATS

KEG AND CARBOY CLEANER

Build a pail-based recirculation spray cleaner

The core assembly components of my cleaner are made of PVC — resulting in them being far less expensive and easier to put together.

Photos by Bill Staats

Cleaning kegs and carboys can be a real chore. In search of a way to make it easier, I came across the "Projects" column by Bill-John Neidrich in the May-June 2010 issue of *Brew Your Own*. I used that project as a starting point, but made a number of changes that, among other things, makes it easier and less expensive to build.

In that 2010 project the core assembly components are made of copper and require soldering. The core assembly components of my cleaner are made of PVC — resulting in them being far less expensive and easier to put together. This design uses a rotating spray head to clean the body of the keg and uses auxiliary lines to feed cleaning solution through the gas (in) and beverage (out) dip tubes, but does not require a ball valve to turn off the flow to the auxiliary lines when cleaning a carboy as the 2010 version did. The keg ball quick disconnects will stop the cleaner flow if not connected to a keg. The rotating spray head is necessary when cleaning kegs as it puts back pressure on the pump discharge, which is needed to help force cleaning fluid through the auxiliary lines. An alternative option if you want to save more money is drilling holes in a ½-inch FPT cap and using that instead of the spray head. For carboy cleaning I have found that it works better without either attached as a much higher volume of cleaning solution is circulated through the carboy when using only the riser tube.

My cleaner is designed for ball-lock kegs, but with some modifications the basic design could be used to clean pin-lock kegs. Using a carboy dryer/storage stacker on top of the lid holds the carboy securely in place for cleaning. When using the carboy stacker to retain the carboy, a single riser length works well for both kegs and carboys. As an alternate use, on brew day I replace the spray head with a brass ½-inch FIPT x ½-inch barb adapter, drop the pump into my pool and use the pool water for my post-boil wort chiller. As with any AC line-powered device around water, only connect the pump to a GFCI-protected outlet.

TOOLS & PARTS

PARTS LIST:

(1) Sump Pump with a 1-inch NPS (National Pipe Straight) threaded connection.
(1) 5-gallon (19-L) heavy duty pail with recessed lid center
(1) Carboy dryer/storage stacker
(1) PVDF mini whirling washer ball (PN 80-91 from G.W. Kent, Inc. or equivalent) (or a ½-inch FPT cap)
(2) male adapters, PVC, ½-inch MIP thread x ½-inch slip
(1) 18-inch (46-cm) section of ½-inch SCH 40 PVC pipe
(1) Reducer bushing, PVC, ¾-inch spigot x ½-inch FIP
(1) Reducing female adapter, PVC, 1-inch FIP x ¾-inch slip
(2) Straight barb adapters, nylon, ⅛-inch MIP x ¼-inch barb (Lasco PN 19-9643)
(2) 14-inch (36-cm) section of 3/16-inch (ID) clear PVC hose
(1) Liquid and gas quick keg disconnect

TOOL LIST:

Power drill (drill press preferred)
21/64-inch drill bit
⅛-27 NPT tap
Bench Vice
PVC pipe cutter or hacksaw
2-inch hole saw
saber saw
File or belt sander

1. MODIFY THE PAIL LID

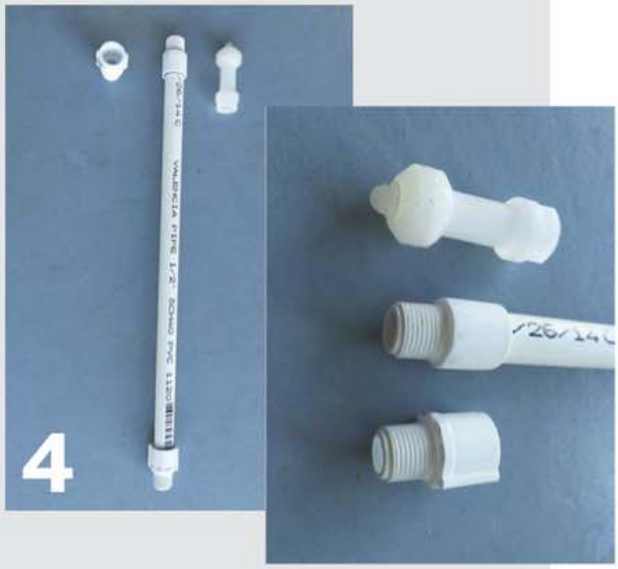
Buy the carboy dryer/storage stacker before selecting your pail to make sure the dryer/stacker bottom fits within the recess of the lid. This will assure that the lid will hold the dryer/stacker in the center of the assembly, preventing the carboy from sliding sideways and possible breakage. A recessed lid center will also eliminate the need to drill holes around the lid edge for drainage back into the pail. For a ball-lock keg, mark a 6-inch (15-cm) diameter circle in the center of the lid. Mark a 2-inch (5-cm) diameter circle on both sides of the center circle along a centerline each 3½ inches (9-cm) from the center of the lid. Mark four lines tangent to each of the two 2-inch (5-cm) circles and tangent to the center 6-inch (9-cm) circle. Mark a third 2-inch (5-cm) diameter hole near the lid edge as a right angle to the centerline for power access. The three 2-inch (5-cm) circles may now be drilled using a 2-inch (5-cm) hole saw or cut with the saber saw (the hole layout may be different for pin-lock kegs). Complete cutting the pattern as shown with a saber saw.

2. ASSEMBLE THE PUMP CONNECTION

With PVC cement, insert the ¾-spigot x ½-inch FIP reducer bushing into the slip end of the 1-inch FIPT x ¾-inch slip reducing female adapter. Allow the connection to fully bond before proceeding. Using a vice and a power drill, drill a 21/64-inch hole ⅞ inch (2 cm) from the ½-inch MIP end of the assembly completely through the center of the slip connection of the reducing female adapter, both sides. It is important to make sure this hole is located between the threaded ends not to interfere with the threads of either end. Tap both holes using a ⅛-27 NPT tap.

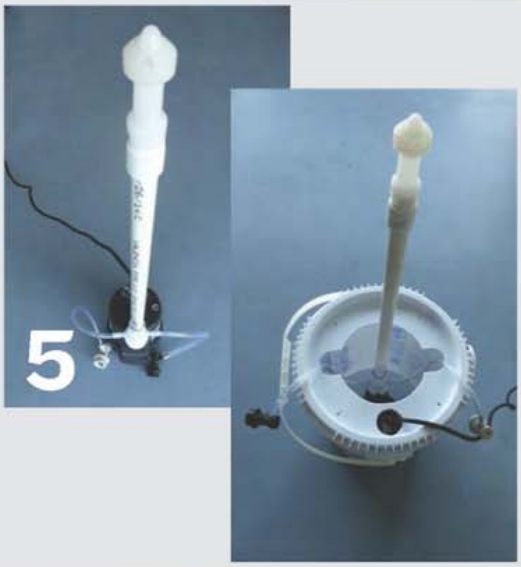
3. ASSEMBLE THE KEG QUICK CONNECTS

Wrap the 1-inch NPS threaded pump connection with plumbing tape and screw the pump connection onto the pump. Wrap the threads of the two nylon straight barb adapters with Teflon tape and screw the adapters into the two tapped holes. Press the two 14-inch (36-cm) lengths of 3/16-inch tubing onto the two barb adapters, then press the two keg quick disconnects barbed ends into the tubing. Warming the plastic hose ends in hot water will make placement over the barbed ends easier. If using both ball and pin lock kegs, insert a quick disconnect in the center of each of the lengths of tubing to allow converting between ball and pin keg disconnect use (not shown here).



4. ASSEMBLE THE RISER TUBE AND MODIFY THE SPRAY HEAD

Assemble the keg/carboy riser tube by gluing a ½-inch MIPT x ½-inch slip male adapter onto each end of the 18-inch (46-cm) section of ½-inch PVC pipe using PVC cement (the length of your pipe may vary slightly based on pail and keg/carboy dimensions – the riser should be fitted to place the spray head roughly 4–8 inches (10–20 cm) from the upper end of the keg/carboy to be cleaned). Allow the connection to fully bond before proceeding. Remove any external protrusions from one end of the riser slip connection with a file or belt sander to allow insertion into the carboy neck (my adapters had two half-round ribs along the length of the slip end presumably for gripping the adapter shown in the picture). The PVDF mini whirling washer ball will have a small ridge of plastic between the upper and lower halves of the ball that may prevent the ball from entering the neck of the carboy. Carefully remove any flash protruding beyond the washer ball between the top and bottom halves with a file or belt sander to allow insertion into the carboy neck. Remove protruding flash material only; do not remove any of the ball material.



5. PUTTING IT ALL TOGETHER

Screw the rotating spray head (or the ½-inch FPT cap with holes drilled in it if you choose this less expensive option) onto the modified end of the riser. Screw the other end of the riser into the pump connection. For final assembly, the pump assembly is placed in the pail and the lid is placed on top with the pump AC cord routed through the power access hole.

6. USING THE CLEANER

Place roughly 1–2 gallons (4–8 L) of cleaning solution into the pail. For cleaning kegs, simply place the keg upside down over the riser, connect the two quick disconnects, and set the keg onto the lid. For carboys, remove the rotating spray head, place the carboy stacker into the recess of the lid and set the carboy onto the stacker. Plug the pump into a GFCI-protected power source and begin cleaning. BYO

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BY SAM DAVIES

BREWING ACROSS THE GLOBE

At age 19, Matt Wiley is brewing with the pros

The biggest struggle is doing all this while being a kid . . . I'm just too young [and] it's not a very kid-friendly world.

Matt Wiley started homebrewing when he was 15. At age 19 now, he's already completed a brewing program in England and is brewing professionally in New Zealand.

Matt Wiley is not your typical 19-year-old student. After finishing high school, the Burlington, Vermont native took the fall semester off before moving to England to participate in the 9-week Brewlab program at the University of Sunderland. The school is located in the heart of Sunderland where the students actually brew for local pubs and taverns. There, he spent days listening to lectures about beer and nights buried in books about hops. Instead of learning in a classroom, he got his education in the brewhouse, under the watchful eye of professional brewer Arthur Bryant.

Wiley started homebrewing in 2010. When he was 15, his mother suggested he try brewing beer as a creative outlet. Wiley got a brief run-down of the "whats" and "hows" of brewing from the employees at Vermont Homebrew Supply. After a short shopping spree, Wiley and his friends set out to make their first beer, which, according to him, "didn't come out so great . . . I couldn't get anyone to drink it."

After the disastrous first batch, Wiley was hooked. Even at a young age, the art of brewing held an appeal. Beginning with no formal training and only a brief explanation of the brewing process "was a little overwhelming at first," Wiley admits. He spent hours reading books and scanning articles online and, through the always-effective process of trial and error, Wiley slowly began crafting beers that attracted the attention of those who tried them.

Despite speaking with a few local brewing companies, Wiley decided to wait to kick off his professional brewing career in the United States, saying, "the biggest struggle is doing all this while being a kid . . . I'm just too young [and] it's not a very kid-friendly world."

In spite of the difficulties posed by his age, Wiley still makes a great beer. He often looks to professional brewers like Sam Calagione, the founder of Dogfish Head Craft Brewery, for inspiration and motivation. Calagione has traveled the world in search of different recipes and ingredients for his beers, resulting in unique brews. Like Calagione, Wiley focuses on finding creative ways to combine ingredients that blend together to form a smooth, crisp, delicious final product. The freedom involved in creating his own recipes is Wiley's favorite part. "There are unlimited possibilities," he says, "sometimes I'll be making a batch [and] I'll just go into a Whole Foods store and just start grabbing random food ingredients." In fact, the batch he is working on right now has several different types of flowers in it, including lavender and roses to add a floral aroma and taste.

Wiley is currently living in New Zealand where he is going from brewery to brewery, crafting beers in exchange for room and board. Aside from being able to legally drink the beer he makes, Wiley has been drawn to New Zealand by the opportunity to be at the start of another beer explosion. "The craft beer scene in New Zealand is just starting to grow. It's cool to see how closely connected the bars are with the brewers; it's basically just like one big group of friends."

In the next few years, Wiley plans to move back to the United States to start his own brewing company. Given his experience in New Zealand, his knowledge base from Sunderland, and his lifelong passion for brewing, it's safe to say that his return will be welcomed by craft beer drinkers all across New England. BYO

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