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Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

DECEMBER 2019, VOL.25, NO.8

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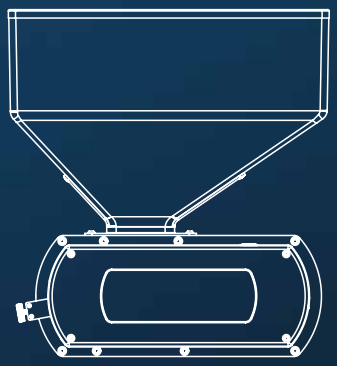
304 Ss brewtech



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departments

where to find it

RECIPE INDEX

RECIPE STANDARDIZATION

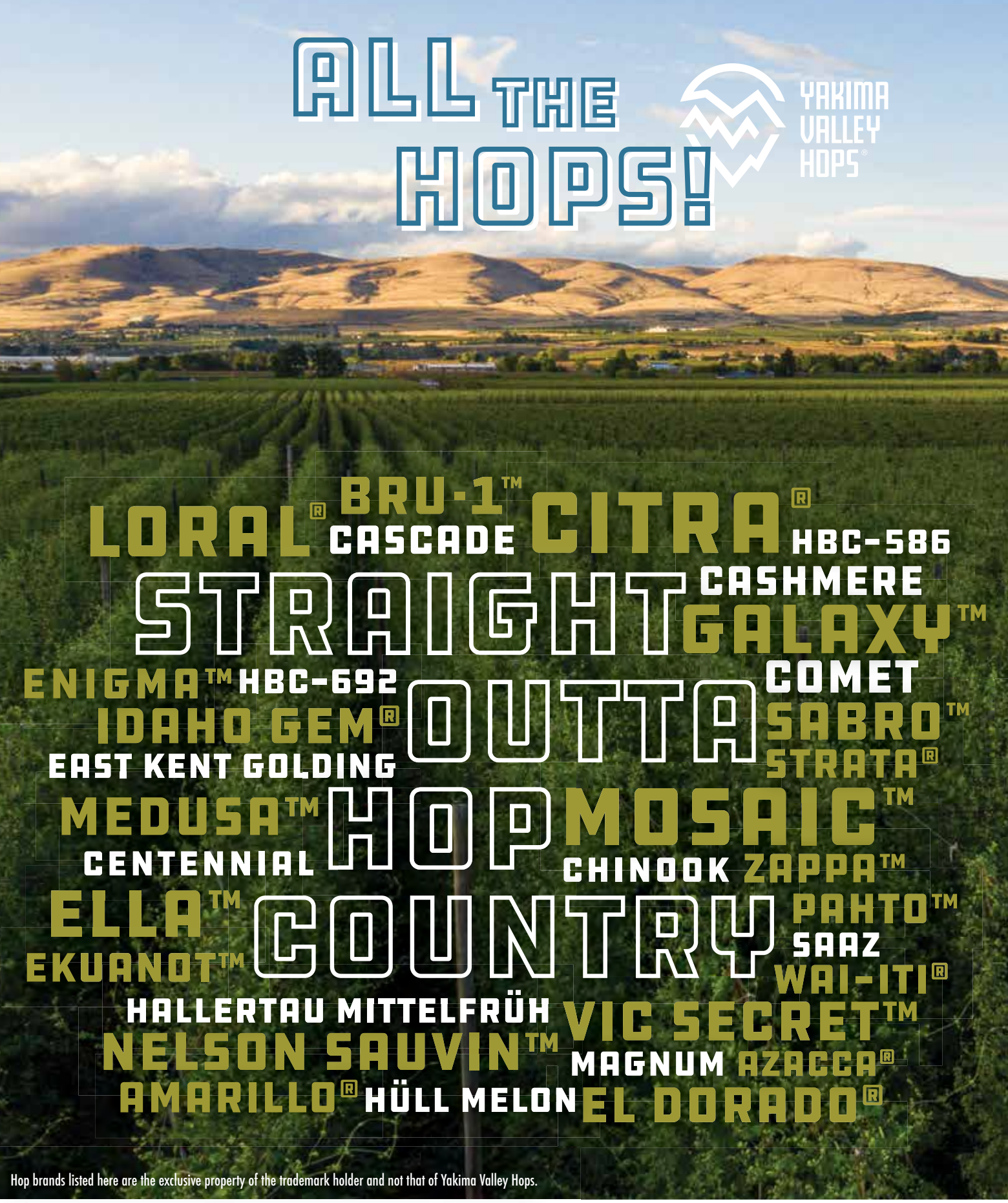
EXTRACT EFFICIENCY: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one US gallon of water, would yield a wort of 1.024.)

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. Increase hop dosage 10% if using whole leaf hops.

Gallons:
We use US gallons whenever gallons are mentioned.



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[WHOLESALE] [RETAIL]

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Cover Photo:
Pat Mullin - Boulevard Brewing Co.

Q

Do you have any holiday traditions that pertain to beer; homebrew or commercial?

Every year while visiting my parents for Christmas I make the pilgrimage to New Glarus Brewing to buy 4–5 cases of beer to share. I grew up just south of there, barely across the Illinois border, and started visiting the brewery regularly in 1997 at its original location. Our entire family values the importance of buying local to its community, and I feel like I "grew up" with this brewery in my Midwestern cornfield backyard. One of the first beers I ever homebrewed was a clone of their Spotted Cow (using Wyeast 1056).

My main holiday tradition is that I brew and switch to drinking dark beers for most of the winter season. My favorites are a robust English-style porter and a clone of Guinness Stout. There's something about the holiday season that makes these beers special for me and I think they fit in very well with the foods of the season, and I also enjoy a heavy dark beer sitting by a fire late at night before bed.

I have two "go-to" holiday beer traditions. They are: Serving a Belgian ale with Thanksgiving dinner. It can be a tripel, strong golden, saison, lambic or Trappist ale, as long as it is gold in color. I mix it up every year. The second is buying a 6-pack of Sierra Nevada Celebration Ale.

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suggested pairings at BYO.COM

Cleaning and Sanitation Science

Many breweries and homebrewers will introduce *diastaticus* yeast strains into their brewing equipment from time-to-time. The key to successfully containing these strains to the places where they belong is proper cleaning and sanitation for fermentation and packaging equipment. Make sure you're doing it right. https://byo.com/article/cleaning-and-sanitation-home brew-science/

MEMBERS ONLY

Modern Meadmaking

Mead, which is a fermented beverage made from honey, is arguably one of the oldest alcoholic beverages. Using some modern methods, mead is also relatively easy and quick to make, and you can use equipment you already have on hand for homebrewing. https://byo.com/article/modern-mead-making/

Barrel Aging: Pro Brewer Tips

So you got yourself a barrel . . . next up is to figure out what to do with it. Get some advice from six professional brewers who have more than earned their stripes in this specialized department. https://byo.com/article/professional-barrel-aging/

MEMBERS ONLY

Baltic Porter

There is no such thing as pigeon-holing Baltic porter . . . the only generalization you can make about the beer style is that it's a dark beer. Here is another take on the style from Jamil Zainasheff. https://byo.com/article/baltic-porter-techniques/

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MAIL

DOES FERMENTATION REALLY STRIP HOP VOLATILES?

In the "Mr. Wizard" column "Freezing Hops to Kill Microbes," (https://byo.com/mr-wizard/freezing-hops-to-kill-microbes) it states, "Most brewers do dry hop after fermentation is complete because the carbon dioxide produced during fermentation does strip hop volatiles and reduces the impact of the hops added." Hasn't the concept of biotransformation (adding hops at high kräusen) and the rise of New England IPAs debunked this myth?

John Eischen • *via email*

BYO *Recipe Editor Dave Green responds: "I wouldn't call it a myth. Biotransformations are as real as, at least as far as my understanding, CO_2 scrubbing is a real thing. The volatile hop oils will join the CO_2 during the bubble's expulsion from solution and subsequently the fermenter. It's one reason that hops added to the kettle are not going to be as effective in aroma contribution as the same hops added post-fermentation.*

"But with that said, dry hops added late in fermentation will minimize the scrubbing action while allowing biotransformations to occur on certain oils. There are folks that will add dry hops along with yeast pitching to maximize biotransformations on those hops, but then they will most likely add another round of hops after fermentation is complete, if looking for maximum aroma. Yeast also strip hop oils from the fermented beer when they flocculate, so there are reasons to force some flocculation prior to this round of hopping too. Some like to drop the temperature down to the low-60s °F (~16 °C) for this purpose.

"For my hop-forward beers, I add my first dry hops ¾ of the way through fermentation and then again several days after fermentation has died down and I am packaging into kegs. I'll often split the dry hops in half between these two additions and am more than happy with my results.

"I hope that answers your question. If you have some information that counters this though, we're all ears."

SHAVED COCONUT ADDITIONS

I am going to try brewing the clone recipe for Free Will Brewing Co.'s C.O.B. (www.byo.com/recipe/free-will-brewing-company-c-o-b) and I'm wondering if the Baker's shaved coconut is sweetened?

contributors

Ashton Lewis has been *Brew Your Own's* Technical Editor and "Help Me, Mr. Wizard" columnist for the last 24 years. He joined BSG in December 2016, where he is the Technical Sales Manager for the Central Midwest. Prior to joining BSG, Ashton was the Staff Master Brewer and the Brewing Group Sales Manager for the Paul Mueller Company. He is also a partner in Springfield Brewing Company (SBC) in Springfield, Missouri, and has been part of this brewery, originally built as a showcase of Mueller equipment, since 1997. Ashton was SBC's Master Brewer for 21 years. Ashton holds a B.S. in Food Science from Virginia Tech (1991) and a M.S. in Food/Brewing Science from UC-Davis (1994).

Ashton does double duty in this issue, writing his regular "Mr. Wizard" column on page 20, as well as the cover story profile on Boulevard Brewing Co. on page 58.

Jill Ramseier was raised in Canby, Oregon between a filbert orchard and an egg farm, she started her career cooking the savory comfort food she loves, everything from high-volume Creole to farmhouse French cafe food. An adventure soon landed Ramseier in Ohio, where an opportunity to run a pastry program at a fine dining bistro allowed her to make breads, pastries, and pastas from scratch daily. Eventually she returned home to Oregon to open the Deschutes Brewery Public House in 2008. After setting up a 24/7 scratch baking program that turns out 50,000 of the brewery's well-loved pretzels a year, she returned to her savory roots and became Executive Chef in 2013. When not overseeing the brewery kitchen, she enjoys spending time at home with her family, puttering around in her garden, or enjoying their farm.

Beginning on page 44, Jill shares six recipes to fill your table for holiday brunch, each cooked with a different beer style.

Jason Phelps started homebrewing nearly 15 years ago, and like many hobbies it became a life changing experience. After first learning to make beer, Jason branched out into cider, wine, and ultimately mead. Along the journey Jason has received more than 120 competition medals for a wide range of fermentations. As an author of articles in both *Brew Your Own* and *Wine-Maker* magazines, Jason loves to share his experiences and knowledge with other beverage makers. After retiring from a 25-year career in IT, Jason and his wife, Margot, opened Ancient Fire Mead & Cider in Manchester, New Hampshire, in 2017.

Beginning on page 72, Jason shares tips and recipes for making meads perfect for the holidays.

THE GRAINFATHER
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MAIL

That seems to be all I can find in the Baker's brand. Appreciate any input you may have!

Mike Higgins • *via email*

This actually should not make a difference in the end (unless they're sweetening with an unfermentable like Stevia) since the yeast will ferment out any simple sugars that are found in the coconut. So go ahead and add whether sweetened or unsweetened.

CHOOSING A YEAST STRAIN

I would like to brew a clone recipe for Unibroue's La Fin du Monde and I'm just wondering what yeast you'd use for an all-grain brew. I was thinking Wyeast 3864 (Canadian/Belgian Ale) but it's not sold any longer. Would Wyeast 1214 (Belgian Abbey Style Ale) work? Anything better?

Jay Hogan • *via email*

BYO *Recipe Editor Dave Green responds: "So the Wyeast 3864 strain is still being occasionally propagated by Wyeast since it is listed in the Private Collection series. You could email them to see if they have any plans of offering that one anytime in the near future. With that said, my favorite go-to Belgian strain is the supposed Westmalle strain, Wyeast 3787 (Trappist Style High Gravity). To me: 1) It's temperature tolerant, so you don't need to be temperature paranoid, 2) A little bit cleaner than 1214, which to me would be more like the relatively clean La Fin du Monde, and 3) It's a reliable attenuator, which I love. There are some really good strains in the White Labs lineup too, but if you're going Wyeast, then 3787 would be my top pick. But yes, 1214 would work nicely as well. Honestly, you may only be able to tell the difference if you tasted the two side-by-side."*

HOW MANY APPLES ARE NEEDED TO MAKE CIDER?

After reading some articles on cidermaking, I'm inspired to make some of my own. However, the articles I've read neglect to give an important detail. How many apples (pounds/quarts/etc.) are required per gallon?

David Bittle • *via email*

We just did a cider press at the office this fall and the differences between apple types was astounding. However, in looking for some general guidelines we asked Steve Bader, who makes a lot of cider every year and has frequently written articles on the subject. Here is his reply: "There are lots of variables here, but a 'rule of thumb' is 15 lbs. (6.8 kg) gets you approximately 1 gallon (3.8 L) of juice. Apple variety makes a huge difference, as well as how ripe they are and whether you use enzymes to extract more juice. For some varieties of apples you need closer to 22–24 lbs. (10–11 kg) to get a gallon (3.8 L) of juice." BYO

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BEGINNER'S BLOCK

BY DAVE GREEN

BACKSWEETENING

The what of this process is simple . . . add sugar to sweeten up your alcoholic beverage. It can be any type: Beer, cider, mead, or even wine. We have a plethora of sugars to choose from — table sugar, honey, raw cane sugar, maple syrup, agave, apple juice concentrate (for cider), etc. Seems simple, right? But the process is very limiting because yeast, once arrested, can no longer carbonate the beverage. Ergo backsweetening is more common in the still (uncarbonated) cider, mead, and wine world. But if you keg your beer, well then you can easily do it as well.

WHY BACKSWEETEN?

Backsweetening is an optional task that can easily ruin your efforts if not handled properly. Bottle bombs and oversweetening are two of the most common problems associated with backsweetening-gone-wrong efforts. So why go through the effort when there are other options to sweeten a beer with an unfermentable sugar? First is the ability to fine-tune every batch. Second is that the flavors found in fermentables like maple syrup and honey just can't be matched with unfermentables like Stevia, maltodextrin, or lactose.

When it comes to hard cider, acidity is one of the other key components to the flavor profile. A dry cider will be skewed heavily towards the acidity. Cidermakers may consider backsweetening a little to balance this out as sugar will reduce the perception of acidity. Another reason could be you're making this batch for someone with a sweet tooth. Backsweetening a beer like an imperial stout with something such as agave, maple syrup, or a raw sugar (like demerera or turbinado) can add flavors such as vanilla-almond, or earthy-woody, and even caramelly flavors depending on the grades and sugars of choice. Finally, backsweetening can enhance "fruitiness" character, especially in fruited cider, fruit beer, or melomels. Adding a fruit concentrate can really help build this characteristic.

WHEN TO BACKSWEETEN

This process needs to occur prior to bottling for still beverages (still cider or mead), but can happen just about anytime post fermentation if you plan to keg. If you plan to bottle, a bit of time of bulk aging and retesting prior to bottling is a good thing. Also, it takes a little time for the proper yeast arresting chemicals (sorbate and metabisulfite) to fully affect the yeast. One of the biggest concerns is refermentation in the bottle and a little time to make sure the beverage remains stable at room (or cellar) temperature can be reassuring.

HOW TO BACKSWEETEN

Add sorbate at the rate of a ½ tsp. per gallon (3.8 L) along with potassium metabisulfite sulfite at a rate of about ¼ tsp. per 5 gallons (19 L). For a more precise metabisulfite calculator, you can find one on our sister publication's website at: https://winemakermag.com/sulfitecalculator. Generally it's good practice to add the sulfite, wait 12 hours, then add the sorbate. Wait another 48 hours and then add the sugar.

There are two ways to approach backsweetening, the guesstimate approach and the precision approach. If you want to take the guesstimate approach to cider and meads, then you need to know some basic guidelines. A dry cider or mead means that fermentation has gone to completion and there is no fructose, sucrose, glucose, etc. left. The 2008 Beer Judge Certification Program (BJCP) Style Guidelines for ciders stated that less than 0.9% residual sugar (9 g/L) is dry. Medium (or semi-sweet) cider runs 0.9–4% sugar (9–40 g/L) range. This is actually where many commercially available ciders labeled "dry" such as Angry Orchard Stone Dry and Strongbow Original Dry are found. Above 4% (40 g/L) and you are entering the sweet range, such as Woodchuck Amber or Stella Artois Cidre. Clinitest® is a quick and easy way to go about measuring the residual sugar in your beverage but hydrometers can work as well. Just remember that truly dry alcoholic beverages will be less than 1.000 SG. For each 1% sugar increase, the hydrometer reading will rise about 0.004. To backsweeten from 2 g/L to 5 g/L (0.2% to 0.5%), simply add 3 g of sugar for every liter in your fermenter. This will allow you to guesstimate the correct level of sweetness, but beware, oversweetening happens quickly.

The precision approach means bench trials. NOTE: These numbers need to be adjusted based on % sugar in whatever sugar solution you plan to use (e.g. maple syrup is often 66% sugar). To perform bench trials you'll need a few tools: A good scale, a 1-mL graduated pipette, a 50-mL graduated cylinder, and a thief. Pull a sample out of the fermenter in the thief and measure three 50 mL aliquots. Make a sugar solution by mixing 25 g of sugar into 25 mL of water, then top up with water to 50 mL of sugar solution. You will need to heat this up to get it to dissolve. This is now a 0.5 g/mL (500 g/L) sugar solution. So each mL you add will add 1% sugar (10 g/L) to your 50-mL samples. You can start with some extremes or you can dial it in a smaller range if you're trying to hone-in on specifics. But be sure to pour a separate control sample as well to test against the dry version. But even after identifying the "best" amount from trials, add in increments and taste as you go along. If you're having trouble deciding . . . crowd-source! Get some friends over and see what they think.

HOMEBREW DROOL SETUP

JESPER CLEMENSEN • AARHUS, DENMARK

I had three goals when I started designing my new brewing system: Less hassle, small set-up, and no entangled hoses lying around. It has been a fun, challenging, and also, at times, somewhat frustrating process to build this system . . . but in a weird way isn't that part of the fun? I am now extremely excited to see it all come to fruition and the system has been working perfectly since the first test run (which wasn't perfect).

Personally I'm more into the professional three-kettle brewing set-ups, where you have your hot liquor tank (HLT), mash/lauter tun (MLT), and a boil kettle (BK). But since a small footprint was a must, I opted for a small brew-stand with moveable HLT and MLT. Next I wanted the system to be aesthetically pleasing, but still engineered in a way that wort is easily moved from one phase in the brew to another. This is done with the help of a pump, and a series of valves and pipes that are mainly hard-plumbed.

Despite the engineering, I have tried to keep the brew process as manual as possible. I'm not much for the electronic one-pot systems, where you preset time and temperature. I like to get a good feel of my brew and the process by manually keeping track of these aspects.

Cleanliness was another important feature in my design process, and not just aesthetically. I have kept much of the material that contacts the wort stainless steel. This allows me to easily wash down the stand, while the inner workings can withstand caustic cleaners, and the pipes can easily be rinsed with the residual cooling water.

If I had to mention three of my favorite features it would probably be that all wort remains enclosed at all times, minimizing cleaning afterwards and there are no accidental spills/splashes. Next I like that the system is designed with almost zero dead space thanks to the Ss Brewtech pots and my own engineering. Finally, I love that I can step infusion mash by simply opening a few handles. Skål!

WHAT'S NEW

BARTH-HAAS HOP AROMA STANDARDS KIT

A new beer sensory kit that focuses on the various aroma descriptions provided by hops has been released by the Barth-Haas Group. Developed by their Brewing Solutions and Sensory Team, the kit is designed to help train brewers and folks in the brewing industry on the flavor attributes of hops. The kit is broken out into 12 distinct aroma vials each representing categories that comprise sensory language. Each vial is made up of food-grade compounds that were developed for smelling and not for consumption. Each kit retails at $39.99 (USD) and lasts for 6 months. www.johnihaas.com/aromastandardskit/

24 DAYS OF CHEER

Designed to hold standard 12-oz. (355- mL) bottles of beer, make this holiday season into a celebration each day of December with the 24 Days of Cheer from Craft Advent Calendar. Perfect as gifts for family, friends, or make one for yourself. You can mix homebrew with commercial brew, as well as any specialty drinks such as nips, cider, wine, and liquor. This does not come pre-packaged so you can be in control of the beverages. Each box is roughly the same size as a standard case of 24 bottled beers. The boxes start at $24.99 (USD). To learn more, visit craftadventbox.com

THE GRAINFATHER GLYCOL CHILLER

The glycol-chiller era is upon us homebrewers. If you are looking for precision control over your fermentation temperatures in tandem with The Grainfather conicals, you have to check this out. The Grainfather Glycol Chiller allows four independently controlled fermentations to occur simultaneously. The unit can handle cold-crashing 6 gallons (23 L) of beer down to 39–43 °F (4–6 °C) in as little as 4 hours. Unit comes equipped with insulated silicone hoses, self sealing couplers, glycol, a condensation jacket (for protection) and a stainless steel funnel to get the glycol in the unit. Additional hoses, couplers, and glycol is required if you plan to run more than one fermenter. Learn more at grainfather.com/grainfather-glycol-chiller/

Photo courtesy of High Gravity

SUPPORT YOUR LOCAL HOMEBREW SHOP

In case you haven't heard, brick and mortar homebrew retail shops are on the decline in recent years in the US. Latest numbers from the American Homebrewers Association (AHA) put the number of homebrew shops at 656, down from 815 in 2015. After talking with several shop owners about the decline, most cited increased availability of craft beers in local markets as well as online sales as two of the major factors contributing to the decline. Add in the potential correction from an oversaturation of shops at its high point and even Forbes Media took note. The Forbes article also noted changing demographics as a cause.

With that in mind, make sure that you are not contributing to the decline. While the convenience of online shopping may be a short-term gain, the long term loss of a resource like a homebrew shop is significant to the hobby and brewing. November 2, 2019 was Learn to Brew Day here in the US, but make sure that you are taking every opportunity to teach the next generation of homebrewers and guide them through the world of beer, beyond the latest hot beer in the market. Over the last three decades homebrewers have helped fuel a renewed interest in craft beer across the planet, let's make sure we continue to perpetuate this for our next generation too. So maybe this New Year. . . skip the membership to a gym and get down to the local homebrew shop, buy some supplies, and brew with friends. That sounds like a much better resolution, in our book at least.

Upcoming Events

DECEMBER 14
2019 SWFL Homebrew Throwdown

Open to the public, this event is hosted by the SWFL Homebrewers and Millennial Brewing Company of Fort Myers, Florida. There will be over 20 homebrewers pouring their beers as well as several local food trucks, vendors, live music, games, raffles, and more on hand. Ticket sale proceeds will be donated to a local charity. Homebrewers will be judged in two categories, one by professional craft brewers and one by the general public. The event runs from 4–7 p.m. You can learn more at the Facebook page for the SWFL Homebrewers.

DECEMBER 15
4th Annual Iron Brewer Competition

holds its final round of judging by the public at Ferment.Drink. Repeat (FDR) Brewing Company in San Francisco, California. The public will decide which of the top 5 teams from the preliminary judging round takes home the top prize of Iron Brewer 2019. Winners will get to brew their winning beer at FDR and serve it at the 2020 SF Beer Week Opening Gala. Proceeds from the competition go to support the Portola Neighborhood Association (PNA). For more information visit www.fermentdrinkrepeat.com/iron-brewer-competition

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PURSUE WHAT'S POSSIBLE

REPLICATOR

BY MICHAEL BURY

DEAR REPLICATOR, My love for Dogfish Head (DFH) started while watching their short-lived *Brew Masters* TV mini-series. I loved how they went into the brewery and showed the ins and outs. Living in Minnesota, DFH wasn't available. The closest distribution point was Wisconsin. Next thing I know, I purchased two cases to bring back. One of my buddies only had two on his list: Burton Baton and 120 Minute IPA. So naturally, I had to try both. That was the beginning of my love for Burton Baton. I am lucky enough now to be able to get it in Minnesota, but this beer is one of the greats and everyone should know about it.

Brad Sukut
Eagan, Minnesota

Coming from the Mid-Atlantic region, I've had my fair share of Burton Baton and can affirm how tasty a treat it really is. Dogfish Head (DFH) is the culmination of Founder and Head Brewer Sam Calagione's dreams mixed with a tenacity to create his own path, especially in the face of establishment. When told no, Sam had a history of seeking an alternative route. After developing an appreciation of high-quality craft beer during a stint as a waiter at Nacho Mama's in New York City, Sam became smitten with homebrewing. His first concoction wasn't the prototypical ESB, brown ale, or stout, but rather a pale ale with cherries. It was an immediate success that laid the groundwork for numerous culinary-inspired beers to come.

Having lobbied to change the state liquor laws of Delaware with the help of local lawyer Dick Kirk, DFH became the first brewpub to open in the state. With it came media coverage and notoriety even before DFH opened in 1995. There was only one small problem with such exposure; there were now a lot of thirsty patrons to satisfy and Sam was brewing on a modest 10-gallon (38-L) (yes, not BBL) system. To keep up with demand and ensure that taps never ran dry, he was brewing almost every day.

DFH serves up the typical range of beers that many breweries have, including quite a few high-octane brews that feature the "Dogfish Danger Cap" — a neon yellow-green cap with a Dogfish exclamation point to indicate that the drinker should savor the brew. Their iconic IPAs are known for being continually hopped for the duration of the boil. They've also established several collaborative brews under the Ancient Ales series with Dr. Patrick McGovern from the University of Pennsylvania, who analyzed ancient earthen-ware to bring ancient brew recipes into a more modern light. More recently DFH has launched SeaQuench and Slightly Mighty, two low-calorie beers, a Gose-ish beer and an IPA respectively, that pack quite the flavor punch.

Another aspect of DFH that I personally find intriguing is their Beer and Benevolence (B&B) program. Every year, the B&B program touches around 200 non-profits. In 2018 alone, the 13th annual Dogfish Dash gathered 3,000 runners from 28 states and raised $150,000 for The Nature Conservancy, Delaware chapter. Also, the first Dogfish Head I.P.A. (I Pedal A-Lot) attracted nearly 1,000 cyclists to southern Delaware. They raised $30,000 for bike safety and advocacy by the Urban Bike Project and Sussex Cyclists. The funds allowed for the construction of three cycle service stations along Delaware bike paths.

One can't discuss DFH in 2019 without mentioning their merger with Boston Beer Company, who owns the brands of Sam Adams and Angry Orchard. On May 9, 2019, an announcement was made that shocked the craft beer world. "More than a dozen of our peers have sold to international conglomerates, others have come together through platforms bringing a handful of craft breweries together in rollups," announced Sam and Mariah Calagione in a statement. "While neither of those strategies appealed to us, we did realize that Dogfish Head would be a stronger company with the support of our friends at Boston Beer, and vice-versa." Jim Koch also reassured the community, "Just as important as our passion for brewing is our commitment to championing and preserving the independent, American craft movement." Each brewery will retain their individual status as independent craft brewers. But back to your request . . .

Mark Sarfarik, Dogfish Head's Brewmaster, provided us with all the juicy details about this beer. "Burton Baton is a 10% ABV imperial IPA that is a blend of 90 Minute IPA with an English old ale that is aged in our 10,000-gallon (380-hL) oak foeders. Since most people don't have the ability to wood-age beers at home, this recipe is more of a composite of the two threads." In addition, Mark conferred several additional tips for the beer, some of which are included in the "Tips for Success" section of the recipe. First off, the dry-hop timeline for the beer should be no more than 3–4 days as extended aging can result in harsh, tannic-type flavors. With the majority of dry hopping protocols, most of the magic is really accomplished in the first 72 hours. Secondly, DFH's oak foeders are fairly neutral so they're more interested in the oxidative character that oak aging brings. To this end, Mark suggested the addition of the honey malt to drive a bit of that toffee sweetness. Finally, the water profile at the brewery is fairly soft with only 20 ppm calcium. Through additions, they arrive at ~70 ppm of calcium and during the mash you should be striving for a pH between 5.3 and 5.4.

With all these tips and tricks, hopefully you'll be able to recreate Burton Baton for enjoyment and sharing at home. Cheers!

DOGFISH HEAD CRAFT BREWERY'S BURTON BATON CLONE

(5 gallons/19 L, all-grain)
OG = 1.088 FG = 1.016
IBU = 65 SRM = 11 ABV = 9.5%

INGREDIENTS

15 lbs. (6.8 kg) pale ale malt
0.5 lb. (0.23 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) honey malt
0.2 lb. (90 g) amber malt
1 lb. (0.45 kg) corn sugar (10 min.)
15.2 AAU Warrior® hops (60–30 min.) (1 oz./28 g at 15.2% alpha acids)
9.5 AAU Simcoe® hops (30–15 min.) (0.75 oz./21 g at 12.6% alpha acids)
4.1 AAU Palisade® hops (15–0 min.) (0.5 oz./14 g at 8.2% alpha acids)
14.4 AAU Palisade® hops (0 min.) (1.75 oz./50 g at 8.2% alpha acids)
2.1 oz. (60 g) Simcoe® hops (dry hop)
2.9 oz. (80 g) Amarillo® hops (dry hop)
1.4 oz. (40 g) Palisade® hops (dry hop)
1.1 oz. (30 g) American medium-toast oak chips (optional)
Wyeast 1098 (British Ale) or White Labs WLP007 (Dry English Ale) or Lallemand Nottingham yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mill the grains, then mix with 5.1 gallons (19.2 L) of hot strike water to achieve a single infusion rest temperature of 155 °F (68 °C). Adjust mash pH to 5.3–5.4 using lactic acid, if needed. Hold at this temperature for 60 minutes. Mashout to 170 °F (77 °C) if desired.

Vorlauf until your runnings are clear before directing them to your boil kettle. Batch or fly sparge the mash and run-off to obtain 6.5 gallons (25 L) of wort. Boil for 60 minutes. Add the Warrior® incrementally from 60–30 minutes, then add the Simcoe® incrementally from 30–15 minutes, and finally, add Palisade® incrementally from 15 minutes to the end of the boil. Also, at 15 minutes left in boil, you may want to add either Irish moss or Whirlfloc as fining agents. At 10 minutes left, add the corn sugar.

After the boil, add the flameout hops indicated and whirlpool for 10 minutes before rapidly chilling the wort to 63 °F (17 °C). Oxygenate with pure oxygen and pitch a healthy count of yeast. Allow the beer to free-rise to 68 °F (20 °C).

Once primary fermentation is complete, dry hop with all three varieties. After 3 days, drop the temperature to 55 °F (13 °C) and after 24 hours, rack the beer to secondary. If oaking, add it now (1.1 oz./30 g of medium-toast American oak) and age for 14 days. Bottle or keg the beer and carbonate to approximately 2.5 volumes.

DOGFISH HEAD CRAFT BREWERY'S BURTON BATON CLONE

(5 gallons/19 L, extract with grains)
OG = 1.088 FG = 1.016
IBU = 65 SRM = 11 ABV = 9.5%

INGREDIENTS

8.25 lbs (3.74 kg) extra light dried malt extract
0.5 lb. (0.23 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) honey malt
0.2 lb. (90 g) amber malt
1 lb. (0.45 kg) corn sugar (10 min.)
15.2 AAU Warrior® hops (60–30 min.) (1 oz./28 g at 15.2% alpha acids)
9.5 AAU Simcoe® hops (30–15 min.) (0.75 oz./21 g at 12.6% alpha acids)
4.1 AAU Palisade® hops (15–0 min.) (0.5 oz./14 g at 8.2% alpha acids)
14.4 AAU Palisade® hops (0 min.) (1.75 oz./50 g at 8.2% alpha acids)
2.1 oz. (60 g) Simcoe® hops (dry hop)
2.9 oz. (80 g) Amarillo® hops (dry hop)
1.4 oz. (40 g) Palisade® hops (dry hop)
1.1 oz. (30 g) American medium-toast oak chips (optional)
Wyeast 1098 (British Ale) or White Labs WLP007 (Dry English Ale) or Lallemand Nottingham yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Bring 6.5 gallons (25 L) of water to roughly 150 °F (66 °C). Steep all the specialty malts 15 minutes before removing and draining. Add the extract, with stirring, before heating to a boil. Boil for 60 minutes following the all-grain recipe for hopping and fermentation directions.

TIPS FOR SUCCESS:

Mark adds, "this is a very high-gravity fermentation, so oxygen rather than air is recommended for wort aeration. Pitching double the normal amount of yeast is highly recommended." If you have trouble finding Palisade®, Willamette is a good substitute, or if Warrior® isn't available, any high alpha-acid bittering hop should suffice. Another unique technique DFH uses is called continually hopping. It means that small charges of hops are added roughly every minute or so. "This can be emulated at home by dividing each variety up into manageable, small quantities and spreading the addition out over the times indicated in the hopping schedule." BYO

BY DAWSON RASPUZZI

MAKING SPICED MEADS

A little spice is always nice

Spiced meads, often called methyglyns or metheglins, date back as far as mead itself. The options are limitless when it comes to choosing what spices and herbs, as well as how they are used. Two professional meadmakers share their advice for approaching this style of mead that is perfect for the winter holidays.

When I make mead I try to take away the variables. To do that, I like to add spices and herbs after fermentation. If I add spices to a mead that has completed that process, I know exactly what I am adding them to. Adding them prior is like building on a moving foundation.

Contact time with the spices varies depending on the spice. We have recipes that call for spices and herbs with contact times of only hours! We don't always add these types of items once, either. We have been known to add various ingredients for different lengths of time, many times. It can add dimension and it can enhance the flavor and make it taste more like the ingredient.

Likening meadmaking to cooking, dried herbs and spices give a more concentrated, direct flavor, so be careful. A general rule of thumb in cooking is use half the amount of dried spice than you would for fresh. Remember, it is to always easier to start with less than you think and add more later to develop the recipe.

I don't usually do anything unique to spices/herbs prior to their addition. I do use strainer bags just to keep things contained. I can remove it when I need to and it keeps my equipment cleaner (e.g. pumps). We do have a mortar and pestle, but it is rarely used.

Even with multiple additions, I don't like to overpower honey varietals with anything. I do like to find their affinities though. A lot of varietals out there have wonderful spice characteristics — clover being a great example. Clover honey has a wonderfully warm, cinnamon characteristic. Some may think it would be great to add more, but I would much rather add something that complements it. A great example would be nutmeg or vanilla, ginger or coriander seed, pineapple or coconut. We become our only limits, but I would choose to take the road that respects the subtlety of the honey.

California orange blossom honey, which is wildly different in flavor than its counterpart from Florida, has an amazing jasmine flower flavor with aromatics so reminiscent of jasmine rice. This honey is amazing with lemongrass, ginger, vanilla, and orange zest. Sometime the spice or herb that you are looking for is right there in the honey you have.

Spices and herbs can also complement fruit meads well. A couple of my favorite spice/fruit combinations are strawberry and basil (a classic), as well as grapefruit and rosemary.

Here are my other top pieces of advice for homebrewers:

1. Take great notes! You will never remember what you think you will.
2. You might as well make your batch 5 gallons (19 L). The downfall of a 1-gallon (4-L) batch is it is such a small sample size to really get good data and it is too small of a sample size when you realize how good it is!
3. Sometimes the stems and woody pieces of herbs have great flavors to build on as well. Don't waste what might be a great addition.
4. #endthewaronweeds — Some of the best flavors we have used are considered weeds (crimson sumac, wild carrot, pineapple weed, and sweet fern, to name a few). Just make sure that what you are using is safe to consume.

Sometimes the stems and woody pieces of herbs have great flavors to build on as well. Don't waste what might be a great addition.

Ash Fischbein is a passionate meadmaker, brewer, and serial entrepreneur based in Ossipee, New Hampshire. While he was too young to buy it at the time, he started making mead and beer during high school. He has been dedicated to crafting the perfect brew ever since. Ash is the Co-Owner of the award-winning Sap House Meadery and Hobbs Brewing Company.

Raphael Lyon opened Enlightenment Wines and Meadery as a small part-time farm winery in 2009. In 2015, Enlightenment grew into a full-scale production meadery with a tasting room and cocktail bar in Brooklyn, New York. After graduating from Brown University with a degree in media and culture, Raphael farmed at his family homestead, where he began his first experiments with making fruit wines and meads from local ingredients, a curiosity that has continued for 15 years.

One of the first things that any meadmaker needs to understand about using herbs is that they are not just simply used for flavoring. While they contain flavors, and those flavors should be considered, more often than not — like the use of hops in beer — they serve multiple roles as fermentation aids, preservation aids, and as any quick glance into the historical and archeological record will tell you, tend to be herbs with healing and psychoactive benefits.

It is for this reason that the history of meadmaking, like most alcohol making, is tightly wrapped up with the practice of medicine and magic. Remember, distillation of spirits for making tinctures is a relatively new development. Until that time all medicine extracted in alcohol would have been done with wine, mead, or more likely some combination of both. Many meads were created as much for the benefit and extraction of the herbs as it was the production of alcohol. When you think about making herbal meads — think about vermouth, cordials, and amaros — we recognize them as cocktail ingredients today, but they were medicinal wines when first created.

It is probably for this reason that Americans have fallen into the habit of talking about mead with herbs as "methyglyn," a Welsh word with the same root as medicine. We don't use that word at our tasting room or on our bottles, however. Instead we advocate for the term "botanical mead." That distinction is important to us. It's easier to say and understand for one. But critically and more importantly, using a Welsh word to describe a kind of beverage that's made around the world, and has been for thousands of years before Welsh was even a language, seems uninformed. It places Northern Europe at the center of a tradition when it doesn't really belong. Most botanical meads made today are made in Africa after all — it's called *tej*. If anything we should be calling our herbal meads *tej*. Failing that, "botanical mead" seems like a good compromise.

That being said, the second thing to understand is that use of herbs and botanicals are not a sideshow to meadmaking, or a style of making mead. Again like the use of hops in beer, they are a core element of meadmaking. The historical record is very clear on this subject. Virtually all mead residues found in archeological sites, and recipes when they can be found of more modern types, have some type of local herbs in them. Yes, you can make mead without herbs, but it's much harder to do, more likely to sour, and more difficult to preserve. It also doesn't taste as good.

Flavor aside, plant matter tends to provide the critical element of tannin, which not only helps structure the final product, but before the use of commercially-available yeast and storage in wood barrels, it would have also helped clear the wine. Raw honey has virtually no tannins or bittering agents but it does have an enormous amount of protein. If you want those proteins to settle out and clear you need to either boil the honey, which destroys its nose, or add a tannin source to help the proteins coagulate and sink with the yeast into the lees. Sometimes this can be accomplished with fruit, but not always. Luckily there is a whole army of herbs with tannins that don't really have much of a taste so you can add them to your mead without overpowering the honey flavor if that's what you're after. Bay is a commonly used one, and I believe it's why you see it in many old English recipes.

Now then, you're probably wondering, what herbs are good choices to add to your botanical meads, when should they be added, and so on. All I can say on the subject is that every plant is different and every plant has hundreds of flavors and chemicals. Some herbs require hot water extraction, some cold, some only express themselves in alcohol, some in a few days, some in a few months. There is no hard rule.

A good herbalist book can give you a sense of where to start (I recommend Maud Grieve's *A Modern Herbal*, it's available to read online for free). Other than that, it's all about trial and error, testing, and learning.

One last piece of advice as you start experimenting with different herbs in your homemade meads is to take good notes along the way!

BY ASHTON LEWIS

POST-SOURING GRAVITY

Also: Multi-batch brews, priming a keg, and fermenting lemon juice

Q I HAVE BEEN GETTING INTO SOUR BEERS LATELY WITH TWO OF MY LATEST BEING IRISH REDS KETTLE SOURED WITH GOOD-BELLY MANGO-FLAVOR PROBIOTIC JUICE DRINK. I STOPPED THE FIRST AT A pH OF 3.8 AND THE SECOND AT 3.4. BOTH ARE GREAT, WITH THE 3.4 THE BEST. WILL LET THE NEXT BATCH GO A BIT LOWER. THIS STARTED ME THINKING, OBVIOUSLY THE SOURING BACTERIA EATS SUGAR TO MAKE THE LACTIC ACID, SO HOW MUCH OF THE FERMENTABLE SUGAR IS USED UP? THE IRISH REDS WERE ALREADY EXPECTED TO RESULT IN A LOW ABV. I LOST MY STARTING GRAVITY READINGS ON BOTH SO I CAN'T GET ANY NUMBERS BUT THE TASTE TELLS ME THE FINISHED PRODUCTS ARE LOWER THAN EXPECTED. ALSO, WOULD THE LACTIC ACID HAVE MESSED UP THE READINGS ANYWAY? I'M THINKING THE NEXT BATCH I MAY USE 50–100% MORE FERMENTABLES. DOES THAT SOUND REASONABLE?

DUNCAN K. BURNS
CHARLESTON, SOUTH CAROLINA

The hydrometer is a pretty handy brewing tool and you can certainly use it to monitor the change in wort density before and after your souring phase.

Some sugar is consumed during the kettle-souring phase by Lactobacillus, *creating lactic acid. A hydrometer reading can tell you about how much.*

A Thanks for the interesting question, Duncan. The product you are using as your source of bacteria lists *Lactobacillus plantarum* as the only bacterial ingredient in this beverage. *Lactobacillus plantarum* is a facultative heterofermentative lactic species. This means that under anaerobic conditions, *Lactobacillus plantarum* behaves like a homofermentative lactic species and produces lactic acid as its sole metabolic by-product, which then switches to a heterofermenter under aerobic conditions and also produces ethanol, acetic acid, and carbon dioxide. Not all *Lactobacillus plantarum* strains behave the same, but they generally ferment a wide array of carbohydrates (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2546631/) and wort is a great growth media for these bacteria. Sounds like you are concerned that these little critters are going to consume too much fermentable sugars and cut into the production of ethanol by yeast?

The hydrometer is a pretty handy brewing tool and you can certainly use it to monitor the change in wort density before and after your souring phase. The specific gravity of lactic acid solutions vary by concentration, but over the range seen in wort/beer the specific gravity is not much higher than water. This means that as carbohydrates are metabolized the specific gravity of the wort will drop, and that the wort density at the time of yeast pitching can be used like the original gravity (OG) of non-sour brews. This is not an exact measurement, but it is a reasonable approximation.

One thing to keep in mind about fermentations, in general, is that fermentation by-products often regulate fermentation. In the case of lactic acid fermentations, environmental pH affects metabolism. This is why yogurt contains lactose, even after prolonged storage in the presence of lactic acid bacteria. Kettle sours tend to bottom out around pH 3.2, empirically suggesting that the environment is regulating the rate of

fermentation. The other practical consideration relevant to your question is the kettle sour process. Most brewers monitor pH during the souring phase and use pH as a control point; for example, if the goal is to reduce pH to 3.4, the brewing process advances to the next step when this goal is achieved. This means that even if lactic acid bacteria are able to consume all fermentable carbohydrates, the brewing process control would prevent that from occurring. The brewers I know who are commercially brewing kettle sours all carefully monitor pH because many of these brewers are looking for flavor consistency as well as efficient use of their equipment; as soon as the wort pH falls to the target level, they are moving on to wort boiling.

I am not even going to touch attempting to calculate alcohol content of kettle sours because there are simply too many variables to consider. The best calculation tools used to approximate alcohol content in beer based on OG and FG are based on lots of data from "normal beer." In order to develop the same sort of model for sour beers requires a matrix of process measurements in addition to lab analysis of the ethanol content of the finished beer. Sounds like a great project for an eager brewing chemist!

Something to consider about these beers is how they stand up on the palate and if there is a real need to boost OG to offset the loss of fermentables during the souring phase. Most kettle sours being produced commercially have average to below-average alcohol concentrations and generally are made from worts in the 10–12 °Plato (1.042–1.050 SG) range, and sometimes lower. Berliner weisse is a great example of a low-alcohol beer that does not leave my palate asking for the missing experience that is often the case with reduced-alcohol, non-sour styles. If you like what you find in the market and want to brew these sorts of beers at home, skip the additional fermentables. Alcohol consumption is dropping globally and brewers are being challenged to produce lower-alcohol alternates to traditional beers. Kettle sours, with their refreshing acidity and high drinkability, are really a style that fits in with this shift. Focus your process and recipe on how your beer stands up to tasting, and make changes from a flavor standpoint first and ABV targets second.

Q I AM CURRENTLY BREWING WITH ONE OF THE GRAINFATHER-LIKE ALL-IN-ONE BREWING SYSTEMS TO PRODUCE BETWEEN 5–6 GALLONS (19–23 L) OF BEER WITH EACH BATCH. ONE OF THE BEERS IS A BIG IMPERIAL STOUT AND IS ABSOLUTELY DELICIOUS! THE ONLY PROBLEM IS THAT I DON'T HAVE ENOUGH OF IT.

I WAS WONDERING IF IT WOULD BE POSSIBLE TO PRODUCE A LARGER VOLUME OF THE BEER BY ADDING MORE WORT IN BATCHES. LET'S SAY ON DAY ONE I PRODUCE A 5-GALLON (19-L) BATCH AND ADD IT TO THE FERMENTER WITH YEAST AND THE NEXT DAY BREW ANOTHER 5-GALLON (19-L) BATCH AND ADD IT TO THE ACTIVELY FERMENTING BEER? THIS WOULD INCREASE THE VOLUME OF WHAT I COULD PRODUCE WITHOUT BUYING NEW EQUIPMENT, WHICH I DON'T HAVE THE SPACE FOR AT THE MOMENT.

BOB SCHEPERS
LEIDEN, NETHERLANDS

A The answer is yes! This is a great way to produce more beer volume from a brewhouse of a fixed size and is commonly used by commercial brewers around the globe. The economics of this are simple: Two single-batch fermenters cost 2 units of currency, one double-batch fermenter costs about 1.3 units of currency, and one quadruple-batch fermenter costs about 1.7 units of currency. The commercial economics become even more pronounced when the cost of cleaning, labor, utilities, instrumentation, and automation are considered. Multi-batch fermenters have a multitude of real advantages. There are a few general tips to consider when putting more than one batch into a single fermentation vessel.

Multi-Batch Tip #1:

Most breweries fermenting multiple batches of wort in a single fermenter fill the fermenter within about 18 hours because periods longer than this can result in an interruption in the way yeast grow and transform wort to beer. Without getting in the weeds of this topic, you will be a happy and successful multi-batch brewer if your first brew fills into the fermenter towards the end of day one and the second brew fills into the fermenter before noon on the following day. If you brew on the weekend, this means doing a late afternoon/early evening brew on Saturday and a morning brew on Sunday (or Friday evening and Saturday morning). Your first brew may just be beginning to ferment when your second brew is added. Brewing both brews in the same day is preferred, but this can seem more like work than having fun!

Multi-Batch Tip #2:

Add all of the yeast pitch, enough for the combined volume, to the first brew. As you become more experienced with this method you can reduce the yeast pitch rate because there is yeast growth in between initial pitching and the second batch of wort flowing into the fermenter, but beginning conservatively is a good plan. Ideally the two brews are produced in the shortest timeframe possible and the yeast population is likely in the lag phase (still no growth — reproduction has not yet commenced) when the second batch of wort is added to the fermenter.

Multi-Batch Tip #3:

Commercial breweries aerate in-line between the wort cooler and the fermenter. A two-brew fermentation is usually aerated on both fills when the two brews fill into the fermenter

before yeast growth begins. Many breweries will skip aeration after yeast growth takes off. You can aerate your fermenter twice if the two batches are filled in quick succession, but if the two batches take longer than ~8 hours to produce consider skipping the second aeration. Why aerate twice? If the second batch comes in without aeration, the oxygen content of the wort is diluted and may cause fermentation issues. If you are using dried yeast, aeration is not a concern because dried yeast does just fine in non-aerated wort. This is another topic for another day!

Multi-Batch Tip #4:
Limit your multi-batch brewing to two batches per fermenter. Things become a bit more complex when fermenters contain more than two batches. Some brewers add yeast with alternating wort fills and also alternate how wort is aerated. This can all be done at home, but you are looking to solve a practical problem that is easily addressed without adding too much complexity.

Multi-Batch Tip #5:
Another method that works very well at home is to simply ferment your two brews as independent batches and blend the two batches together after primary fermentation is complete. If you normally rack your beer into a secondary, this would be an ideal time to conduct the blend. If you use a single-vessel process, you can rack one of the batches into the other provided your fermenter is large enough.

Q ALL THE RECIPES IN *BYO* CALL FOR CORN SUGAR "IF PRIMING." THERE ARE MANY ARTICLES ABOUT KEGGING AND CARBONATING AND A FEW OF THEM I READ MENTIONED PRIMING WHEN KEGGING BUT DID NOT SAY HOW MUCH OR IF IT IS A STANDARD PRACTICE. I AM CURRENTLY USING 5-GALLON (19-L) "CORNY" SODA KEGS AND USE BOTTLED CO_2 TO CARBONATE. I BREW ALL-GRAIN IPAs AND WINTER ALES, NORMALLY AROUND 6.5% ABV. IS PRIMING FOR KEGS RECOMMENDED AND IF SO HOW MUCH CORN SUGAR FOR A 5-GALLON (19-L) BATCH?

MURRAY NUNN
HAPPY VALLEY, OREGON

A This is a popular topic and we have run many variations on this basic question in past issues of *BYO*. I believe that there are some reasons to keg condition and will give some practical considerations for you to mull over about this topic. Whether carbonating in bottles or in a keg, you must measure the volume of beer you are carbonating in order to know how much priming sugar to add for a given level of carbonation. Without going into the nitty gritty detail of past material, 110 grams/3.9 ounces of sugar will increase the carbonation level of 18 L (4.75 gallons) of beer by 3 grams of CO_2 per liter of beer or 1.5 volumes. You can check out this answer for the details on carbonation calculations https://byo.com/mr-wizard/bottle-priming/.

One common rule of thumb among brewers who routinely keg condition is to use about 75% of the priming sugar suggested in a recipe for bottle-conditioned beer. I have never been able to find the original source of this advice. Most of the explanations for this are vague and simply state that keg-conditioned beer becomes over-carbonated if the priming addition suggested for bottle-conditioned beers is not reduced. Some suggest that the problem is due to the common practice of pressurizing the headspace of the keg after filling to seal the lid. By doing this, the priming sugar has less headspace to pressurize. I am not sold on this explanation because a Corny keg usually has more total headspace volume than 5-gallons of beer filled into 53 bottles. Assuming the typical beer bottle contains 15 mL of headspace, 53 bottles have a total of 795 mL of headspace, which is greater than the headspace volume when a Corny keg is filled to 5 gallons (19 L). Volumetric details and hypothetical asides, the contemporary rule is to use less sugar for keg conditioning than you do for bottle conditioning.

I spend a lot of time visiting commercial brewers as part of my job as Technical Sales Manager – Central Midwest at BSG. One thing that I am seeing and hearing more of lately is spunding. For many brewers the practice of capping a fermenting tank of beer with an adjustable pressure relief valve for the sole purpose of capturing carbon dioxide and controlling the head space pressure of the tank, in other words spunding, is a new technique and there is a lot of excitement about this method. Old school lager heads, like me, have been spunding for a long time and have wondered why other brewers have not used this handy method of carbonation. Not only does spunding make use of carbon dioxide that is produced during fermentation to carbonate beer, it also saves time, can improve foam retention when compared to methods that result in beer foaming, such as carbonation stones, and reduces gas stripping of aromatics. This latter point is a big selling-point for brewers who are adding gobs of dry hops, like the crazed haze head crowd.

The easiest and, in my opinion, best way to repeatedly carbonate beer in a keg is with a spunding valve. You don't have to make adjustments for your batch volume or initial carbon dioxide content because the spunding technique works by releasing any excess pressure from the keg. This means that a surplus of carbon dioxide is intentionally produced. A typical carbonation level for draft beer is 5 g/L or 2.5 volumes. If a keg is being conditioned at 72 °F (22 °C), the equilibrium pressure is 31 psig. I indicated earlier in this discussion that 110 grams (3.9 oz.)of sugar are needed to increase the carbonation level of 18 liters (4.75 gallons) of beer by 3 g/L or 1.5 volumes of carbon dioxide (this takes into account the carbonation of the beer after/during fermentation).

When using a spunding valve, the exact amount of sugar

is not critical as long as there is a bit more than needed. Boost the 110 grams (3.9 oz.) by 20% and add 132 grams (4.7 oz.) when you rack your brew from the primary to your Corny keg, seal the keg lid by pressuring to about 10 psig, and attach your spunding valve. Most of these valves do not have calibrated markings on them. You will need to adjust the valve to relieve at 31 psig before you are ready to walk away for a few days. This is easy to do by pressurizing your keg to about 35 psig, adjusting the valve so that it stops venting gas at 31 psig, and then reducing your headspace pressure to about 10 psig by pulling the tab on the pressure relief valve that is on top of the Corny keg.

Over the next several days, the headspace pressure will increase as the priming sugar is fermented. When the pressure reaches the relief set point, excess gas will vent until the priming sugar has all been fermented. The same method can be used without priming sugar as long as the fermentation is capped with the spunding valve when the beer is about 2 °Plato (0.008 SG) above terminal gravity. When the carbonation process is complete, simply remove the spunding valve, transfer the keg to your cooler, and allow your beer to cool and settle before serving. No further adjustment is needed. The last thing to check before serving is the equilibrium headspace pressure associated with the beer carbonation level. In this case the target was 5 g/L or 2.5 volumes. If the beer is stored in a 38 °F/3 °C cooler, ~11.2 psig is needed to maintain this level of carbonation. Easy peasy!

Q I RECENTLY ATTEMPTED A LEMON ALCOHOLIC BREW, BECAUSE WE HAD A FULL FRUITING LEMON TREE IN OUR BACKYARD AND HAD MORE LEMONS THAN WE KNEW WHAT TO DO WITH. THE CULTIVAR IS MEYER LEMON, WHICH IS BOTH JUICY AND A LITTLE LESS ASTRINGENT THAN NORMAL STORE-BOUGHT LEMONS.

USING A CHAMPAGNE YEAST, THIS BREW TOOK MANY DAYS TO BEGIN FERMENTING AND THEN WEEKS TO FINISH FERMENTING. I EXPECTED AN INFECTION BUT AM HAPPY TO REPORT THAT DID NOT HAPPEN. IN FACT IT NEVER ACTUALLY FERMENTED FULLY; I WAS LEFT WITH A SWEET LOW-ALCOHOL PRODUCT. IT WAS ONLY DRINKABLE IF YOU FURTHER BACKSWEETENED.

I HAVE BEEN ADVISED TO CAREFULLY LOOK AT THE pH AS THIS MIGHT BE PARTLY RESPONSIBLE. NATURALLY I WILL DEFER ANY FURTHER EXPERIMENTS UNTIL I CAN PINPOINT THE PROBABLE CAUSES OF MY INITIAL RESULT. IF YOU HAVE TIME I'D GREATLY APPRECIATE ANY COMMENTS YOU THINK MIGHT HELP.

PETER OWENS
AUSTRALIA

HELP ME, MR. WIZARD

A It seems that people, past and present, have accidentally or intentionally fermented just about everything. The easy way to categorize alcoholic beverages is by raw material; beer is made from grains, wine is made from fruit, and mead is made from honey. One commonality with all of these beverages is that the starting point (brewer's wort or winemaker's and meadmaker's must) is a relatively friendly environment for yeast. Although the modern zymurgist often adds nutrients to optimize growth conditions, wort and must can quickly be fermented by wild and cultured yeast. Lemon juice, on the other hand is not so friendly.

The pH of lemon juice is very low and is typically reported to be around pH 2.2. To put this in perspective, this is about 1,600 times more acidic, as defined by the concentration of hydrogen ions, than wort at pH 5.4, and 16 times more acidic than grape must at pH 3.4. Yeast are effected by environmental pH and don't perform well when the pH drops below about 3. Brewers who successfully bottle condition sour beers know this step can be tricky because the combination of low pH and alcohol requires acid-tolerant yeast strains for conditioning. Lemon juice is truly an extreme environment and the very limited fermentation you experienced is typical for the descriptions of lemon juice fermentations reported by others.

If you simply want to ferment lemon juice into a mildly alcoholic beverage and not follow traditional methods, I would suggest a few things to improve the environment before adding your yeast. Start with the pH obstacle and do something to move the pH upward. One way to do this would be to dilute the lemon juice with wort. Wort is a good source of amino acids, which serve the role of pH buffer and nutrient. Not too different from a kettle sour, except here wort is added to make the juice less acidic. Dried malt extract would make this process easier and a handy method for a quick brew day. Not too interested in a lemon beer? Consider making sima, a Finnish mead made with honey and lemons. The important thing is to bring the pH into a friendlier range.

The other challenge that should be addressed when fermenting lemon juice is nitrogen; lemon juice does not have much and yeast need it for growth. Although yeast nutrients have become fairly common in brewing as brewers have pushed the envelope, all-malt worts made for traditional styles are a good source of nitrogen and many brewers don't have much need for or experience with nutrients. Wine and meadmakers, on the other hand, are well-versed in the use of nutrients because the musts used for wine and mead are usually deficient in nitrogen. Consider using a general purpose yeast nutrient like Superfood that contains a blend of amino acids, diammonium phosphate, and vitamins.

I hope this high-level answer gives you a little insight into some of the things you may want to consider the next time you attempt fermenting lemon juice. Definitely an interesting ingredient with some fun challenges. BYO

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BY GORDON STRONG

BALTIC PORTER

Imperial stout's vagabond cousin

Just about every country that borders the Baltic Sea produces a stronger porter that can be called a Baltic porter.

BALTIC PORTER
BY THE NUMBERS

OG:	1.060–1.090
FG:	1.016–1.024
SRM:	17–30
IBU:	20–40
ABV:	6.5–9.5%

Photo by Charles A. Parker/Images Plus

Baltic porter has something in common with Buffalo wings and Philly cheesesteak – it only includes the name of the place when it's from somewhere else. If you get an authentic Baltic porter from one of the countries touching the Baltic Sea, it's likely to just be named "porter." This is true for most porters; the strong ones from the Czech Republic also carry that name, as do the remaining ones from the UK, and some in other countries.

However, craft brewers in the United States and elsewhere in the world are more likely to use the name Baltic porter to differentiate it from the other types of porters that are produced. Still, they all trace back eventually to the original dark beers called porter brewed since the early 1700s in England, as do stouts (originally, termed stout porter).

Just about every country that borders the Baltic Sea produces a stronger porter that can be called a Baltic porter. While derived from (or inspired by) the beers that were once shipped from England to Russia, Baltic porters have evolved enough to be distinctly different from their forefathers. Most are produced as lagers, for instance.

Flavor-wise, modern Baltic porters often have more in common with doppelbocks than porters. They often have the strength of stronger stouts, but the flavor is sweeter and less burnt. Perhaps tropical stouts can sometimes have a similar balance, but I don't want anyone to get the idea that Baltic porters are sweetened. They just happen to be richly malty with a restrained bitterness that can give them a sweeter balance.

Brief geography lessons: The Baltic Sea is the body of water that is north of central Europe, between Denmark and Russia, and south of Scandinavia. It is kind of like the Mediterranean Sea's baby brother to the north. It touches Germany, Poland, Russia, Sweden, Finland, and the Baltic States of Lithuania, Latvia, and Estonia. The Danish Straits provide a narrow entry point to the North Sea, and subsequently the Atlantic Ocean.

The Baltic Sea has been an important trading route since medieval times. The Norse and the Hanseatic League used it for mercantile purposes, as did the British Empire. The oft-repeated story about how Catherine the Great of Russia favored imperial stout? The exported English beer was shipped via the Baltic Sea.

The Beer Judge Certification Program (BJCP) categorizes Baltic porter as Style 9C in the Strong European Beer category, along with doppelbock and eisbock. The category name references beer rather than lager to recognize that some versions of Baltic porter are top-fermented ales rather than bottom-fermented lagers; the other two category members are German lagers. Baltic porter was first added to the BJCP Guidelines in the 2004 edition.

HISTORY

In this article, I'm talking more about the beer than the name, but the term Baltic porter is relatively recent. Michael Jackson wrote about porters in the Baltic region in the early to mid-1990s, and subsequently seemed to stick with Baltic porter or Baltic-style porter to describe them. I created the first beer style description for them in the 2004 edition of the BJCP Style Guidelines. But the beers from the area have a much longer history than the name.

Historically, porter and stout were big export products from Britain in the 1700s and 1800s (and continue to be today from Ireland). The products exported varied over time as the markets evolved, brewing ingredients and technology changed, and wars and

taxes had an effect. Strong dark beers were shipped to the eastern markets over many years, not just for Catherine the Great to enjoy her favorite Russian imperial stout. Burton ales were exported, as were porters and stouts of varying strengths like double brown stout — not everything was enormous. And not everything was highly roasted, as the sweet London brown ales that were the basis of original porters didn't use roasted malt, as that was not invented until 1817.

Wars, tariffs, government protection and intervention, and commercial interests interrupted imports to Baltic countries. Some British immigrants created breweries in Baltic countries (such as Scottish-born David Carnegie, in Sweden), while other countries developed their own breweries to brew similar products. Some of these other countries, such as Poland, began incorporating their own brewing traditions — German malts, hops, yeast, and brewing practices (such as decoction mashes). Later, some of these traditions made their way into the former Soviet states as parts of Poland were forcibly incorporated into the USSR.

The point is that modern Baltic porters don't have a single point of origin. Yes, they tended to be derived from English beers originally, but different export beers were the source. And in different countries, local brewing traditions at the time helped modify the styles. And the transformation process was repeated several times, and not the same in all countries. So the result is a collection of beers with a somewhat similar profile that form a style, but that don't have a common history. When talking about commercial beers, the country where the beer was produced is important to note since that helps the understanding of their interpretation of the style.

In the craft-beer era, there has been a bit of a resurgence of the style in Europe, and it remains quite popular in Poland. Many American craft breweries make seasonal versions but they are often more roasty and bitter than their European counterparts. Some of these are probably best thought of as imperial porters,

BALTIC PORTER

(5 gallons/19 L, all-grain)
OG = 1.083 FG = 1.024
IBU = 30 SRM = 54 ABV = 7.8%

INGREDIENTS

7 lbs. (3.2 kg) Maris Otter pale ale malt
3.5 lbs. (1.6 kg) German dark Munich malt
1.5 lbs. (680 g) UK brown malt
1 lb. (454 g) German wheat malt
1.75 lbs. (794 g) German Caramunich® II malt
1.25 lbs. (567 g) UK crystal malt (90 °L)
8 oz. (227 g) Belgian Special B malt
12 oz. (567 g) UK chocolate malt (450 °L)
6 oz. (170 g) Carafa® Special III malt
1 oz. (30 mL) black treacle
9 AAU Fuggle hops (60 min.) (2 oz./57 g at 4.5% alpha acids)
1.75 AAU Hallertauer hops (10 min.) (0.5 oz./14 g at 3.5% alpha acids)
0.5 oz. (14 g) Hallertauer hops (2 min.)
Wyeast 2112 (California Lager) or White Labs WLP810 (San Francisco Lager) or Mangrove Jack's M54 (Californian Lager) yeast
¾ cup corn sugar (for priming)

STEP BY STEP

Two or three days before brew day, make the yeast starter (2-qt./2-L starter), aerating the wort thoroughly (preferably with oxygen) before pitching the yeast.

On brew day, mash in the pale ale, Munich, brown and wheat malts at 151 °F (66 °C) in 26 qts. (25 L) of water. Hold at this temperature for 60 minutes. Add the three crystal and two chocolate malts, then raise mash temperature to 170 °F (77 °C). Hold at this temperature for 5 minutes then begin to recirculate the wort. Run off wort and sparge with water hot enough to keep the grain bed around 170 °F (77 °C). Collect 6.5 gallons (25 L) of wort. Boil wort for 60 minutes, adding hops at times indicated. Ferment at 62 °F (17 °C). Lager at 34 °F (1 °C) for 12 weeks.

BALTIC PORTER

(5 gallons/19 L, extract with grains)
OG = 1.083 FG = 1.024
IBU = 30 SRM = 54 ABV = 7.8%

INGREDIENTS

6.6 lbs. (3 kg) Maris Otter liquid malt extract (15 min.)
1 lb. (454 g) extra light dried malt extract
1.5 lbs. (680 g) UK brown malt
1.75 lbs. (794 g) German Caramunich® II malt
1.25 lbs. (567 g) UK crystal malt (90 °L)
8 oz. (227 g) Belgian Special B malt
12 oz. (567 g) UK chocolate malt (450 °L)
6 oz. (170 g) Carafa® Special III malt
1 oz. (30 mL) black treacle
9 AAU Fuggle hops (60 min.) (2 oz./57 g at 4.5% alpha acids)
1.75 AAU Hallertauer hops (10 min.) (0.5 oz./14 g at 3.5% alpha acids)
0.5 oz. (14 g) Hallertauer hops (2 min.)
Wyeast 2112 (California Lager) or White Labs WLP810 (San Francisco Lager) or Mangrove Jack's M54 (Californian Lager) yeast
¾ cup corn sugar (for priming)

STEP BY STEP

Steep grains in 3 gallons (11 L) of 158 °F (70 °C) water for 30 minutes. Remove grain, add dried malt extract and enough water to make at least 3 gallons (11 L) of wort. Boil wort for 60 minutes, adding hops at times indicated. Keep some boiling water handy and do not let boil volume dip below the 3-gallon (11-L) mark. Add liquid malt extract in the final 15 minutes of the boil. Chill wort, transfer to fermenter and top up to 5 gallons (19 L) with cold water. Aerate wort with oxygen and pitch yeast. Ferment at 62 °F (17 °C). Lager at 34 °F (1 °C) for 12 weeks.

under the American craft beer nomenclature — they are like sweet, scaled-up American porters more than the imported modern versions.

Since the style definition and name came well after the commercial examples, it's best to remember that beer styles are a modern invention to categorize beers that are already being made. So in this case, a group of modern porters from the Baltic region that had a similar profile were grouped together to create a style for competition purposes. Judges of these beers should likewise remember that there are many different interpretations, and that modern Baltic porters may only have a passing resemblance to any historical beers.

SENSORY PROFILE

Baltic porter is a strong, dark, malty beer that has many different variations throughout the Baltic region. It is not an easy beer to characterize since there are so many different examples, all of them quite good. My caution is to avoid trying to generalize about the style because there is almost always a counter-example. I know, because I've tried to describe them this way and it doesn't work.

If I did try to generalize by area, I would say that those from Scandinavia tend to be a bit closer to the English origin of porter than those from further east. Carnegie Porter from Sweden was brewed with ale yeast for a long time before switching to lager yeast recently. Those from Poland tend to be higher in alcohol. Those from the Baltic States tend to have a more caramelly flavor. And those from the Southern Baltic area tend to have more of a German malt influence. But these are rough generalizations that cannot be used as rules.

Modern Baltic porters are most often made as lagers, so they tend to have a smooth character; even if made as ales, they tend to be cold-fermented and conditioned to maintain this profile. While lagers, they have a fruity character from malt more than from yeast — the same kind of fruitiness sometimes found in doppelbocks and stronger beers. The roasted malt character should not have a sharp, acrid, or burnt quality. The base malt flavor is often more rich and malty than bready. These are the main qualities that define the style.

Most examples are in the 7–8.5% ABV range — Sinebrychoff is 7.2%, Okocim is 8.3%, and Baltika is 7%. Some of the Polish porters are stronger, with Zywiec weighing in at 9.5%. On the lower end, Carnegie is somewhat of an outlier at 5.5%. In the past, the range went down to allow this beer, but it was so much of an anomaly that the lower end of the range is set at 6.5%. A warming alcohol level is desirable, but the beer should never seem hot.

The body of the beer is fairly full, but the lager smoothness, aged alcohol, and medium to medium-high carbonation keep it from seeming heavy. The beer is dark but not often found to be black – commonly they vary from a dark reddish copper to a dark brown. The head should be thick and persistent, with a tan color. Clarity is good, although you shouldn't be able to see through darker versions.

The malt flavors are complex and varied. A rich malty base supports character notes of caramel, toffee, nuts, toast, or licorice. Darker malt flavors provide a rich chocolate, coffee, or molasses flavor, but should never have burnt notes. The malt character is sensed in both the flavor and aroma. The beer can be a bit chewy and sweet, but the darker malts and alcohol tend to balance the sweetness. The beer can start malty and sweet but should have some dryness towards the finish. Hops provide bitterness balance but rarely much more in flavor or aroma.

More than many descriptions, I find myself describing Baltic porter as containing flavors from several other styles. It has the body, maltiness, and richness of a doppelbock, the darker malt character of an English porter but with the roast of a schwarzbier, and the alcohol and fruitiness of an old ale. While related to an imperial stout, its flavor profile actually has less in common with this style than with many of the others mentioned.

BREWING INGREDIENTS AND METHODS

I think there are two basic ways to make a Baltic porter: One is to start with an English porter, and scale it up with some additional crystal malts and ferment it with lager yeast, and the other is to start with a doppelbock, and boost the darker and fruitier flavors. Or you can take elements from both methods and combine them. Just try to avoid burnt and hoppy flavors, especially New World-type hop flavors.

The base malt can be Pilsner, pale ale, or Vienna malt — the flavor profile of the other malts will tend to dominate the base. Munich or dark Munich malt can provide richness like in bock beers. Caramel malts, including German types like Caramunich®, can add some sweetness and fruitiness. Darker malts such as chocolate or debittered black malts can give darker flavors. If trying to play up the English origin, adding brown or amber malt can bring in complex toast. The balance of these malts will give the beer its complexity, especially when used to make a stronger beer.

Adjuncts, especially sugars, can be used to increase the flavor complexity and color. Using something like molasses or treacle can have a large impact on the flavor, so try to use a light hand. Some of these flavors can overlap darker crystal-type malts, so be careful of doubling up on those flavors (similar advice to what I tell people for brewing darker Belgian styles).

Some recipes can be quite complex (as mine is), or some can be simplified. Sinebrychoff is said to be made with four malts — I'm assuming a base malt like Pilsner or Vienna, a richer base malt like dark Munich, a caramel malt like Caramunich®, and a chocolate malt for color and flavor. Balancing the percentages of these malts gives the beer its flavor profile, and can take some tweaking to meet your personal taste preferences.

When using a complex grain bill, I think a single infusion mash will work well. I don't think a high mash temperature is necessary since the quantity of specialty grains will tend to provide the beer with body and residual sweetness. If the grain bill is simple, then a more complex mash program like decoction mashing can increase the malt flavor complexity and darkness.

Continental-type hops, often Saazer-type, are appropriate, as are Polish hops. Using a clean bittering hop like

Magnum will produce good results. The hop character is often subtle so the so-called noble hops that give a floral, herbal, or spicy character provide compatible flavors. The citrusy, piney, dank, or tropical flavors from New World hops are inappropriate in this style, as are any bittering hops that give a harsh bitterness.

German lager yeast is a good choice, especially something that produces a malty profile such as the W34/70 yeast — available as dry yeast from Fermentis, or as liquid yeast from Wyeast 2124 (Bohemian Lager), or White Labs WLP830 (German Lager). I would also consider White Labs WLP833 (German Bock) yeast. There used to be a Swedish porter yeast available from Wyeast, but they discontinued it when it was discovered to be the same as their Ringwood strain (Wyeast 1187). Any clean-fermenting yeast that doesn't overly attenuate the beer should work well, however. I think a cold-conditioning phase helps the flavor profile develop and also allows the alcohol to smooth out.

HOMEBREW EXAMPLE

My version is somewhat of a hybrid, taking inspiration from the Swedish Carnegie Porter, but making it as a lager and scaling up the strength. Specialty malts and sugars provide much of the flavor profile, while lagering provides the smoothness. I blended this beer with a blackberry melomel – a flavor combination I still love – to win a gold medal in the Fruit Beer category at the National Homebrew Competition (NHC) in 2009.

I'm using English pale ale malt as the base, which can add some breadiness. I amplify this character while adding maltiness by using both dark Munich (Munich II) and British brown malt — a combination I love. I develop complexity by using three crystal malts and three dark malts or sugars. Yeah, you can simplify this. But I do like layering flavors in complex beers, and this is a way to achieve it. As I suggested, a complex grain bill can support a simple mash program so I just use a single step.

I use a combination of English and German hops as an homage to the dual roots of this style. Bittering is kept at a modest level, while the final gravity is at the high end of the style. The darker malts will add some dryness to the finish so the sweetness won't be extreme.

Perhaps the most unusual aspect of my recipe is my choice of California Lager yeast (like you'd use in California Common), which was done so I didn't have to maintain quite as cold a fermentation temperature. If you switch to something like W34/70, be sure to lower the fermentation temperature to a normal (colder) range for that yeast.

The strength of the beer is right in the middle of the range for the style, about 7.8%. So while it has flavors similar to those from a Carnegie Porter, it has strength more similar to those from the Baltic States. I'm not trying to produce a clone beer, just one that will seem interesting and complex. I think it makes a great cold weather alternative to imperial stout. BYO

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PENNSYLVANIA SWANKEY

by Jason Simmons

I always thought "swanky" was a word that meant to be dressed with style, to have suave class, or a personality with a smooth strut when you walk. A top hat and a fancy walking cane is what I imagined.

However, my perception of the word changed after my boss at Lindgren Craft Brewery brought to my attention an old, almost forgotten beer style, called Pennsylvania swankey. Being located in Pennsylvania, we felt obligated to research and try to resurrect the style to historical accuracy. In this journey of discovery into the world of swankey, we reached out to several historical societies, genealogy groups, Pennsylvanian beer historians, and visited libraries with historic literature to get the scoop.

The first thing we noticed was that there were actually three swanky beer styles: Cornish swanky, Australian swanky, and Pennsylvania swankey. All are similar but have minor variations. Seeing that our focus was Pennsylvania swankey, let's start with that one first.

SETTING OUT TO RECREATE A REGIONAL FARMHOUSE ALE

Photo by Michael Lindgren

Photo by Jason Simmons

A glass of Clark's Ferry Swankey that we brewed at Lindgren Craft Brewery, in Duncannon, Pennsylvania after considerable research into the historic Pennsylvania swankey style.

PENNSYLVANIA SWANKEY (WITH AN "E")

Pennsylvania swankey is a unique style that was made by German immigrant farmers in western Pennsylvania and was just about obsolete by the end of the 1800s. This mild table beer was brewed by farmers, usually by the gallon (4 L), and, as far as we can tell, was not brewed commercially for distribution. It was a true, historic homebrew beer style. The recipes varied based on what was available on the farm during the time of brewing. Since the style was not being commercially brewed, there is limited information on recipes, however the sources we did find shared many similarities that give us a good idea of what the style was like.

Before 1770 there was a small German population in Pennsylvania, but after the Revolutionary War we start to see a migration of Germans to mainly the western parts of Pennsylvania, as well as Ohio and Indiana. Many of these Germans came from the Hesse or Frankfurt area of Germany, and many from the Alsace-Lorraine area that ran between France and Germany. The German immigrants really started to populate Pennsylvania from the 1780s–1790s in search of land rights for farming. Farming, we found, was the sole reason to make swankey.

As these German immigrants farmed their land they were in need of a refreshing beverage to enjoy during their lunch break. After working in the hot summer sun, they would have wanted this beverage to be low in alcohol (3–4% ABV), highly carbonated or effervescent, and to be made from ingredients they already had available on the farm. While the men worked the fields, household brewing duties were considered a cooking task done by the women using many of the same ingredients of other kitchen duties like making bread. This beer is meant to be drank young, and usually ready for consumption within four days of brewing. The recipes share some similarities to root beer or soda making, which the Germans were also known to produce.

According to Robert Wahl and Max Henius, in their classic 1901 publication, *American Handy Book of Brewing, Malting and Auxiliary Trades*, swankey was a "temperance beverage" and its name is a corrupted derivation from the German word *Schwenke,* an old high-German word for "water" used for washing or rinsing.

WATER

The water used in those times would be the drinking water that they had on the farm, which was usually well water located near the Pennsylvania Allegheny Mountains. The bedrock of the Allegheny region is mostly sandstone and quartzite, and the water is generally hard to very hard. Having lived in several mountain hollers across Appalachia, I can confidently say that water profiles from farm to farm, holler to holler, and mountain to mountain will all be impressively different from each other. In the spirit of this style, when brewing a Pennsylvania swankey you can just use what you have available.

MALT & MALTING

In the time from 1700–1900 the word "malt" meant malted barley, and 6-row barley would have been the barley of choice. Six-row barley is the native barley of North America and it was more beneficial for farmers than the European-introduced 2-row due to the higher protein content ranging 12–13.5% vs. 11–13% protein found in 2-row. The higher protein percentage was sought after for nutritional reasons in other household food production. Modern 6-row barley also has a higher diastatic power, which makes the conversion of starches to fermentable sugars easier. With this in mind, historians agree 6-row barley would have been what was grown in this region in the 1800s.

In the 1902 *American Handy Book Of The Brewing, Malting, & Auxiliary*

Trades by Wahl & Henius, it states: "1901 Crop returns from the records of the New York Produce Exchange show that Pennsylvania was (in the) the top 10 producers among states in wheat and oats, but a minor role in barley production."

The malting of 6-row barley was not a huge operation. In fact, malting on the farm was often as simple as grabbing a few handfuls of barley kernels, wetting them, allowing the kernel to sprout, heating in the kitchen oven, and then using immediately. Hearths and wood-burning stoves were common heating and cooking sources for homes in Pennsylvania in the 18th and 19th centuries. Due to the primitive malting and kilning practices, the color of the beer would vary from straw yellow to brown.

OTHER FERMENTABLES

Wheat bran: There was an abundance of wheat bran due to farming wheat for bread production, and because of this wheat bran made up a large portion of the fermentable source in swankey. We came across no mention of unmalted or malted wheat, rather the same wheat bran that they would use for cooking. Seeing that the wheat bran was not malted, this would be another indicator to the use of 6-row barley vs 2-row barley. Most recipes we came across call for about 4.5 cups of wheat bran per gallon (4 L).

Photo by Michael Lindgren

Wheat bran, molasses, and 6-row barley make up the fermentables in Pennsylvania swankey, with star anise adding a licorice flavor.

A wheat kernel is made up of three parts: The bran, endosperm, and germ. The bran is the hard outer layer of the wheat kernel, which is jam-packed with various nutrients and fiber. During the milling process, the bran is stripped away from the wheat kernel and then becomes a byproduct, making it a cheap source of starch in a brew. Wheat bran has a sweet, nutty flavor. It can be used to add texture and a full-bodied taste to make bread, muffins, and other baked goods. When using wheat bran in brewing, even though it is the outer part of the grain, you should use extra rice hulls to prevent a stuck mash.

Molasses (or brown sugar): To make the body of the beer thinner these brewers used light molasses or even brown sugar to add simple fermentable sugars that would also add a little flavor. Again, light molasses or brown sugar was used for baking purposes and would be readily available in the kitchen.

RATIOS OF FERMENTABLES

With a long list of chores to do, brewing tasks were done as quickly and easily as possible. For the most part, the majority of recipes called for thirds— ⅓ malted 6-row barley, ⅓ wheat bran, and ⅓ molasses.

MASHING

Mashing a Pennsylvania swankey requires a 2-step process. The first mash is similar to a cereal mash. This is done by adding boiling water to the wheat bran to hydrate and gelatinize the starches without boiling the mash as you would in a common cereal mash. This will allow access to the starches by the amylase enzymes for conversion of starches to fermentable sugars. This altered cereal mash is let to rest for about 20–30 minutes depending on what else is going on in the farmhouse kitchen. By this time all the starches will be gelatinized.

Next, enough water and malted 6-row is added to reach roughly 150 °F (66 °C). Amylase temperatures are in the range of 147–156 °F (64–69 °C). Due to the crude brewing practices without tools such as thermometers and hydrometers to monitor the amylase enzyme activation, general "to touch" temperature ranges would be a major factor in poor mash efficiency, and would also be a good reason to add simple sugars. With the addition of simple sugars, the mash temperature would benefit from a higher temperature of around 150 °F (66 °C) as it will create fermentable sugars as well as some complex unfermentable dextrins like you might find in today's crystal or cara malts. This would help add some body to a very thin beer.

There is no mention of using rice hulls in the production of any swankey ale, but I would highly recommend it to help in lautering. In classic swankey measurements, use a handful or two for a 5-gallon (19-L) batch.

HOPS

Hops that were used were more likely than not those that were naturally growing in the nearby woods and easily foraged or cultivated. This American native hop is a landrace (naturally grown with no help of humans) variety called Cluster. Cluster accounted for close to 99% of harvested hop varieties in the 19th century due to easy access and abundance when foraging. It was mentioned in some old local texts that the hops would be picked off the bine when the hop cone started to feel papery, before they turned brown. Measurements were not really recorded, instead we often found one handful of hops per gallon (whole cone hops, of course). This roughly comes out to around 10–15 IBUs.

In the German brewing magazine *Brauwelt* (1995) Hahn and Shellhammer state that "German breweries implemented first wort hopping 100 years before (first wort hop tests) and some experimented with mash hopping. The facts are that this didn't occur only in Germany, but also in England and Belgium."[1]

Due to the ease of adding hops to the kettle from the start and the fact that German and English brewers were already practicing first wort hopping techniques in producing classic beer styles, it would make sense that this technique was likely

PENNSYLVANIA SWANKEY

RECIPE

LINDGREN CRAFT BREWERY'S CLARKS FERRY SWANKEY CLONE

(5 gallons/19 L, all-grain)
OG = 1.030 FG = 1.004
IBU = 15 SRM = 10–15 ABV = 3.5%

INGREDIENTS

1.8 lbs. (0.82 kg) 6-row malted barley
1.8 lbs. (0.82 kg) wheat bran
1.7 lbs. (0.77 kg) light molasses (10 min.)
3.6 AAU Cluster whole-leaf hops (first wort hop)
(0.66 oz./19 g at 5.5% alpha acids)
1 star anise, crushed (5 min.)
Lallemand Nottingham, or SafAle S-04, or Wyeast 1098 (British Ale), or White Labs WLP007 (English Dry Ale) yeast
6.85 oz. (195 g) brown sugar (if priming)

STEP BY STEP

Boil roughly 1.25 gallons (5 L) of water and dough in the mash tun with the wheat bran. Rest 15–20 minutes then measure the temperature. Add roughly 1.25 gallons (5 L) of room temperature water a little at a time to bring the temperature to around 156 °F (69 °C). This extra water will allow you to break up the bran easier while mixing to thin out the mash and ensure that there are no dough balls.

Add 6-row malted barley to reach a target mash temperature of about 150 °F (66 °C), then rest for 60 minutes. Sparge with 172 °F (78 °C) water (mash tun will rise to 168 °F/76 °C), and lauter to 6.5 gallons (25 L) in the kettle along with the hops.

Total boil time is 90 minutes, adding molasses at 10 minutes until flameout. Stir well to mix the molasses into solution. At 5 minutes until flameout add the crushed star anise. At flameout, whirlpool for 15 minutes, then knock to 65 °F (18 °C). Transfer to the fermenter, pitch yeast, and ferment at that temperature. No aeration is needed or a yeast starter if using a liquid yeast strain.

Once fermentation is complete, transfer the beer over to a bottling bucket or keg for packaging.

Bottle or keg condition to 2.8 volumes of CO_2 using brown sugar. You must accurately measure the volume of beer needing to be primed to hit your target. Dose the brown sugar at a rate of 1.37 oz. per gallon (10.26 g/L) and let rest at room or ambient temperature for about three days to condition.

HISTORIC FORAGED PENNSYLVANIA SWANKEY

(5 gallons/19 L, all-grain)
OG = 1.030 FG = 1.004
IBU = 15 SRM = 10–15 ABV = 3.5%

INGREDIENTS

1.8 lbs. (0.82 kg) 6-row malted barley
1.8 lbs. (0.82 kg) wheat bran
1.7 lbs. (0.77 kg) light molasses (10 min.)
3.6 AAU Cluster whole-leaf hops (first wort hop)
(0.66 oz./19 g at 5.5% alpha acids)
10-qts. (10-L) fresh-picked alehoof
Fleischmann's Active Dry or similar bread yeast
6.85 oz. (195 g) brown sugar (if priming)

STEP BY STEP

Boil roughly 1.25 gallons (5 L) of water and dough in the mash tun with the wheat bran. Rest 15–20 minutes then measure the temperature. Add roughly 1.25 gallons (5 L) of room temperature water a little at a time to bring the temperature to around 156 °F (69 °C). This extra water will allow you to break up the bran easier while mixing to thin out the mash and ensure that there are no dough balls.

Add 6-row malted barley to reach a target mash temperature of about 150 °F (66 °C), then rest for 60 minutes. Sparge with 172 °F (78 °C) water (mash tun will rise to 168 °F/76 °C), and lauter to 6.5 gallons (25 L) in the kettle. Before kettle heat is turned on, add the hops and half (~5 quarts/5 L) of the alehoof.

Total boil time is 90 minutes, adding molasses at 10 minutes until flameout. Stir well to mix the molasses into solution and then add remainder of alehoof. When the boil is complete, allow the wort in the kettle to naturally cool to about 98 °F (37 °C). Then transfer to the fermenter and pitch yeast.

Once fermentation is complete, transfer the beer over to a bottling bucket or keg for packaging.

Bottle or keg condition to 2.8 volumes of CO_2 using brown sugar. You must accurately measure the volume of beer needing to be primed to hit your target. Dose the brown sugar at a rate of 1.37 oz. per gallon (10.26 g/L) and let rest at room or ambient temperature for about three days to condition.

Photo by Michael Lindgren

The amount of star anise to add when making Pennsylvania swankey is up to the brewer, but we found crushing one star for a 5-gallon (19-L) batch adds a light licorice character that complements the beer without being overpowering.

applied to swankey beer production too. Since brewing was just one of a handful of tasks being completed in a day's work, first wort hopping would be beneficial to time management.

SPICES

Star anise: In addition to using hops, German brewers used star anise to give a unique licorice flavor. The cooling mouthfeel effect in the aftertaste was desirable as the purpose of this beverage was to be a refreshing thirst quencher in the heat. As mentioned earlier, Germans were known for their root beer production and star anise would be a common spice found in a German farmer's kitchen for making root beer. Dosing rates would depend on the brewer and how much they enjoy the licorice flavor. With the Germans making root beer using star anise, we can assume that they might go a little heavy on the spice, possibly to a point that may be overpowering to some. When we brewed our own version of this style, we found that a dosing rate to give a light classic licorice character that complements the rest of the beer without being overpowering is one star per 5 gallons (19 L).

Alehoof/creeping Charlie: When star anise was not available, the farmers went out in the fields and foraged a common ground ivy by the name of alehoof as a substitute as it shares some flavor similarities to star anise. Alehoof, also known as creeping Charlie or creeping Jenny, grows in abundance all across Pennsylvania and much of North America. One recipe called for a dosing rate of 1 quart (1 L) of freshly picked and washed alehoof per gallon (4 L) added with the hops, then add another quart (1 L) before adding molasses. Slightly different than the use of star anise.

BOIL ADDITIONS, KNOCKOUT

Boil length varies between brewers and, seemingly, what else was going on in the kitchen. We found that the boil times ranged anywhere from 60 minutes up to 120 minutes. The longer the boil time the darker the wort becomes. I feel it is safe to assume that the mash efficiency of the manor in which the farmers brewed in this time period was not very high (which is why simple sugars were added), and collecting a larger pre-boil volume and extending the boil to condense the minimal sugar content into something useable would have been a reason for extended boils.

As mentioned, about 10-15 IBUs worth of whole cone Cluster hops were added, most likely as first wort hops. Crushed star anise would be added at 30 minutes left of boil, and the molasses added at flameout or right before flameout to make sure it properly dissolved in the wort. We chose to add our star anise at flameout because we wanted to minimalize the licorice flavors, but still wanted its presence. Cooling the wort was as simple as taking the kettle off the fire and let-

Photo by Jason Simmons

Alehoof, grown throughout much of North America, is an option we found mentioned in historic records as an alternative to star anise. Often found as weeds growing in lawns, it's a fun new ingredient to experiment with in a homebrewery.

ting it naturally cool to yeast-pitching temperature while other kitchen tasks were performed. Traditional methods call for a natural cooling over time, so for homebrewing you can either do just that, or you can whirlpool for 15 to 30 minutes and then chill to fermenting temperatures.

YEAST

The German brewing heritage has been known for their excellent production of lagers. If these Pennsylvania German immigrants used a lager strain that might have been brought with them when they migrated to America, then the yeast would have produced plenty of sulfur by-products that would have required considerable time and cold temperatures to remove. There is no mention of sulfur in any records we came across, which, along with the quick turnover time, would rule out the use of lager yeast as a fermentation option.

The more likely option is that the farmers used what was readily available to them, a flaked dry yeast called "barm." This variety of yeast would likely be the same yeast used for baking bread and other cooking needs. The yeast is added to the wort when the wort is at "blood temperature" (which is 98.6 °F/37 °C) where bread yeast is able to thrive.

At high kräusen the top layer of yeast is collected, dried in the sun, flaked, then stored away for later use.

English ale strains are another yeast option as there are many similarities between Pennsylvania swankey and (English) Cornish swanky. Both styles are similar to that of an English mild ale, so it might be a possibility that these Pennsylvania German farm brewers had a separate supply of brewers ale yeast for beer making as well as another Pennsylvania favorite, hard cider. This was the route that we decided to go at the brewery. I have had past experience fermenting with bread yeast, and we felt that a neutral English yeast strain would be more palatable to consumers than bread yeast, and to keep with tradition . . . it's what we had available at the brewery on the Lindgren family farm.

FERMENTATION & PACKAGING

Wort would be placed into 1-gallon (4-L) jugs along with the yeast and allowed to ferment at summertime room temperatures of 65–80+ °F (18–27+ °C) depending on the weather. Traditionally the beer was fermented in a jar/fermenter bunged with a cork, and when the cork popped they tied down the cork with a string and considered it ready to drink. Because these homebrewers were not commonly using hydrometers or thermometers, the gravity of the beer when sealing the cork was not documented and likely varied. The gravity will be several points above terminal gravity, leaving enough sugars behind to bottle condition the beer. This creates a very high carbonation level, which is classic to this style, and also similar to that of root beers and other sodas.

Swankey was often made in small batches that where drank quickly, so long-term storage or bottles exploding due to overcarbontaion were not of much concern. If the beer needed to be stored for a short time then the jug with the tied down cork bung would be moved to the family root cellar to chill so the yeast would go dormant (a similar technique was also used in their production of root beer). When serving, strain the beer into another jug or glass, leaving the trub (which they called "eminence") behind.

Average beer styles are carbonated around 2.65 CO_2 volume and sodas are higher around 3.00 CO_2 volumes. At our brewery we allowed the beer to fully attenuate then carbonated to 2.80 CO_2 volumes by bottle conditioning with brown sugar. This helped us with consistency and to hit our carbonation target.

CORNISH & AUSTRALIAN SWANKY BEER

As mentioned, there is mention of other beer styles called "swanky" (without the "e"). Legend claims that swanky beer originated in Cornwall, which forms a peninsula on England's southwestern tip. The problem is that throughout the ceremonial county of Cornwall there are no historical records of swanky to be found — no mention of swanky in its culture, brewing records, family recipes passed down through generations, or even in the language.

Oswald Pryor's popular 1962 book *Australia's Little Cornwall* is probably the best known reference to swanky. When Pryor was 81 years old he recalled his life in migrant Cornish communities in South Australia. He said "Swanky was a brew of sugar, hops, ginger wheat, malt, and yeast. It had to be allowed to work for three days in bottles before the corks we tied down with a string."[2]

When talking with Pennsylvania beer historian Rich Wagner about these styles we agreed that the Cornish swanky shares many similarities to the Pennsylvania swankey with the main exception being that the Cornish used ginger instead of star anise as their spice choice.

There are only a few mentions of swanky in Australia. Australia was a British colony, and on the Copper Coast in Southern Australia they host a bi-annual Cornish heritage festival called Kernewek Lowender. Coopers Brewery brews a swanky for the festival, but it is listed as a sparkling ale, and it does not seem to have a resemblance to the other swanky ales.

Clearly there is still a lot of mystery around swankey, and swanky, which made the project of researching and attempting to recreate the style that much more fun. As a homebrewer it's hard to resist the allure of mystery around beer. Even if the resulting beers aren't exactly as they would have been on the farms more than a hundred years ago, we feel like it's a good reflection of a historic, defunct beer style. BYO

REFERENCES

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[2] *Beer Advocate* "Swankey Beer: The Strange History and Surprising Diaspora Of A Lost Style" by Jessica Boak & Ray Baily. June 2015 Issue #101

Beer Brunch

Holiday treats cooked with beer

by Jill Ramseier

Background photo by Shutterstock.com

Pumpkin pie, turkey with all the fixings or a glazed ham, cold evenings by the fire with wool blankets, gingerbread cookies, and winter ale. There are so many lovely things about fall and winter to be had. Wonderful big family dinners aside, the humble brunch is my new favorite way to welcome guests and enjoy the darker days of the season with friends. I find after holidays, I always have a few extra beers to use up, a lot of leftovers to eat, and some friends or family I didn't get to see because we all had so many things going on. My solution? Day-after brunch featuring delicious baked goodies to warm up the house and a tasting lineup of homebrews and pastries.

Pumpkin Ale FRY BREAD

We love this one served with scrambled eggs, roasted peppers, and basil, or sprinkled with cinnamon sugar. I like to make it with pumpkin ale or winter ale, but you could substitute any ale you brew. *Makes 8–10.*

INGREDIENTS FOR STARTER

⅓ cup room-temperature beer (pumpkin or other malty ale)
½ cup bread flour
pinch of instant yeast

INGREDIENTS FOR DOUGH

1 cup flour
1 tsp. baking powder
1 tsp. salt
1 tsp. sugar
⅓ cup warm milk
1 Tbsp. pumpkin or squash puree (I like the additional flavor, but alternately you can sub an egg yolk)
2-3 cups rice bran or vegetable oil (for frying)

When going the savory route, I fry a pepper to serve on top of the eggs at the same time as the bread to save time and add some flavor.

STEP BY STEP

1. To make the starter, mix the three ingredients together in a medium bowl at least an hour before you plan to make the fry bread. Cover loosely and allow it to sit at room temperature.
2. Using a wooden spoon, stir the remaining ingredients into your starter. Beat until a soft dough forms and then dump out onto a ½ cup of flour on the counter. Knead just until it forms a flat ball, then flatten further patting it with the flour until it is about 6x8 inches (15x20 cm) and ⅓-inch (1-cm) thick. Brush off any remaining flour and cut into 8–10 triangles (and one tiny piece to test the oil).
3. Preheat oil to 350 °F (177 °C) in a heavy, wide pot on medium-low heat.
4. Test the oil heat by dropping the tiny piece of dough carefully into the oil. If it begins to bubble, you may slowly add a few pieces of dough to the pot, if not you can turn heat up to medium and wait until it bubbles. Do not overcrowd the pot.
5. Working in batches of 3 or 4, fry them until the first side is golden brown and then turn with a pair of tongs. When second side is browned, carefully remove to a plate with a paper towel (to absorb excess oil) and sprinkle while hot with a little salt or cinnamon sugar, and serve.

Flanders Red
BACON BREAD

A braided beer bread full of bacon and cheese. ***Makes four large rolls (or 12 small rolls if you choose to twist each spiral instead of braiding them in threes).***

INGREDIENTS FOR POOLISH (A LIGHTLY PRE-FERMENTED DOUGH — MAKE 24 HOURS BEFORE)

1 cup Flanders red ale
8 oz. (0.23 kg) bread flour

INGREDIENTS FOR DOUGH

1 lb. (0.45 kg) poolish
1 cup warm water (90-110 °F/32–43 °C)
½ cup olive oil blend
1 lb. 2 oz. (0.51 kg) bread flour
2 Tbsp. salt
1 packet (¼ oz.) instant yeast
1 lb. (0.45 kg) thin-cut bacon
1 cup shredded parmesan (optional)

INGREDIENTS FOR EGG WASH

1 small egg
1 Tbsp. water

STEP BY STEP

DAY 1

1. Mix ingredients for poolish until no large clumps remain.
2. Cover loosely with a towel or plastic wrap and leave at room temperature for 24 hours.

DAY 2

1. Mix all of the ingredients for the dough except the bacon in a Kitchenaid with a dough hook on low for 6 minutes.
2. Pull from machine and knead for another minute or two until dough is smooth and elastic.
3. Place in an oiled bowl and cover loosely with a towel. Set in a warm place and let rise 1 hour.
4. Divide in to 12 pieces, roll each into a long log (about the size of a piece of bacon).
5. Lay a piece of bacon across each bread "stick" and then braid three together, pinching and tucking the ends under.
6. Proof, or let rise, 1 hour or until doubled in size.
7. Using a pastry brush, mix egg and water to make egg wash, and brush on any area of exposed dough that is not covered with bacon.
8. OPTIONAL — sprinkle buns with additional parmesan cheese, if desired.
9. Bake at 375 °F (190 °C) for 40–50 minutes until bread is golden brown and bacon is cooked.

Dunkel DANISH

An impressive beer pastry with apple & cream cheese filling that is sure to be a hit for any gathering, served as breakfast or even dessert! This recipe works best if you can make the dough well ahead of time.
Makes 12 Danishes (and extras freeze well!).

INGREDIENTS FOR DOUGH

¼ cup room-temperature dunkel beer
½ cup room-temperature milk
1 egg
2¼ cups bread flour
¼ oz. (7 g) instant yeast
1 tsp. salt
1 Tbsp. sugar
1 cup cold butter, cut into small cubes

INGREDIENTS FOR FILLING

8 oz. (227 g) soft cream cheese
4 Tbsp. sugar
1 egg
1 tsp. vanilla
Pinch of salt
1 tsp. cinnamon
1 Tbsp. butter
2 apples, diced small

STEP BY STEP

DAY 1: MAKE DOUGH

1. Mix beer, milk, and egg, set aside.
2. Using food processor, pulse dry ingredients together, then add butter and pulse a few more times until butter is reduced to very small shreds (smaller than the size of peas).
3. Dump in wet ingredients and pulse for a few seconds just until mixture combines to a sticky wet dough. This will appear gooey and you'll be able to see butter dots throughout it.
4. Wrap in plastic, into a disk that is about ¾-inch thick (2-cm) and then chill overnight.

DAY 2

1. Let dough come to room temperature.
2. Roll out into a 20-inch (50-cm) square. You may use some flour to keep it from sticking, but brush off any unnecessary flour so it doesn't toughen your dough.
3. Fold in thirds. Roll out 3 times like this until the butter dots become thin butter blurs and dough is soft and stretchy (pictured, top).
4. Re-wrap in plastic and refrigerate for at least 1 hour to rest (or your dough will be tough).

MAKE FILLING

5. While the dough rests, make the filling by beating cream cheese with sugar, egg, and vanilla.
6. Sauté apples in butter with a pinch of salt and the cinnamon, just until apples are soft.
7. When the dough is rested, roll out into a large rectangle.
8. Place onto a sheet tray lined with parchment paper.
9. Spread the filling on the middle third of the Danish dough and sprinkle with apples.
10. On sides of Danish dough, cut strips at an angle.
11. Fold strips over Danish, alternating sides so that it creates a braided pattern to hold filling in (pictured, middle).
12. Brush with a little egg wash (see bacon bread recipe on page 49 for instructions) and let sit in a warm place for an hour until dough is puffy.
13. Bake 25–35 minutes at 375 °F (190 °C) until golden brown throughout.
14. Let cool completely before cutting.

Gose Breakfast COOKIES

A salty, sweet, and hearty treat for those times you need breakfast on the go, this one is a perfect pocket-able brunch for heading out into the snow to enjoy winter at its fullest. ***Makes 12 large cookies.***

INGREDIENTS FOR COOKIES

2 sticks butter
¾ cup sugar
¾ cup brown sugar
2 large eggs
1 tsp. vanilla
1½ cups all purpose flour
1 cup whole wheat pastry flour
2 tsp. salt
1½ tsp. baking soda
1¾ cups old fashioned rolled oats
¼ cup of Gose beer
¾ cup chopped walnuts
¾ cup raw sunflower seeds
¾ cup dried cranberries

INGREDIENTS FOR ICING

1 cup powdered sugar
1 tsp.+ Gose beer
1 Tbsp. flaked sea salt* (I used a smoked Gose, so I opted to use Malden smoked sea salt, but you can use Himalayan pink sea salt, fleur de sel, or any flaked sea salt you prefer)

STEP BY STEP

1. Preheat oven to 350 °F (177 °C).
2. Cream butter and sugars, adding vanilla and eggs one at a time until each is fully combined.
3. Sift flours, salt, and baking soda together, then mix them into the creamed butter, mixing just until smooth.
4. Mix the ¼ cup of Gose with the rolled oats at least 5 minutes before mixing them into the next step.
5. Add all the seeds, nuts, fruit and oats/Gose into the original mixture until all are distributed.
6. Scoop ¼ cup servings of dough and drop onto a sheet tray lined with parchment paper.
7. Bake at 350 °F (177 °C) for 18 minutes.
8. While the cookies bake, stir together powdered sugar and beer until no clumps remain (if too thin, adjust with more powdered sugar).
9. When the cookies come out of the oven, drizzle icing over them and sprinkle with sea salt.

INGREDIENTS FOR BREAD DOUGH

4 cups high-gluten/bread flour
2 Tbsp. sugar
1 Tbsp. salt
1 package instant yeast
1 cup New England IPA beer
1 cup hot water

INGREDIENTS FOR FIG FILLING

4 oz. (113 g) dried black mission figs
½ cup brown sugar
1 tsp. salt
1 tsp. vanilla extract
¼ cup New England IPA beer

STEP BY STEP

1. Start by making the dough. Pre-mix hot water and beer.
2. In a medium bowl, mix flour with sugar, salt, and yeast.
3. Using a wooden spoon, mix liquid into the flour bowl until a shaggy dough forms.
4. On a lightly-floured surface, knead dough until elastic and soft (adding flour only as needed)
5. Cover loosely with a towel or plastic wrap in a warm place and let rise for 1 hour.
6. Now make the fig filling. Puree the figs with sugar, salt, and vanilla in a food processor until a nice fig paste has formed, then add the beer and continue to process so that you get a nice spreadable paste.
7. When dough has doubled in size, turn it out of bowl onto a lightly-floured surface and gently press it into a rectangle 12 x 8 inches (30 x 20 cm) (try not to stretch).
8. Spread fig puree across dough completely, except for a one-inch (2.5-cm) edge farthest from you.
9. Gently roll dough closest to you in a spiral away from you, taking care to keep dough roll even in thickness.
10. When done, the edge that was free of fig puree can be pinched shut and put on the bottom.
11. Place fig roll onto a pan with parchment paper (or in a greased loaf pan if you prefer).
12. Loosely cover and let rise at least an hour until doubled in size and relaxed.
13. Preheat oven to 425 °F (218 °C) (convection is a plus if you have the option).
14. Bake 35 minutes and check it: Color should be golden brown evenly across loaf. If not, continue to bake, checking every 5 minutes or so.

Hazy Fig BREAD

This bread is as nice fresh from the oven as it is toasted with butter the next day, and a great way to use up dried fruit. Feel free to substitute any fruit you love and might have on hand.
Makes one loaf.

Espresso Stout MUFFINS

Fluffy coffee cake-style muffins, which pack a burst of malty vanilla stout flavor and a punch of caffeine to jumpstart the morning. We like to serve them with bacon or sausage links and fresh fruit.
Makes 12 muffins.

INGREDIENTS

1 stick soft butter
1 cup sugar
1 large egg
1 tsp. vanilla
1 cup cake flour
½ Tbsp. baking powder
½ cup sour cream
2 Tbsp. stout beer
2 Tbsp. sugar
1 tsp. instant espresso powder

STEP BY STEP

1. Cream butter and sugar, add egg and vanilla and then mix until smooth.
2. Sift flour and baking powder in a second bowl.
3. Mix beer and sour cream in a third bowl.
4. Mix ingredients from first three steps until smooth.
5. Spoon equally between 12 muffin tins lined with paper.
6. Mix 2 Tbsp. sugar and 1 tsp. espresso powder together and then top each muffin with ½ tsp.
7. Bake at 375 °F (190 °C) for 25 minutes. BYO

LITERS OF FUN

It's not often you get to have a special beer experience at either end of the thermometer within the same week. For over one hour during a brewery visit and tasting in Munich, Germany, 18 *Brew Your Own* readers including Publisher Brad Ring watched as a frozen-solid Eisbock slowly melted dripping into a decanter leaving a 25% ABV complex and malty treat to enjoy. The mercury climbed quite a bit a few days later as the group had red-hot pokers dipped into their glasses of weizenbock at Brauerei Schneider in Kelheim, Germany instantly caramelizing the sugars and creating a toffee-like drink barely resembling the original beer.

With visits to 20 breweries, a hop farm, and a malt house, the group was lucky to experience the incredible beer culture of Bavaria first-hand

during *BYO*'s Bike, Hike, and Brewery Adventure in late September. We visited an amazingly broad spectrum of breweries from the two-employee, husband-and-wife team of Munich's Hopfenhacker who served us a homemade dinner and homemade beers in their small, urban brewhouse started up a few years ago to the hilltop, historic brewing school campus and wheat beer benchmark Weihenstephan founded just a bit earlier in 1040. Along the way we had the chance to meet with local brewers and ask plenty of questions while enjoying their beers.

Each day we either biked or hiked to different breweries starting in the Munich area and working our way north to the Franconian city of Bamberg. Along the way we visited several monastery breweries and small, local breweries where the only place you could enjoy their beer was onsite at their biergarten. We even spent the evening sleeping only a few floors above two different breweries during the trip.

The group also got up close and personal with brewing ingredients during the week-long trip. We waded into the forest of climbing hops in the famed Hallertau region midway through harvest and also had an in-depth tour of Weyermann Specialty Malts in Bamberg watching the germination beds and drum roasters produce the backbone of future beer in front of our eyes.

From Bamberg's famous rauchbiers to the wonderful unfiltered kellerbiers of the countryside to crystal-clear Märzen in Munich, it was a special chance to enjoy so many classics at the source. All that beer had lots of great food paired alongside, giving plenty of fuel for biking and hiking to the next stop. It was a treat to walk underground to a 150-year-old lagering cellar while sipping the small brewery's kellerbier, sit under the ancient vaulted ceiling of Rauchbierbrauerei Schlenkerla in Bamberg with their house-smoked beer in hand, and even try to skip rounded stones across the Danube River standing on the shore in front of the Kloster Weltenburg after enjoying their tasty dunkel. It was a week made all the more special by sharing it with fellow homebrewers passionate about beer and exploring the incredible cities, countryside, and beer culture of Bavaria and Franconia.

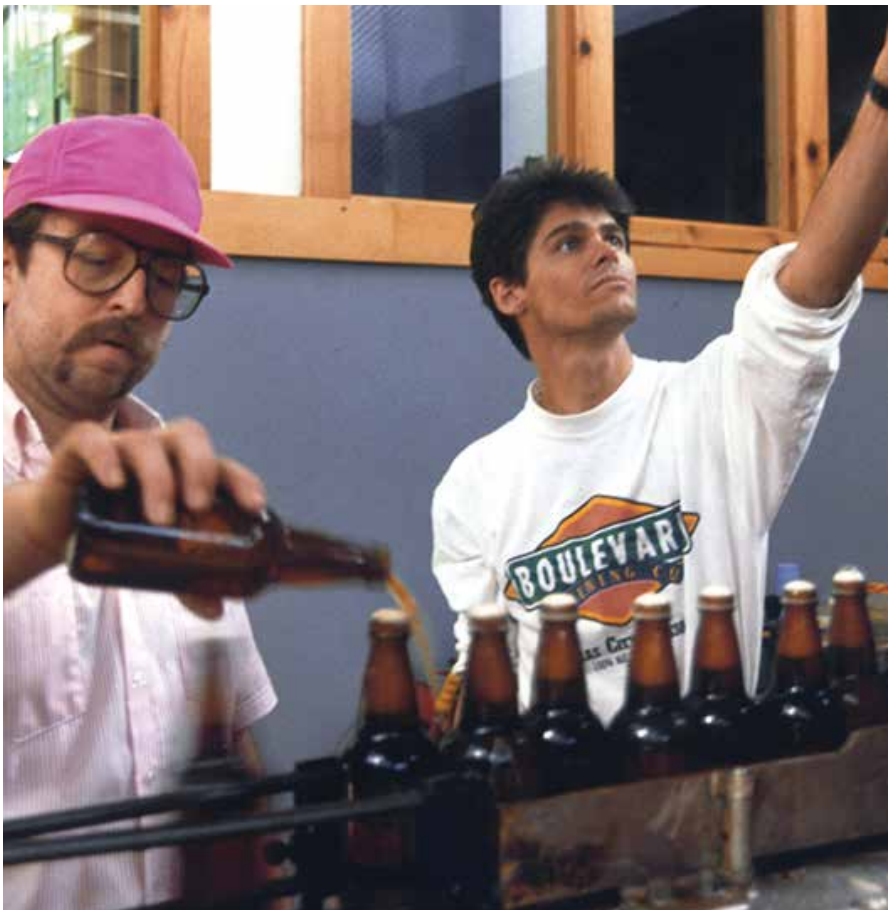
BYO plans to visit other great world brewing regions during upcoming annual trips and we hope that you can join us on a future adventure.

BOULEVARD
OF MALTED DREAMS

by Ashton Lewis

CLONE RECIPES & TIPS FROM A MIDWESTERN CRAFT BEER PIONEER

Photos courtesy of Boulevard Brewing Company



John McDonald (right) founded Boulevard Brewing Co. 30 years ago in his hometown of Kansas City, Missouri in a quest to bring flavorful beer to the Midwest.

While a lot has changed in its 30 years, the first recipe brewed at Boulevard was its Pale Ale, which remains a staple in the brewery's lineup 30 years later.

"It was the summer of 1984, and John McDonald was thirsty. On vacation in Europe, the future founder of Boulevard Brewing Company wandered into a bar specializing in Belgian beers. He tried one, then another and another, amazed by the variety, the aromas, and the flavors. He was hooked." — **Boulevard's story from www.boulevard.com**

THE FIRST DECADE: 1989 – 1999

The story of Boulevard Brewing begins like other pioneering breweries of the 1980s, owing its humble beginnings to the quest for great beer. John McDonald began homebrewing to quench his thirst for beer with flavor. The American brewing scene at the time was not exactly rich with options; this was especially true of John's hometown of Kansas City, Missouri. After completing his degree in art, McDonald made his living as a carpenter and worked out of a brick building located on Kansas City's Southwest Boulevard that was also his home, carpentry shop, and homebrewing hobby space. Pretty soon the hobby became the subject of dreams, plans begat dreams, and McDonald's plans gave rise to Boulevard Brewing Company in 1989.

The original 35-barrel brewhouse was pulled from a brewery in the small town of Vierkirchen, Bavaria and installed in McDonald's now empty workshop and home. His original business plans were to someday grow the brewery to 6,000 barrels of annual production. Boulevard's first barrel of beer to roll from brewery doors was Boulevard Pale Ale, followed by Boulevard Irish Ale, a perennial seasonal since 1990, Bully Porter, and Boulevard [filtered] Wheat. Other beers from the early days included Bob's '47, an Octoberfest lager, and their Christmas beer called Nutcracker.

In the beginning, all production was sold as draft beer. Thanks to a loan from a banker willing to take a chance on McDonald's young business, a kindly-used bottling line was added to the brewery and bottle-conditioned bottles of Boulevard beer made their market debut in 1993.

McDonald needed people as his

company grew and hired Bill Cherry in 1994, who stepped into the Brewmaster role after completing his masters in food/brewing science at UC-Davis. Prior to his time at Davis, Cherry was a food microbiologist for Louis Rich and Claussen (both under the Oscar Mayer umbrella at the time).

In 1996, the brewery installed a centrifuge, introduced Boulevard Dry Stout to the market, re-tooled their wheat beer process, and gave it the name Boulevard Unfiltered Wheat. At this point annual production had reached about 10,000 barrels per year, far surpassing John's long-term production goals. Things were looking pretty good for the 7-year-old microbrewery selling most of its beer in and around Kansas City.

The decision to relaunch Boulevard Wheat as Boulevard Unfiltered Wheat was a terrific move for the growing brewery because Unfiltered Wheat became the brewery's #1 selling brand, quickly spreading through the central Midwest, and putting Boulevard Brewing Company on the radar as a regional brewer of consistently excellent beer. Boulevard's Unfiltered Wheat was hot!

Cherry remained the Brewmaster at Boulevard until 1999, during which time he was instrumental in establishing Boulevard's quality control lab and saw the brewery grow from about 8,000 barrels per year to 36,000 barrels per year. His wanderlust led him to Vermont where he went on to establish Switchback Brewing Company in Burlington, Vermont. McDonald, who originally was attracted to brewing by Belgian beer, decided to look eastward for his next brewmaster. And this time he specifically was in search of someone with hands-on experience brewing bottle-conditioned Belgian ales. The search ended when McDonald was put in contact with the Belgian brewer Stephen Pauwels.

Pauwels graduated from the Catholic University College, KAHO Sint-Lieven in 1991 with a degree in biochemical engineering and he had practical brewing experience working at Brouwerij Krüger (then owned by Interbrew), the Domus brewery in Leuven, and at Brouwerij Riva. Pauwels joined a very small handful of Belgian brewers working in the US when he took over as Boulevard's Brewmaster in 1999.

THE TEEN YEARS: 1999 – 2009

The next decade would prove to be huge for Boulevard. Pauwels was tasked with introducing more beers into the lineup and his first development for the KC brewery, Zon, was released in 2001. Zon, a Belgian-style witbier named for the Flemish word for sun, has won numerous Great American Beer Festival (GABF) medals in the Belgian-style witbier category, and is still on the brewery's calendar as a summer seasonal. New brews were being developed when time permitted, but additional brewing capacity was needed and an expansion plan was launched.

Most US craft breweries planning expansions during this era were looking towards suburban and semi-rural locations to build new breweries. Not Boulevard. Named after Southwest Boulevard, the road bordering the northwest walls of the original brewery building, McDonald decided to build his expansion adjacent to the original brewery. The new building was built with growth in mind and was designed to functionally and aesthetically fit with Boulevard's urban

After outgrowing its original 35-barrel brewhouse, Boulevard constructed Brewhouse II in 2006, right next door to the original facility in Kansas City. The new 150-barrel brewhouse allowed for significant expansion in Boulevard's lineup of beers and distribution capacity.

Brewery II is a 4-vessel, 150-barrel brewhouse commissioned by world-renowned German equipment supplier Krones-Steinecker in 2006.

surroundings. The new building also featured design elements, like the wooden butcher-block floor in the brewhouse and modern and open feel of the building's interior that reflected McDonald's eye for art and a love of carpentry.

Krones-Steinecker, a world-renowned German equipment supplier, regarded for its exceptional packaging equipment and Steinecker brewhouses, was chosen to supply a 4-vessel, 150-barrel brewhouse as well as a new state-of-the art bottling line. The expansion, simply named "Brewhouse II," afforded the brewing staff much needed breathing room after pushing the original facility to its limits. By 2006, shortly before the new brewhouse was commissioned, Boulevard's 35-barrel brewhouse was turning out 3,000 brews per year for a total production volume approaching 100,000 barrels. The brewing team now had the production volume in Brewhouse II to allow for the growth of core brands like Unfiltered Wheat and Pale Ale, and the original 35-barrel brewhouse that could now be used to brew the beers that they had been perfecting during construction of the new facility.

Boulevard's Smokestack Series, named after Boulevard's iconic brick smokestack, was launched in 2006 as a separate, high-end brand. According to Pauwels, the Smokestack Series was set up to allow failure. This sounds unusual, and when asked for clarification Pauwels explained that this brand, with a different look and reduced emphasis on the Boulevard brand, allowed him and his brewing team to more aggressively experiment and push the boundaries of their brews without worrying so much about failure.

The reader needs to roll back the clock 13 years to appreciate the brewing scene at the time. A brewery like Boulevard that was doing quite well with clean ales and lagers was not overly keen to throw a wrench into a smooth-running engine with different yeasts, bacteria, and flavor profiles that were far different from the brews that defined the brewery. Think of when Herbie Hancock transitioned from straight-ahead jazz to funk and put all of his cards on the

Boulevard's mixed-fermentation and barrel program includes about 5,000 used oak barrels, four vertical foudres, one horizontal foudre, and its own bottling line. Clean beer is transported from the brewhouse to the off-site facility where it is allowed time to age with wild cultures.

A FEW DEEP QUESTIONS
WITH STEVEN PAUWELS

Q What is your advice to homebrewers who want to brew Belgian-style (non-sour) beers at home?

A When brewing high-gravity styles, get your final gravities low by using adjuncts like flaked corn, raw wheat, and sugar. Really, the preferred adjunct for this is sugar, like invert sugar, used at levels up to 15–20% of the total extract. Adjuncts make for a dryer, cleaner, and more balanced finish, especially with bigger beers.

I also suggest avoiding overly-phenolic yeast strains. When brewing Belgian-style beers, yeast selection is the most important consideration. At Boulevard, we have a house Belgian ale strain that we use in many of our beers, including Tank 7, that has a balance of esters and phenols. You know, all Belgian ale strains are POF+ (phenolic off-flavor positive), and probably all trace back to a few strains that likely mutated over time into a much greater number. I prefer the strains that are not too phenolic.

Q What can you tell our readers about Tank 7?

A New beers come on the beer scene in waves. When I first thought of brewing a saison at Boulevard it was a reaction to what was in the market at the time. There is no right or wrong way to approach a style, but the saisons being brewed in the US at that time were not my idea of the style. They were too sweet, under-attenuated, and often spiced.

Many brewers think of DuPont yeast when considering brewing saison. But they don't consider that the fermenters at DuPont are open, square, and shallow. The DuPont yeast produces a good balance of phenols and esters in this type of fermenter, but does not produce the same flavor profile in taller tanks. Hydrostatic pressure suppresses ester production and the DuPont strain expresses more phenolic in tall fermenters. Our house strain produces a nice balance of esters and phenols when used in unitanks.

Q What is the White IPA story?

A Larry Sidor (Brewmaster at Deschutes at the time) and I decided to brew a collaboration beer. We met in an airport bar, I think it was before the CBC (Craft Brewers Conference) or annual MBAA (Master Brewers Association of Americas) meeting, to talk about our plans. Deschutes was brewing a lot of very hoppy beers at the time and we at Boulevard were brewing with a lot of wheat. So we decided to brew a white IPA for our collaboration, and we decided to use lemon grass as one of the ingredients. Lots of lemon grass was used because it is subtle.

I remember peeling lemon grass for two days. At Boulevard, I recruited my son's high school friends and high school kids of my Boulevard colleagues to help peel lemon grass. The lemon grass was added in the whirlpool for aroma. Our beer was simply called Collaboration #2 and Deschutes called their beer (brewed in Bend, Oregon) Conflux 2. We only brewed Collaboration #2 once, but Deschutes brewed the beer again and turned it into Chain Breaker. The collaboration we brewed did represent a new beer style.

table. That's what risk meant to the 100,000+ barrel brewery best known for its top-selling Unfiltered Wheat, dubbed by many as a gateway beer.

Boulevard's Smokestack brand was a move intended to protect its core brands against potential market stumbles, but the fear of failure was a case of an unneeded insurance policy. Examples of beers flowing from Boulevard's skunk works under the Smokestack Series banner included Saison, Saison Brett, Bourbon Barrel Quad, Dark Truth Imperial Stout, The Calling Double IPA, The Sixth Glass, Double Wide IPA, Chocolate Ale, and the renowned Tank 7. These brews were all big, expressive beers that were simply not common in the Midwest when released. Not only did these bold beers draw attention from the beer aficionado community, their high-end shelf presence gave Boulevard's public image a new and more sophisticated dimension that helped drive the sales of their core brands.

Saison was one of the first specials to be released after the debut of Zon and was inspired by Pauwels' sensory experiences as a youngster growing up in Belgium. He wanted to brew a beer that was drinkable and thirst-quenching with earthy and hay-like aromas reminiscent of his time as a teen in Belgium helping farmers put up hay. Early versions of this beer were experimental and not sold. Over time Saison was fine-tuned to hit the mouthfeel and drinking sensation Pauwels desired, and dry hopped to provide the hay-like aromas envisioned in his mental impression of his ideal saison.

While the Smokestack Saison was

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BOULEVARD BREWING CO.'S TANK 7 CLONE

(5 gallons/19 L, all-grain)
OG = 1.071 FG = 1.007
IBU = 38 SRM = 4 ABV = 8.5%

Tank 7 has become one of Boulevard's most recognized brands and a terrific example of a modern saison. The recipe got its start as a riff on Saison, a brand in the Smokestack Series, when Pauwels was working on Saison Brett. The Smokestack Saison recipe was tweaked to boost the strength from 7.5% to 8.5% ABV and the beer was dry-hopped with Amarillo® hops, which were relatively new at the time. The brewers were tasting the base for Saison Brett from Fermenter #7, coincidentally a 300-barrel Mueller fermenter built in Springfield, Missouri by the author's former employer, and really dug what they were tasting. The "clean version" of Saison Brett (essentially Tank 7 bottle-conditioned with Brett *and other conditioning yeast) became Tank 7 and the rest is history.*

INGREDIENTS

9.25 lbs. (4.2 kg) North American 2-row Pilsner malt
2.5 lbs. (1.13 kg) North American white wheat malt
1.5 lbs. (680 g) invert sugar
1.8 AAU Magnum hops (first wort hop)
(0.15 oz./4 g at 12% alpha acids)
6 AAU Simcoe® hops (60 min.)
(0.5 oz./14 g at 12% alpha acids)
19.95 AAU Amarillo® hops (5 min.)
(2 oz./56 g at 10% alpha acids)
5 AAU Amarillo® hops (dry hop)
(0.5 oz./14 g at 10% alpha acids)
Wyeast 3787 (Trappist Style High Gravity) or White Labs WLP530 (Abbey Ale) or Omega Yeast Labs OYL-028 (Belgian Ale W) or SafAle BE-256 yeast
1 cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. Adjust all brewing water to a pH of 5.5 using phosphoric acid. Add 1 tsp. calcium chloride to the mash.

Mash the malts at 145 °F (63 °C) for 50 minutes, heat to 154 °F (68 °C) and hold for 25 minutes, then heat to 163 °F (73 °C) and hold for 15 minutes. Start recirculating wort. Raise the temperature to 168 °F (76 °C) for 15 minutes.

Sparge slowly and collect 6.5 gallons (24.5 L) of wort. Add first wort hops and invert sugar when sparging is complete.

Heat to boiling, and boil the wort for 90 minutes, adding hops at the times indicated in the recipe. Adjust OG post-boil with RO water as required.

Chill the wort to 62–64 °F (17–18 °C), pitch the yeast, and ferment until complete. Dry hops should be added when gravity is about 1.016. Cool to 32–34 °F (0–1 °C) and cold condition for four days. Rack the beer, prime and bottle condition, or keg and force carbonate.

BOULEVARD BREWING CO.'S TANK 7 CLONE

(5 gallons/19 L, extract only)
OG = 1.071 FG = 1.007
IBU = 38 SRM = 4 ABV = 8.5%

INGREDIENTS

4 lbs. (1.8 kg) Pilsen dried malt extract
2.3 lbs. (1 kg) wheat dried malt extract
1.5 lbs. (680 g) invert sugar
1.8 AAU Magnum hops (first wort hop)
(0.15 oz./4 g at 12% alpha acids)
6 AAU Simcoe® hops (60 min.)
(0.5 oz./14 g at 12% alpha acids)
19.95 AAU Amarillo® hops (5 min.)
(2 oz./56 g at 10% alpha acids)
5 AAU Amarillo® hops (dry hop)
(0.5 oz./14 g at 10% alpha acids)
Wyeast 3787 (Trappist Style High Gravity) or White Labs WLP530 (Abbey Ale) or Omega Yeast Labs OYL-028 (Belgian Ale W) or SafAle BE-256 yeast
1 cup corn sugar (if priming)

STEP BY STEP

Heat 6.5 gallons (24.5 L) of water in your brew kettle to 180 °F (82 °C). Turn off the heat and add the malt extract and sugar, and stir thoroughly to dissolve completely. You do not want to feel extract at the bottom of the kettle when stirring with your spoon. Turn the heat back on and bring to a boil. Add the first wort hops while raising to a boil.

Boil the wort for 90 minutes, adding hops at the times indicated in the recipe. Adjust OG post-boil with RO water as required.

Chill the wort to 62–64 °F (17–18 °C), pitch the yeast, and ferment until complete. Dry hops should be added when gravity is about 1.016. Cool to 32–34 °F (0–1 °C) and cold condition for 4 days. Rack the beer, prime and bottle condition, or keg and force carbonate.

BOULEVARD BREWING CO.'S BOB'S '47 CLONE

(5 gallons/19 L, all-grain)
OG = 1.055 FG = 1.011
IBU = 27 SRM = 11 ABV = 5.8%

A tribute to Bob Werkowitch, former Master Brewer of Kansas City's George Muehlebach Brewing Company and graduate of the U.S. Brewer's Academy class of 1947. Bob's '47 is Boulevard's take on a traditional German-style Märzen/Oktoberfest.

INGREDIENTS

6.6 lbs. (3 kg) North American 2-row Pilsner malt
3.3 lbs. (1.5 kg) Munich malt (10 °L)
0.66 lb. (300 g) Munich malt (15 °L)
0.66 lb. (300 g) European crystal malt (50 °L)
0.15 lb. (70 g) European crystal malt (15 °L)
5 AAU Vanguard hops (60 min.)
(1 oz./28 g at 5% alpha acids)
2.5 AAU Vanguard hops (30 min.)
(0.5 oz./14 g at 5% alpha acids)
SafLager W34/70 or Omega Yeast Labs OYL-114 (Bayern Lager) or White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. Adjust all brewing water to a pH of 5.5 using phosphoric acid. Add 1 tsp. calcium chloride to the mash.

Mash the malts at 152 °F (67 °C) for 60 minutes. Start recirculating wort. Raise the temperature to 168 °F (76 °C) for 15 minutes. Sparge slowly and collect 6.5 gallons (24.5 L) of wort.

Heat to boiling, and boil the wort for 90 minutes, adding hops at the times indicated in the recipe. Adjust OG post-boil with RO water as required.

Chill the wort to 50–54 °F (10–12 °C), pitch the yeast, and ferment until complete. Lager at fermentation temperature (50–54 °F/10-12 °C) for 2 weeks, then cool to 32–34 °F (0–1 °C) and cold condition for four days.

If you have a spunding valve, transfer beer from primary to keg when gravity is about 1.020, close keg, pressurize to ~5 psig to seal lid, attach spunding valve, and hold at fermentation temperature (50–54 °F/10–12 °C) for 3 weeks. Cool to 32–34 °F (0–1 °C) and cold condition for four days before serving.

BOULEVARD BREWING CO.'S BOB'S '47 CLONE

(5 gallons/19 L, partial mash)
OG = 1.055 FG = 1.011
IBU = 27 SRM = 11 ABV = 5.8%

INGREDIENTS

3.5 lbs. (1.4 kg) Pilsen dried malt extract
1 lb. (0.45 kg) Munich dried malt extract
1.5 lbs. (0.68 kg) Munich malt (10 °L)
0.66 lb. (300 g) Munich malt (15 °L)
0.66 lb. (300 g) European crystal malt (50 °L)
0.15 lb. (70 g) European crystal malt (15 °L)
5 AAU Vanguard hops (60 min.)
(1 oz./28 g at 5% alpha acids)
2.5 AAU Vanguard hops (30 min.)
(0.5 oz./14 g at 5% alpha acids)
SafLager W34/70 or Omega Yeast Labs OYL-114 (Bayern Lager) or White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Start with 1.5 gallons (5.6 L) of water in the brew kettle; heat to 158 °F (70 °C). Steep the crushed malts in a mesh bag for 45 minutes, then remove.

Add 5 gallons (19 L) more of water, rinsing the grain bag during addition; heat to 180 °F (82 °C).

Turn off the heat. Add the malt extract, and stir thoroughly to dissolve completely. Turn the heat back on and bring to a boil. Boil the wort for 60 minutes, adding hops at the times indicated in the recipe. Adjust OG post-boil with RO water as required.

Chill the wort to 50–54 °F (10–12 °C), pitch the yeast, and ferment until complete. Lager at fermentation temperature (50–54 °F/10–12 °C) for 2 weeks, then cool to 32–34 °F (0–1 °C) and cold condition for four days.

If you have a spunding valve, transfer beer from primary to keg when gravity is about 1.020, close keg, pressurize to ~5 psig to seal lid, attach spunding valve, and hold at fermentation temperature (50–54 °F/10–12 °C) for 3 weeks. Cool to 32–34 °F (0–1 °C) and cold condition for four days before serving.

BOULEVARD BREWING CO.'S PALE ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.053 FG = 1.011
IBU = 30 SRM = 9 ABV = 5.4%

Boulevard Pale Ale is an old-school pale ale with a variety of caramel and high-kilned malts, and a blend of hops that add a zesty aroma. Pale Ale was Boulevard's first beer and continues to be a perennial favorite.

INGREDIENTS

8.5 lbs. (3.86 kg) North American 2-row Pilsner malt
1.6 lbs. (0.73 kg) Munich malt (10 °L)
0.5 lb. (230 g) European crystal malt (25 °L)
0.4 lb. (180 g) European crystal malt (60 °L)
4.65 AAU Magnum hops (60 min.)
(0.39 oz./11 g at 12% alpha acids)
1 AAU Bravo hops (30 min.)
(0.07 oz./2 g at 15% alpha acids)
1 AAU Cascade hops (30 min.)
(0.17 oz./5 g at 6% alpha acids)
1 AAU Styrian Golding hops (30 min.)
(0.2 oz./6 g at 5% alpha acids)
0.8 AAU Bravo hops (0 min.)
(0.05 oz./2 g at 15% alpha acids)
0.8 AAU Cascade hops (0 min.)
(0.13 oz./4 g at 6% alpha acids)
0.8 AAU Styrian Golding hops (0 min.)
(0.16 oz./5 g at 5% alpha acids)
Wyeast 1098 (British Ale) or White Labs WLP007 (Dry English Ale)
or Omega OYL-006 (British Ale 1) or SafAle S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. Adjust all brewing water to a pH of 5.5 using phosphoric acid. Add 1 tsp. calcium chloride to the mash.

Mash the malts at 154 °F (68 °C) for 60 minutes. Start recirculating wort. Raise the temperature to 168 °F (76 °C) for 15 minutes. Sparge slowly and collect 6.5 gallons (24.5 L) of wort.

Heat to boiling, and boil the wort for 90 minutes, adding hops at the times indicated in the recipe. Adjust OG post-boil with RO water as required.

Chill the wort to 62–64 °F (17–18 °C), pitch the yeast, and ferment until complete. Cool to 32–34 °F (0–1 °C) and cold condition for four days.

Rack the beer, prime and bottle condition, or keg and force carbonate.

BOULEVARD BREWING CO.'S PALE ALE CLONE

(5 gallons/19 L, extract with grains)
OG = 1.053 FG = 1.011
IBU = 30 SRM = 9 ABV = 5.4%

INGREDIENTS

4.5 lbs. (2.04 kg) Pilsen dried malt extract
1 lb. (0.45 g) Munich dried malt extract
0.5 lb. (230 g) European crystal malt (25 °L)
0.4 lb. (180 g) European crystal malt (60 °L)
4.65 AAU Magnum hops (60 min.)
(0.39 oz./11 g at 12% alpha acids)
1 AAU Bravo hops (30 min.)
(0.07 oz./2 g at 15% alpha acids)
1 AAU Cascade hops (30 min.)
(0.17 oz./5 g at 6% alpha acids)
1 AAU Styrian Golding hops (30 min.)
(0.2 oz./6 g at 5% alpha acids)
0.8 AAU Bravo hops (0 min.)
(0.05 oz./2 g at 15% alpha acids)
0.8 AAU Cascade hops (0 min.)
(0.13 oz./4 g at 6% alpha acids)
0.8 AAU Styrian Golding hops (0 min.)
(0.16 oz./5 g at 5% alpha acids)
Wyeast 1098 (British Ale) or White Labs WLP007 (Dry English Ale)
or Omega OYL-006 (British Ale 1) or SafAle S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 6.5 gallons (24.5 L) of water in your brew kettle while steeping crushed grains for 20 minutes. Once a temperature of 180 °F (82 °C) is reached turn off the heat. Add the malt extract and stir thoroughly to dissolve completely. Turn the heat back on and bring to a boil.

Boil the wort for 90 minutes, adding hops at the times indicated in the recipe. Adjust OG post-boil with RO water as required.

Chill the wort to 62–64 °F (17–18 °C), pitch the yeast, and ferment until complete. Cool to 32–34 °F (0–1 °C) and cold condition for four days.

Rack the beer, prime and bottle condition, or keg and force carbonate.

BOULEVARD BREWING CO.'S SINGLE-WIDE IPA CLONE

(5 gallons/19 L, all-grain)
OG = 1.056 FG = 1.012
IBU = 57 SRM = 8 ABV = 5.7%

Single-Wide IPA is Boulevard's take on a West Coast-style IPA, with a balanced profile coming from the interplay of malty notes from Single-Wide's grist bill and hop flavors and aromas coming from a solid lineup of American hops and a featured guest from down under.

INGREDIENTS

8 lbs. (3.6 kg) North American 2-row Pilsner malt
2.25 lbs. (1 kg) North American white wheat malt
1 lb. (450 g) Munich malt (10 °L)
0.5 lb. (230 g) European amber malt (25 °L)
10 AAU Topaz™ hops (60 min.)
(0.67 oz./19 g at 15% alpha acids)
3.24 AAU Cascade hops (30 min.)
(0.54 oz./15 g at 6% alpha acids)
3.24 AAU Centennial hops (30 min.)
(0.32 oz./9 g at 10% alpha acids)
3.24 AAU Citra® hops (30 min.)
(0.27 oz./8 g at 12% alpha acids)
3.24 AAU Summit™ hops (0 min.)
(0.20 oz./6 g at 16% alpha acids)
1 oz. (28 g) Cascade hops (dry hop)
1 oz. (28 g) Centennial hops (dry hop)
1 oz. (28 g) Citra® hops (dry hop)
Wyeast 1098 (British Ale) or White Labs WLP007 (Dry English Ale)
or Omega OYL-006 (British Ale 1) or SafAle S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. Adjust all brewing water to a pH of 5.5 using phosphoric acid. Add 1 tsp. calcium chloride to the mash.

Mash the malts at 154 °F (68 °C) for 60 minutes. Start recirculating wort. Raise the temperature to 168 °F (76 °C) for 15 minutes. Sparge slowly and collect 6.5 gallons (24.5 L) of wort.

Heat to boiling, and boil the wort for 90 minutes, adding hops at the times indicated in the recipe (if you can't find Topaz™, substitute Amarillo®). Adjust OG post-boil with RO water as required

Chill the wort to 62–64 °F (17–18 °C), pitch the yeast, and ferment until complete. Dry hops should be added when gravity is about 1.016. Cool to 32–34 °F (0–1 °C) and cold condition for four days. Rack the beer, prime and bottle condition, or keg and force carbonate.

BOULEVARD BREWING CO.'S SINGLE-WIDE IPA CLONE

(5 gallons/19 L, partial mash)
OG = 1.056 FG = 1.012
IBU = 57 SRM = 8 ABV = 5.7%

INGREDIENTS

4 lbs. (1.8 kg) Pilsen dried malt extract
1.5 lbs. (0.68 kg) wheat dried malt extract
1 lb. (450 g) Munich malt (10 °L)
0.5 lb. (230 g) European amber malt (25 °L)
10 AAU Topaz™ hops (60 min.)
(0.67 oz./19 g at 15% alpha acids)
3.24 AAU Cascade hops (30 min.)
(0.54 oz./15 g at 6% alpha acids)
3.24 AAU Centennial hops (30 min.)
(0.32 oz./9 g at 10% alpha acids)
3.24 AAU Citra® hops (30 min.)
(0.27 oz./8 g at 12% alpha acids)
3.24 AAU Summit™ hops (0 min.)
(0.20 oz./6 g at 16% alpha acids)
1 oz. (28 g) Cascade hops (dry hop)
1 oz. (28 g) Centennial hops (dry hop)
1 oz. (28 g) Citra® hops (dry hop)
Wyeast 1098 (British Ale) or White Labs WLP007 (Dry English Ale)
or Omega OYL-006 (British Ale 1) or SafAle S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Start with 1 gallon (3.8 L) of water in the brew kettle; heat to 158 °F (70 °C). Steep the crushed malts in a mesh bag for 45 minutes, then remove. Add 5.5 gallons (21 L) more of water, rinsing the grain bag during addition; heat to 180 °F (82 °C).

Turn off the heat. Add the malt extract, and stir thoroughly to dissolve completely. You do not want to feel 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 90 minutes, adding hops at the times indicated in the recipe (if you can't find Topaz™, substitute Amarillo®). Adjust OG post-boil with RO water as required.

Follow the remainder of the instructions from the all-grain version of this recipe.

UNDER THE HOOD

Boulevard's original brewhouse, a two-vessel design with the lauter tun positioned directly above the mash mixer/kettle, was plucked from Bavaria and relocated in Kansas City. Designed for use with whole hops, the brewhouse had a continuous hop separator that removes hops from wort as it is pumped to the whirlpool vessel for trub removal. Today, pellet hops have replaced cone hops because they are easier to store, ship, and handle.

Although a bit uncommon in the US, this stacked brewhouse configuration was once fairly popular in Germany due it is compact and efficient use of space. This basic operation starts by mashing in the mash mixer/kettle, followed by pumping up to the lauter tun, and collecting wort by gravity flow into the kettle. Decoctions can also be performed by draining the thick mash from the lauter tun into the kettle, boiling, and pumping back to the lauter tun. A cool feature of this design is the use of a single shaft and gear motor turning the raking machine in the lauter tun and the mixer in the mash mixer/kettle. Homebrew systems like the Grainfather were patterned after this design (minus the raking machine and mixer).

As Boulevard grew and needed to brew more beer, the brewhouse was expanded by adding a stand-alone mash mixer and wort receiver. The kettle was modified by adding an internal calandria situated above a heating coil; this design permitted for the production of half batches by boiling with just the coil. These modifications allowed this brewhouse to kick out about 3,000 brews in a single year just before Brewhouse II was commissioned in 2006.

Boulevard's second brewhouse, Brewhouse II, knocks out 150 barrels per brew and was designed and built by Krones-Steinecker in their manufacturing facility located

in Freising, Germany. Brewers know Freising as the home of the Technical University of Munich, Weihenstephan, and the Bayerische Staatsbrauerei Weihenstephan located on the university campus. Not a bad place to source brewing equipment, for sure.

The brewing process in Brewhouse II begins with wet milling. The Steinecker Variomill wets the malt husk in a conditioning chamber and then introduces mash water as the malt feeds into the crushing rollers. Mash is then pumped from the mill and into the bottom of the mash mixer to minimize oxygen pick-up. After mashing is com-

plete and the temperature is raised for mash-out, the mash is pumped to the Pegasus lauter tun.

The Pegasus has some cool brew-geek features, especially the clever use of space in a donut-like space cleared from the vessel's inner area. Engineers at Steinecker removed the least efficient part of a lauter tun's bottom and replaced this area with an enlarged center cone. This design moves the shaft seal of the raking machine well above the product level and makes room on the bottom side of the vessel for the mash inlet piping, with a modest addition to the diameter to account for the area taken from the center. During lauter tun fill, mash is radially distributed from the center across the surface of the false bottom, making for an even and quiet fill while simultaneously minimizing mash piping. A very elegant design, indeed.

Wort flows from the lauter tun to a wort receiver, alleviating process bottle-necks, through a wort pre-heater, and into Boulevard's Stromboli kettle. The Steinecker Stromboli is designed for thorough wort mixing during boiling and improved Di-Methyl Sulfide (DMS) removal; these process improvements over prior designs result from how the wort concentrator and spreader hats (there are two) positioned above the internal calandria are designed. In addition to improvements to wort quality and reduced energy consumption to achieve the same analytical results, the Stromboli includes a vapor condenser in the steam exhaust stack, allowing for substantial energy recovery in the form of hot water that is used on subsequent brews for wort heating.

All fermentations at the brewery are conducted in cylindroconical fermenters, most of them multi-batch, before beer is aged and chilled. Clarification is achieved using centrifugation, with bright beers being sent through two centrifuges set up in series. This practice eliminates the need for filtration, reduces waste generated from filter sheets and/or diatomaceous earth, and eliminates a process step that can remove certain flavor attributes from beer. Boulevard continues to use bottle conditioning for all of their core brands and Smokestack Series beers. All of Boulevard's 12-ounce bottles are filled by their Krones bottling line that was part of the 2006 Brewhouse II project. Kegs are filled in the same facility.

A state-of-the-art packaging hall devoted to canning (pictured at the top of page 68) was commissioned in 2018. Full cans of beer streaming from the 350 can-per-minute filler can either be sent directly to the dry end of the line where they exit the line as 6-pack cases and are then palletized for storage and subsequent shipping, or the filled cans of beer can be diverted through a tunnel pasteurizer prior to packing. The tunnel pasteurizer allows Boulevard to package beers containing fermentable sugars, like the fruity Jam Band, without the risk of package failures in the market.

Boulevard is annually producing about 185,000 barrels from their combined operations in Kansas City and is Missouri's second largest brewery, behind Anheuser-Busch in St. Louis.

Continued from page 63

a great beer unto itself, it was missing an earthy element that Pauwels wanted. Enter *Brettanomyces*. Clean Saison was moved to an off-site warehouse, inoculated with *Brettanomyces*, or *"Brett,"* and bottled. *Brett* is a diastatic yeast that secretes glucoamylase. This enzyme converts dextrins into fermentable sugars that are then fermented by *Brett*. Bottle-conditioned *Brett* beers not only become more carbonated with time, they begin to express the earthy, barnyard-like, phenolic aromatics that are the signature of *Brett* beers. Saison Brett completed Pauwels' mental image of his ideal Saison. Today, Saison Brett is a beer that makes its presence every so often. There was no 2019 release of Saison Brett, but 2020 should see another release of this brew to the approval of its enthusiastic supporters.

The Sixth Glass was another bold, Belgian-inspired beer; a Quadrupel ale, nonetheless. This brew is named for a devilish literary reference that is a metaphor for the beer itself and an inspiration for the artwork. The Sixth Glass takes its name from part of Hans Christian Anderson's *Taarnvægteren Ole*, translated into English as "Ole, The Tower Keeper" and "The Watchman of the Tower." The bottom line was that the Smokestack Series beers made it clear to the beer intelligentsia that Boulevard had game.

Before we jump to the current decade, let's circle back to 2006, when Boulevard began making beers with wild yeasts and bacteria. One may assume that a brewer with Pauwels' past would be anxious to bring on the funk sooner than later. But Pauwels' past brought with it a healthy respect for introducing bacteria and diastatic yeast like *Brettanomyces* into a clean, funk-free, brewery. Saison Brett was Boulevard's first funky beer and the *Brett* added before packaging was all handled in an off-site warehouse facility that the brewery had been using for storage. This was an ideal location to house funky creations along with a small bottling line dedicated to these beers. Used barrels can also be vectors of the funk and Boulevard houses their entire barrel program in this

off-site facility.

Today, Boulevard's mixed-fermentation and barrel program includes about 5,000 oak barrels, four vertical foudres, one horizontal foudre, and a packaging line with cork and cage as well as crown finish options. Beer is moved from the brewery to this off-site facility to ensure that no unwanted microbes are brought into the process.

A NEW DECADE: 2010 AND BEYOND

As the brewery continued to grow and prosper, John McDonald began thinking about retirement and enjoying life after brewing. The decision was made to begin an international search for a buyer that was aligned with Boulevard's beliefs and brewing ethos. Belgium's Duvel Moortgat, operating in the states as Duvel USA after its complete acquisition in 2003 of Brewery Ommegang (Duvel Moortgat was an original investor in the Cooperstown, New York brewer of Belgian-style ales that opened in 1997), would be the new owner of Boulevard. In 2013 the acquisition was complete.

The community of craft beer consumers have not been the friendliest lot when the founders and majority owners of independent companies have chosen to sell their businesses, and the predictable sellout barbs were thrown at the well-liked and widely respected McDonald following his decision. But the hullabaloo settled and Boulevard fans continued enjoying the brewery's beers, while work at the brewery went on for the sizable staff of talented folks passionately pulling Boulevard's rope in the same direction.

Jeff Krum is now the President of the company. He was an original investor in Boulevard and gave John McDonald business advice in the early years. Krum joined the Boulevard team as the company's CFO in 1994, became the VP of Corporate Affairs after the acquisition in 2014, and in 2016 was named President of Boulevard Brewing Company, Brewery Ommegang, and Duvel Moortgat USA, the group's national sales organization.

Steven Pauwels has been the Brewmaster at Boulevard for 20 years and continues to be supported by a strong team including Craig Pijanowski, Boulevard's Brewing Manager who has been with the company for 17 years, veteran Quality Manager Joe Palausky, Packaging Manager Jason Hart, Off-Site Barrel Program manager Ryan McNieve, and Plant Engineer Dalibor "Dali" Grabar, the project manager for Krones-Steinecker during the installation of Brewhouse II who decided to stay in Kansas City following commissioning.

Opened in 2016, the Beer Hall and Rec Center is Boulevard's latest expansion. It features two bars pouring core brands and limited releases as well as a merchandise store and shuffleboard deck.

Launched in 2006, Boulevard's Smokestack Series has created many of the brewery's most coveted beers, including its iconic saison Tank 7.

Boulevard's most recent addition to the brewery campus, the Beer Hall and Rec Center, opened its doors in 2016. The Beer Hall and Rec Center features a reception area with information about company history and a merchandise store on the first floor, an expansive beer hall with two bars pouring all core brands and a wide array of limited-release and experimental brews on the second floor, and a recently opened shuffleboard deck on the fourth floor. Brewery tours and special events can also be scheduled through the Beer Hall and Rec Center.

Boulevard Brewing Company celebrates it 30th anniversary this year. Over the past three decades, the brewery has made many lasting marks in the history pages about the rise of the US craft beer movement. The next time you are planning a beer vacation or are anywhere near Kansas City, a visit to Boulevard Brewing should definitely be part of your plans!

GREEN INITIATIVES

Boulevard is committed to being a zero-waste facility and does not send any brewery waste streams to landfills. Waste aluminum, glass, paper, cardboard, metal, and wood are collected in recycling bins located throughout the brewery campus and sent to area recycling centers. Spent yeast is collected and composted by Missouri Organic, and, like most commercial brewing operations, their spent grains are sent to local farmers to be used for animal feed.

The vapor condenser on the kettle stack is another example of Boulevard's commitment to efficiency. But how does a brewery utilize hot water to save energy? The answer is by using a closed-loop, specially designed water tank for thermal storage. The key feature of this type of vessel is stratification and the intentional establishment of a thermocline, or steep temperature gradient created by differences in water density, in the tank where the temperature above is much hotter than the temperature below. Diffuser manifolds in the top and bottom of the tank help establish the gradient.

Here is how the system works: 172 °F (78 °C) water is pumped from the bottom of the energy storage tank during wort boiling and used as the coolant to condense steam in the kettle's vapor condenser. The vapor condenser is a type of shell and tube heat exchanger with the cooling water flowing through tubes and steam from the boiling wort passing over the exterior surface of the tubes. Think of a giant immersion chiller! As steam condenses, water flowing through the tubes is heated from 172 to 207 °F (78 to 97 °C) and returns into the energy storage tank through the diffuser manifold in the top of the tank. It only takes a single brew to get this tank primed for use.

When wort from the next brew is pumped through the wort heater located between the wort receiver and kettle, 207 °F (97 °C) water from the top of the energy storage tank heats wort from 169 to 203 °F (76 to 95 °C). In the process the hot water is cooled to 172 °F (78 °C) and returned to the bottom diffuser manifold of the energy storage tank. This process reduces total energy consumption associated with wort heating and boiling by about 33%.

Another example of the brewery's environmental awareness is illustrated through a side business created by those in charge a decade ago. The people at Boulevard were noticing as the brewery grew and sold more beer, that more of their beer bottles were ending up in area landfills. Data collection began and they determined that there was a real need for glass recycling in Kansas City because there was none. The solution was to establish a separate company that could recycle glass.

Ripple Glass was founded by then Boulevard President John McDonald, CFO Jeff Krum, and Plant Engineer Mike Utz. The new company began collecting and processing glass in the Kansas City area in 2009. According to Ripple Glass "Kansas Citians threw away 150 million pounds (68 million kg) of perfectly good glass, including some 10 million empty Boulevard bottles, lost forever and buried in local landfills," in 2009 alone.

Today, Ripple Glass has two major customers; Owens Corning in Kansas City, which converts the glass collected and processed by Ripple into glass cullet (small pieces of chopped up glass) for fiberglass insulation, and an Ardagh glass manufacturing plant in Sapulpa, Oklahoma that converts Ripple's cullet into new beer bottles. Ripple's eye-catching, purple collection containers are seen in over 80 communities in Missouri, Kansas, Iowa, Nebraska, and South Dakota, and help these communities keep glass from entering landfills. Mike Utz is now the President of Ripple Glass. BYO

MEADS OF THE SEASON

SPICING UP HOLIDAY MEADS

Photos by Charles A. Parker/Images Plus

Seasonal drinking traditions are a really interesting subject to delve into, as holiday parties and family gatherings often open people up to new beverages that aren't available or of interest during other parts of the year. There's also the added excitement around family traditions, which may seem unique to your family, but they often have common traits shared much more broadly. No matter who you are, where you are from or what you celebrate, there are common themes with the liberal usages of herbs, spices, and fruits, as well as unique, scarce, or prized ingredients in the holiday beverages from wherever you hail. Now that is something we can all celebrate!!

by Jason Phelps

MAKING YOUR BEST HOLIDAY MEADS

Because of the extra attention paid to the details of our holiday gatherings and celebrations we should expect holiday meads to be their best selves as well. Well appointed, while an interior decorating term, came to mind as I was trying to explain the additional allure and hopes for a truly great holiday mead. Great holiday meads will have structure, body, rich flavors, and a balance between the ingredients and attributes that conceptually make sense, but they should also be accessible. We plan to use fruits and spices liberally, and the best holiday meads should be expressive with characteristics that are distinguishable to make that moment of tasting memorable.

The path to a great holiday-inspired mead is one of trial and error. Working with ingredients that may be particularly expressive like peppercorns, anise, or clove, even with short contact times, requires some finesse. Time is the hard detail that can be monitored, but taste is king because the variance of many ingredients, even in the same quantities, means it has to taste right before it can just be made on a schedule. Understanding this means recipes can be great guides, but focusing in on that "perfect" outcome requires your skills in the process. Loving the mead is part of the desired outcome.

To that tune, I'm going to share with you four of my favorite meads that I consider perfect for the holidays. Note that all of these recipes have flexibility to adjust the amounts of spices, fruits, and other ingredients, as well as the techniques used when making them. I will outline my basic procedure, but feel free to follow your own traditional process and adapt the recipe as you feel comfortable.

Spices are the most immediate example of a theme for holiday meads. I love apple pie. I mean, who doesn't? How about a mead that tastes like liquid apple pie?

I'LL HAVE THE PIE

(5 gallons/19 L)
OG = 1.138 FG = 1.025
ABV = 14.5%, est

INGREDIENTS

16 lbs. (2.3 kg) honey
3–4 gallons (11.5–15 L) fresh-pressed cider
25 g 71B-1122 wine yeast
Yeast rehydration agent
Yeast nutrients
Stabilization additives
Peels of two large oranges
5 cinnamon sticks
10 dried berries of allspice (roughly crushed)
3 whole cloves
3 vanilla beans (split and scraped)

I like wildflower honey for apple meads, but keep in mind that all honeys will impart their unique character to mead, so you can search for different honeys that really sing with apples and spices! Mesquite and buckwheat honeys are interesting alternatives, the character of each

being fully expressed in the final product. You can also put a caramel apple twist on a mead like this just by caramelizing some of the honey prior to the ferment. This can be done by heating a small amount of honey in a large saucepan (leave space for expansion as the honey rolls, creating foam) over medium-high heat until it begins to brown and takes on a candy-like flavor. A long-handled spoon and gloves are advised when stirring your caramelized honey this way as hot honey splatter can be very painful.

In this recipe, the honey and cider are mixed together from the onset and fermented.

My typical meadmaking process would be to use the yeast rehydration agent to prep the yeast before pitching, and then a staggered nutrient addition regimen (with degassing) to feed the ferment for the first few days. Depending on the time of year and temperature in my house, I may or may not choose to place the fermenter in a 64 °F (18 °C) temperature-controlled space. Once the fermentation is complete I always use both potassium sulfite and potassium sorbate as stabilization additives, whether I filter the mead or not. All of these additions are based on volume and there are a number of choices for the types and sources of nutrients that can be used. Additional tips and resources on the meadmaking process are included in the sidebar on page 76.

The fermentation should arrest near the target final gravity (FG), after which the spices and orange peels can be added. The spices and peels should be removed once the flavor is as desired. I will often check in 24-hour increments. To my taste, I often find the flavors I am seeking

just after three days. For stronger meads, additional contact time with spices allows for the development of robust flavors to balance with the alcoholic strength and potential sweetness of the mead. Use your own taste to decide if more contact time is needed, or even if you want to add more of any of the spices used. If adding more, I most often remove the existing spices and add a fresh dose of anything I want more of. I also typically use a nylon straining bag to contain citrus peels, whole spices, hops, and other small items to make their removal easier.

Mead has a treasure trove of contextually specific words that typically describe a specific style of mead. In this case, I'll Have The Pie is a *melomel*, which means a fruit mead, but it is also technically a *cyser*, a fruit mead made from apple and honey, as well as a *metheglin*, a spiced/herbed mead, because of the addition of spices. This makes this particular mead a hybrid of both fruited and spiced meads, a very common intersection in mead!

I love the season in which the holidays of Thanksgiving, Christmas, and New Years are celebrated. The added focus on spending time socially means groups of people are looking for experiences to try new and interesting twists on flavors inspired by the season wherever they are. We think of foods with different "classic" flavors right away, but don't forget the drinks!

PEAR & GRAPE COCKTAIL MEAD

(6 gallons/23 L)
OG = 1.067 FG = 0.997
ABV = 7%, est (final, 9% after ferment)

INGREDIENTS

6.4 lbs. (2.9 kg) honey
Water to 4.5 gallons (17 L)
12 g QA23 wine yeast
Yeast rehydration agent
Yeast nutrients
Stabilization additives
12 lbs. (5.4 kg) pears (cored and chopped)
0.3 oz. (8 g) dried elderflower
18 fluid oz. (30 mL) Chardonnay juice (25 °Brix)
1.5 lbs. (0.68 kg) honey
Water to 6 gallons (23 L)

The honey and first fraction of water are combined and fermented. The initial volume will be 4.5 gallons (17 L). Once the fermentation stops the mead will be dry and should be racked off the lees to a clean container and stabilized. The pears and dried elderflower can then be added. Remove these when the flavor is at the level desired, which could be as short as 3–5 days for the elderflower. To finish this mead, mix the remaining honey with water and add that and the Chardonnay juice to a final volume of 6 gallons (23 L).

This pear and white grape mead was inspired by a cocktail that contains pear vodka, white wine, and St. Germain liqueur. The aromas of the drink alone can elevate your mood. I've always associated pears with Christmas gatherings in my family, so I think this mead is a great fit for holiday entertaining.

With this recipe we've got another hybrid *melomel/metheglin*, using both the fruit and spice to blend into the final result.

Mid-winter celebrations come in many forms, and I've seen quite a few mead recipes designed for Yule festivities. While not true for all of these recipes, quite a few contain a lengthy list of components, almost like a tincture for cocktails. Here's my take on a herbed/spiced mead made to usher in the new winter season.

SPICED ORANGE MEAD

(3 gallons/11.5 L)
OG = 1.127 FG = 1.020
ABV = 14%, est

INGREDIENTS

10.5 lbs. (4.8 kg) mix of clover and basswood honeys
12 g Côte des Blancs wine yeast
3 orange peels
1 fresh sprig of thyme
3 tsp. peppercorns (roughly cracked)
6 bay leaves
3 lbs. (1.4 kg) golden raisins
Yeast rehydration agent
Yeast nutrients
Stabilization additives

For this mead everything goes in up front — more on

NOTES ON
THE MEADMAKING PROCESS

The process of making mead is discussed generally in this story as the focus is specifically on making holiday meads. However, for brewers new to the meadmaking process, there are a number of common techniques and important tips that can be applied to consistently make good mead. Many are mentioned briefly in the recipes, but I have called out key points and documented the amounts and related steps for each up front here.

Keep Everything Clean — Sanitation is your best defense for successful homebrewing projects.

Manage Your Volume — Containers should be a bit oversized until you get to the stage you want to age longer-term. You need headspace for mixing/degassing and extra space for any large volumes being added in secondary. Once you get to aging you want as little headspace as possible.

Temperature Control — Controlling your temperature will produce more pleasing meads when using most wine yeasts, and in many cases it will also reduce the aging time that has historically been needed to mellow out fermentation aromas and flavors. I typically ferment meads at 64 °F (18 °C). You should use a temperature in the low end of the range that your chosen yeast will support.

Prepare Your Yeast — Re-hydrate dry yeasts and make starters with liquid yeasts. For yeast rehydration I use Startup from BSG at a rate of 1 gram per oz. of rehydration water. I typically use 1 oz. of rehydration water per 1.5 grams of yeast. I pitch yeast at 2 grams and up to 5 grams per gallon (4 L) along a specific gravity (SG) range of 1.050 to 1.150+. The rehydration process involves adding the Startup to 110 °F (43 °C) water and mixing it thoroughly. Once the rehydration water cools to 104 °F (40 °C) or below the yeast can be added and gently mixed. From here the yeast will begin to bloom up. After 10 minutes or so you can mix it again and add some of the must to both temper the rehydration water and give the yeast a little food.

Take Care Of Your Yeast — Make sure you have good quality nutrients on hand and a staggered process of dosing your ferment with them. I recommend a micro-nutrient blend like Superfood from BSG with a dosage of 1.25 to 2 grams (on an SG range of 1.050 to 1.150+) per gallon (4 L) of volume (for more on Superfood, visit https://bsgcraft.com/resources/FAQ/4.26.18%20Nutrient%20Addition%20Charts.pdf). I also recommend adding 0.5 grams per gallon of diammonium phosphate (DAP). With meads above 1.080 I will break up the nutrients into four equal dosages with additions on days +1, +2, and +3; and the final dose at ⅓ sugar break. For meads below an SG of 1.080 I break up the nutrients into two doses and add them on days +1 and +2. The basis for this difference is how quickly the fermentation progresses to 50% or more of the sugar having been consumed and that you need to get the nutrients in when the yeast can most use them.

I typically warn against the usage of DAP on its own or in nutrient blends past 50% of a ferment. This is because DAP is like candy for yeast and after 50% of the ferment we don't want the spikes in metabolism it can provide. We want a smoother fermentation moving toward completion. Yeast hulls can be used for additional organic nitrogen for sluggish or intentionally lengthy fermentations. Dosages of 1 to 2 grams per gallon (4 L) of yeast hulls provide small amounts of nutrients. Yeast hulls, if not metabolized before the fermentation is complete, can leave behind an earthy or "cheesy" aroma, reminding us that more is not better and intervening past a logical point may be worse.

Stabilization – I advocate for the use of potassium metabisulfite and potassium sorbate for the stabilization of meads that contain residual sugar, whether added initially but unfermented or added during a backsweetening step. The fact that there is sugar present leaves the opportunity for re-fermentation, and the use of both sulfite and sorbate can greatly reduce this risk. The application of these additives should be followed by a rest to allow them time to work. Immediate backsweetening, and worse yet packaging, is a recipe for disaster. These additives do not kill yeast, and this is a common misconception, so some time for action is necessary. The application of sulfite is pH-dependent, but if no sulfite has yet been added an assumption of zero existing can be used to calculate a 50 ppm dose, which is a good baseline. With no free SO_2, a 50-ppm dose can be achieved with 0.32 grams per gallon (4 L) of potassium metabisulfite. For home meadmaking purposes I recommend 0.75 grams per gallon (4 L) of potassium sorbate along with the sulfite. The application of these additives can also be optimized by adding them to a mead that has been racked off the gross lees and is not showing signs of any yeast/fermentation activity. The reduced biomass means there is more sorbate available to ensure all the yeast are bound and stop reproducing.

My basic meadmaking steps are outlined and links to additional resources can be found in the "Education" section of my meadery's website at https://www.ancientfireciders.com/mead/meadmaking/. You can also search the archives of both *Brew Your Own* and *Wine-Maker* magazines for mead-related content from myself as well as a range of other authors.

this topic shortly — and a straining bag to hold the herbs/spices is again recommended to make removal easy. Mix the honey and water together, add the spice bag, and get the fermentation going. Check the flavors after a week or so and remove the spices when you have the desired flavors. Once the ferment is complete the mead can be stabilized and ideally given a short time to age in bulk.

This mead is definitely a bit more savory than the other recipes so far. The thyme and bay leaves do impart an herbal character, but the orange and raisins balance that with some fruitiness, and the black pepper provides a streak of earthy spiciness to make the outcome that much more interesting. I'd call it a *metheglin*, even with the orange peel and raisins. Their attributes are used much more as a spice in this mead than you might see elsewhere.

WHEN TO ADD THE FRUITS/SPICES

We've exercised several different techniques with the fruits and spices in the recipes up to this point. In I'll Have The Pie the fruit (cider) was fermented and the spices were added in secondary. In the Pear & Grape Cocktail Mead all the fruit and spices were

reserved for secondary, and finally for the Spiced Orange Mead we added everything right up front. How do you decide when to use the ingredients?

Ultimately this may come down to preference, but when you are first starting out it makes sense to try the different techniques so you can understand how they might be different. Keep in mind that you can, and should, still consider contact time no matter when you use most ingredients. This means that the impact will still be "x" days of time regardless of whether it is during or after fermentation. It is also worth remembering that any sugar added during primary will likely be fermented.

Over the nearly 15 years I had been homebrewing I ended up developing a couple basic concepts for how I made different types of meads. For most of the draft-style meads (carbonated, lower-alcohol) I tend to flavor them in the secondary. Meads containing either apple and grape juices were often co-fermented with the honey, but most others tended to have the best presentation when raw fruit was steeped with or without spices in secondary. The bold flavors and freshness is what makes this technique stand out for me.

For more traditional meads (higher in alcohol, non-carbonated) I found I would vary the technique depending on the type of ingredient, and most often how likely the delicate aromas might get blown off during a vigorous fermentation. Dried elderflower is pretty delicate and I won't risk losing the aromas from it during a ferment. Cacao nibs, on the other hand, are much more "durable" and might be something I would use in *both* primary and secondary. Here's an interesting tip: The necessary contact time for cacao nibs in particular is long enough that putting them in from day one starts the clock for them earlier in the process.

Can spices interact with the fermentation? While there is a possibility of some ingredients experiencing unusual bio-transformation when applied to an active fermentation, I've never seen any warnings about this that gives me reason to be concerned about doing it. Definitely watch out for anything with preservatives in it, and some dried fruits are heavily sulfited, which will impact the yeast if there is enough sulfite on them.

Spices can be also added in doses, another aspect of control, with the goal of working towards an end result with a much reduced risk of overshooting it. With this you can manage the contact time and the amount used, as well as wield multiple doses of fresh spices, something that longer contact times with the same initial spices can't always produce. There is a lot of opportunity to experiment here.

A LITTLE GOES A LONG WAY

The next recipe is a good example of a little bit of something going a long way. The first time I made candy cane vodka for use as a tincture I broke up two boxes of candy canes into a 1-quart (1-L) mason jar and covered them with vodka. By the time the candy canes finally broke down the vodka was pink and had a very strong candy cane flavor. It didn't take more than a small splash to flavor a cup of hot chocolate or a cocktail with the peppermint blast from candy canes!

This candy cane vodka-infused chocolate mead was made as a small countertop batch as a homebrewer some years ago. We made it a few months before Christmas and we poured it right from the 1-gallon (4-L) carboy we had aged it in during our family Christmas gathering!

CANDY CANE & CHOCOLATE MEAD

(3 gallons/11.5 L)
OG = 1.134 FG = 1.027
ABV = 14%, est

INGREDIENTS

11 lbs. (5 kg) wildflower honey
Water to 3 gallons (11.5 kg)
15 g Côte des Blancs wine yeast
Yeast rehydration agent
Yeast nutrients
Stabilization additives
3 oz. (85 g) cacao nibs (lightly toasted right before use)
Peppermint vodka

The honey and water can be mixed and fermented. Once the fermentation is completed the mead can be racked and stabilized. Slightly toasting the cacao nibs before using them helps to activate the chocolate and get it ready to impart its flavor to the mead. These are added after stabilization in this recipe, and allowed to steep in the mead

for several weeks, but the ultimate goal is for the mead to taste nicely of chocolate, so the timing and even the choice to use more nibs is open for personal interpretation. Once the chocolate flavor has been achieved the mead can be racked off the nibs and then flavored with the candy cane vodka. Less is more here, but use as much as you need to put it right where you like. I couldn't find a documented amount from this project (this is a good time to remind everybody that good note taking is important when you are playing with new recipes!), but I vaguely recall I started with ½-oz. (15-mL) increments in a 1-gallon (4-L) batch, mixing it well in between to make sure I didn't overshoot my goal with the peppermint.

While this example might be at an extreme end of the spectrum of intense flavors, it is also a good example of something to keep in mind when using spices; a little bit often goes a long way. Furthermore, once you get the flavors from the spices in, you can't remove them. You can blend an overly spiced mead down to mellow the spice component, but with that comes other changes depending on the composition (alcohol, sweetness, flavors) of the meads used to blend.

ENTERTAINING WITH YOUR HOLIDAY MEADS

Of course we can always pour ourselves a glass of a delicious holiday spiced mead, but since the season calls for family gatherings and house parties why not use your holiday meads to take your drinks game to the next level?

Mulling or serving mead warm with spices is not as popular as it may have once been, but is an interesting option to serve mead for the holidays. The outcome can often be positive — maybe try a warm version of the apple pie mead recipe shared in this article to make it taste like a fresh apple pie right out of the oven, or even a mulled cider. The simple starter is to slowly warm a sweet, strong mead up in a saucepan with a couple cinnamon sticks. Serve the mead in a ceramic mug with a cinnamon stick for a warm, fragrant drink to push the cold winter weather back for a time. This is an ideal drink when gathering around the fire pit on a cool night!

During the holiday season people are looking for new and interesting twists on adult beverages. Cocktails are very popular and there are two obvious reasons. Firstly, cocktails are a more potent potable, which can definitely elevate an occasion, and secondly, the breadth of distinctive flavors available in spirits, mixers, and bitters can create some incredibly complex drinks. But, have you ever considered using meads in cocktails?

There are all kinds of "rules" out there for making cocktails, and they all make sense. I'd like to hone in on just a couple that can help support some mead cocktail experimentation at home:

1. Cocktails should be balanced, so the strong (spirits), weak (juice, mixers), sour, and sweet components should work together in harmony.

2. Only stir cocktails that contain just spirits (mead included), but you can shake cocktails when fruit juice or other non-carbonated mixers are involved. This is really to promote the clean, clear visuals of this type of drink, but shaking does introduce oxygen, which can dull delicate aromatics rather quickly.

3. Ice used in cocktails should be clean and fresh. As the ice melts the water becomes part of the drink. It needs to taste good.

4. Meads we might use in cocktails have alcohol in them so I recommend backing off a half shot of alcohol when initially making any cocktails with mead. You can always add it back if you feel like it needs the additional alcohol for balance.

Since I've hopefully gotten your mind turning with how meads can be used as cocktails, I guess I'd better share a recipe. Here is one I've come to know well.

At Ancient Fire Mead & Cider in Manchester, New Hampshire we make a 7% ABV, draft-style mead flavored with both apple and ginger that is named With Malus. When we make this we use 30 lbs. (13.6 kg) of fresh ginger in each batch. The result is a ginger-beer level ginger profile, so it makes for a great swap in a Moscow Mule (which is traditionally made with ginger beer). Our partners at The Flight Center Beer Cafe in Nashua, New Hampshire actually make the Ancient Flight Mule cocktail, their riff on a Moscow Mule using our mead — they even use a copper mug to serve it! You can make your own version of this cocktail with this recipe:

MOSCOW MULE MEAD COCKTAIL

INGREDIENTS

2 shots vodka (I like Tito's because it is a bit sweet)
½ shot lime juice
6 fluid oz. (175 mL) semi-sweet ginger mead
Ice

Pour the liquids over ice in a rocks glass or a copper mug if you want to be completely traditional. Stir to mix. Garnish with a lime wedge and even a sprig of mint.

THINKING ABOUT YOUR NEXT HOLIDAY MEADS

At this point you've probably got all kinds of ideas swirling around in your head for holiday-themed meads. While they also drink well out of season, something about timing them when the flavors are at the front of people's minds really makes them sing!

With the stronger mead recipes shared here, some time in the bottle can absolutely help them further develop drinkability so why not plan ahead and start making meads for next year's holiday gatherings? As you sit around the table with your family and friends this holiday season let the flavor combinations inspire you to make something that celebrates your holiday traditions! BYO

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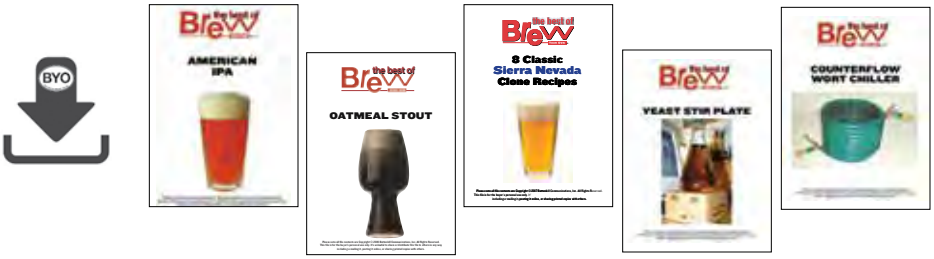

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Diastaticus

Understanding the yeast with a bad reputation

by Katelyn Roberts

Saccharomyces cerevisiae var. *diastaticus* has developed a bad reputation. It has been the culprit in highly publicized recalls, and poses a serious economic and safety risk to brewers. On the other hand, diastatic yeast can produce the gold standard of a style — such as saison. A yeast contaminant can be much harder to identify than a bacterial species because of the similarities to brewer's yeast. The differentiation between specific strains can be difficult and often utilizes several techniques. We will explore this fascinating bug to find what makes it tick, how it can be managed, and how it can be embraced. Let's start with the blueprint for all biology — the genetic code.

GENETIC CODE

Brewer's yeast makes ethanol and CO_2 by metabolizing sugars in the wort. The enzyme glucoamylase plays a major role in this conversion in many yeast species. The production and function of this enzyme is affected by more than one gene, making it a polygenic trait. *Diastaticus* has been defined by the presence of the STA genes. While the exact function of this family is not known, it is accepted that STA1 affects the export of glucoamylase. As with all polygenic traits there are other mechanisms at play, but a simplified view would show glucoamylase being released by STA1-positive yeast (*diastaticus*) and not released by "normal" brewer's yeast. The additional and less restricted enzyme is able to break down starches and other high molecular weight compounds into simple sugars, which can be fermented. In an open system this will lead to high attenuation and, often, a thin mouthfeel. However in a closed system with available carbohydrates, the increased pressure can lead to bottle gushers, and sometimes exploding cans and bottles. The problem isn't the diastatic yeast itself, the problem is either improper use of a known strain or a contamination event. Brewers would be better able to manage either situation with better tools. Large breweries utilize sophisticated molecular genetic techniques that are often out of the reach of smaller breweries. Even on a genetic level there are few differences, and they sometimes don't tell the whole story.

STA1 isn't exactly a fingerprint for diastatic yeast, as stated in the simplified example. Just carrying a gene does not guarantee that it is expressed to a level to cause problems. Other, possibly uncharacterized genes, act as the gas pedals and the brakes to regulate gene expression. An organism's collection of unique genes is known as its genotype. To complicate matters further, genes and traits are not 1-to-1. In addition to polygenic traits, phenotypic genes control two or more often unrelated traits. The genetic code is read through this landscape into a physical organism. Humans and yeast have observable characteristics — hair color, phenol production, alcohol tolerance. The complete collection of these characteristics resulting from the interaction of its genotype with the environment. Just testing for the STA1 gene does not tell the whole story. Combining genotype and phenotype testing would be the best way to evaluate a strain for re-fermentation risk. However, defining *diastaticus* has been a challenge since day one.

DISCOVERY

Diastatic yeast was first reported in 1943 in the comprehensive *A System of Wort Analysis* by Bishop and Whitely. Later published in the Institute of Brewing in London, this report covers topics from yeast flocculation to fermentation vessel design. Researchers noted an "exceptional" secondary yeast that performed uniquely in their attenuation studies. In a well controlled setting all other pure cultures reduced an original gravity (OG) of 1.025 to an average of 1.011 in 48 hours, whereas this "Sample #164" consistently fermented to below 1.005 in the same amount of time. The researchers hypothesized that this yeast was able to export diastase enzyme and break down starches and ferment them. They tested this by preparing growth media with starch as the sole carbon source, and were able to track fermentation. Bishop and Whitely hypothesized that other yeast could excrete the enzyme as well, but at varying levels. They noted that this could explain the conflicting reports at the time about the ability to ferment dextrins. Understanding some of the checks and balances written into the genetic code, the diastatic trait is a spectrum. This makes the jobs of brewery quality control teams even more difficult.

I worked with Dr. Matthew Farber of the University of Sciences brewing program in Philadelphia, Pennsylvania to survey many of the current techniques for identifying *diastaticus* in order to propose a recommendation to breweries. We wanted to cover assays that could fit into the quality control efforts of nano- to macro-scale breweries.

METHODS

Yeast Strains — A collection of commercial yeast were used in this series of assays. Of the nine strains chosen for these experiments, eight had been known to contain the STA1 gene. Generally these were high-attenuating strains, meaning they fermented completely resulting in a dry beer. They tended to be Belgian-type strains and most were used in the brewing of saison styles. All known diastatic strains are POF (phenolic off flavor) positive. They carry a gene that causes them to produce 4-vinyl guaiacol or other phenolic molecules at a detectable level. Not all yeast chosen produce these molecules under normal brewing conditions. Controls for these experiments were two English ale strains that are not considered high attenuating or diastatic. Along with these commercial strains, four industry isolates were also used. These came from a contamination event at a brewery.

Medias — Selective media promotes the growth of certain microorganisms over others, and is an important tool in any quality lab. Newly developed Farber Phan Diastatic Media (FPDM) uses cupric sulfate as a selective agent. Although the biology is not well understood, diastatic yeast

Chart I: Farber Phan Diastatic Media (FPDM) Test

Name	Style	Growth on FPDM
Strain 1	Belgian Saison 1	Weak
Strain 2	Belgian Saison 2	No
Strain 3	High Gravity Ale	Weak
Strain 4	Belgian Strong	Weak
Strain 5	Belgian Ale	No
Strain 6	Belgian Golden Ale	Strong
Strain 7	French Saison	Strong
Strain 8	Weizen	No
Strain 9	Wild	Strong

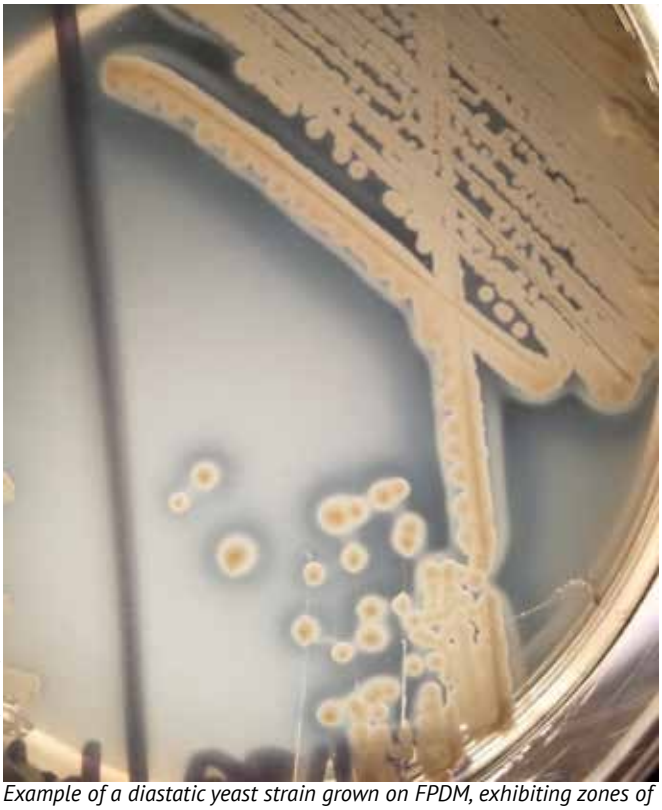

Photo by Katelyn Roberts

Example of a diastatic yeast strain grown on FPDM, exhibiting zones of clearing from starch utilization.

appear to tolerate levels of copper higher than control yeast. FPDM contains soluble starch as a food source for the diastatic yeast that are able to metabolize high molecular weight carbohydrates. Once the plates are chilled the starches become more opaque. If the yeast is able to metabolize them there will be a zone of clearing around the colony. See Chart 1 (on page 84) for a result of our FPDM test on the nine selected commercial strains.

PCR Assay — Researchers and quality control personnel often use polymerase chain reaction (PCR) to identify a specific gene of interest. This technique works by amplifying a specific gene and detecting the number of copies.

Photo by Katelyn Roberts

(Left) negative PCR test, no STA1 detected. (Right) positive PCR test, STA1 gene detected above threshold.

Chart 2: Polymerase Chain Reaction (PCR) Test

Name	Style	PCR test
Strain 1	Belgian Saison 1	Positive
Strain 2	Belgian Saison 2	Negative
Strain 3	High Gravity Ale	Positive
Strain 4	Belgian Strong	Positive
Strain 5	Belgian Ale	Negative
Strain 6	Belgian Golden Ale	Positive
Strain 7	French Saison	Positive
Strain 8	Weizen	Positive
Strain 9	Wild	Positive

Philadelphia-based Invisible Sentinel brings this powerful molecular technology to the food and beverage industry. They have a line of products designed specifically for the needs of modern brewers. Their simple cassette format allows brewers to test samples for organisms including *Pediococcus*, *Lactobacillus*, and *Saccharomyces diastaticus*. We ran our yeast library on the brewSTAT platform for rapid PCR-based detection of the STA1 gene. We began by placing individual colonies of each strain into the pre-filled tubes. The tubes went through an amplification cycle of heating and cooling before being read. This test kit uses antibody-based cassettes to generate a readout. The samples were pipetted onto the sample well and left to develop for two minutes, then the switch was retracted to reveal the results (shown in Chart 2, above).

Sporulation Staining — Contaminants that can form spores pose a greater threat to producers, as they are able to evade conventional sanitation measures. Fixed cells were stained and observed under a microscope to determine spore-forming ability. In order to induce sporulation, colonies grown on yeast extract peptone dextrose (YPD) were streaked for isolation on sodium acetate agar plates. They were incubated at room temperature for three days, out of direct sunlight. A thin layer of cells were heat-fixed onto microscope slides using a Bunsen burner. The slides were placed over a beaker of hot water to keep them damp with steam as the stains were applied. Blotting paper was saturated with *Malachite green* and placed over the slides. The paper was removed and the slides were rinsed with water after ten minutes. A secondary stain of *Safranin* was applied using blotting paper for two minutes. The primary

Photo by Katelyn Roberts

(Left) staining of non spore-forming yeast strain. (Middle) staining of a moderate spore-forming yeast strain. (Right) staining of a non spore-forming yeast strain.

Chart 3: Sporulation Staining Test

Name	Style	Endospore (Y/N)	Quantification (Spore cluster / number of cells visible) x 100
Strain 1	Belgian Saison 1	Yes	4 (4/103)
Strain 2	Belgian Saison 2	Yes	53 (41/77)
Strain 3	High Gravity Ale	Yes	7 (16/240)
Strain 4	Belgian Strong	No	0
Strain 5	Belgian Ale	Yes	29 (44/152)
Strain 6	Belgian Golden Ale	Yes	6 (7/126)
Strain 7	French Saison	No	0
Strain 8	Weizen	Yes	13 (10/77)
Strain 9	Wild	Yes	1 (3/ ~400)

stain will stain all spores blue, and the secondary stain will stain all other cells pink. The slides were thoroughly rinsed off and observed at 400x magnification. Results shown on Chart 3, above.

Over-Attenuation Assay — The major concern over *diastaticus* is its ability to re-ferment packaged beer. In order to simulate this scenario in the lab, we introduced the strains being tested to finished beer and allowed them to ferment (if they could) for a week. The beer was filtered to remove any foreign microbes. The yeast were grown overnight in media, then in a 50/50 mixture of the broth and the beer in order to allow them to adjust to the new environment. Tubes with 10 mL of filtered beer were inoculated with the same amount of yeast and placed in the incubator for seven days. They were then moved to a 39 °F (4 ºC) refrigerator to simulate cold crashing to cause the yeast to fall out of solution. The density of each sample was determined using a densitometer. The data was normalized for evaporation using a control tube that went in the incubator and refrigerator with the other tubes but was not inoculated with any yeast. Each of the test strains were compared to a non-diastatic control English ale yeast. A strain is considered potentially able to over-attenuate when it ferments to three specific gravity points below the standard. The results from this test are shown in Chart 4, below.

Chart 4: Over-Attenuation Assay Test

Name	Style	Over-Attenuation Assay
Strain 1	Belgian Saison 1	Yes
Strain 2	Belgian Saison 2	No
Strain 3	High Gravity Ale	Yes
Strain 4	Belgian Strong	No
Strain 5	Belgian Ale	No
Strain 6	Belgian Golden Ale	No
Strain 7	French Saison	Yes
Strain 8	Weizen	No
Strain 9	Wild	No

BIOFILMS

When microorganisms find a suitable environment, with a comfortable temperature and consistent access to nutrients, they can establish communities called biofilms on surfaces. They produce a matrix for better adhesion and to facilitate the transfer of signaling molecules between cells. This microbial "slime" acts as a pseudo-organism with cells at different layers taking on different roles. Channels are formed to distribute nutrients deep into the biofilm and release waste products. Cells can detach from the biofilm and colonize new surfaces. These structures tend to form in areas with liquid flow and high nutrient levels. The biofilm allows the microbes to flourish off the nutrients while providing protection against the shear of the flow. Microbes in biofilms are more resistant to biocidal treatments. The matrix offers a physical barrier. Another major concern over biofilms is the presence of "persister" cells. These cells are in a dormant state and play a major role in the capacity of biofilms to survive and recover from disturbances.

There is evidence that in addition to spore-forming, diastatic yeast are better able to form biofilms. Cleaning protocols must be stringent to discourage biofilm formation and clear off any that starts to form. Equipment in a brewery makes the perfect environment for biofilms. Sweet wort and carbohydrate-loaded beer flows quickly through hundreds or thousands of feet of tubing and plumbing in an average-size brewery. Stainless steel is particularly vulnerable to befouling. Any scratches in a pipe or your fermenting bucket, or bad welds, extruded gaskets, and non-sanitary valves, fittings, or pumps could provide a community of microbes a hiding place from your cleaning procedure.

UK standards recommend the application of a caustic agent for 30 minutes to clean lines that are regularly cleaned and not heavily contaminated. In laboratory testing, thick biofilms required longer applications of 60 minutes with fresh cleaner passed through every ten minutes. Scientists are working to develop better biofilm removal agents, such as enzymes designed to degrade the matrix before cleaning. The best ways to manage biofilm growth are to take apart equipment regularly, use hot water and caustic

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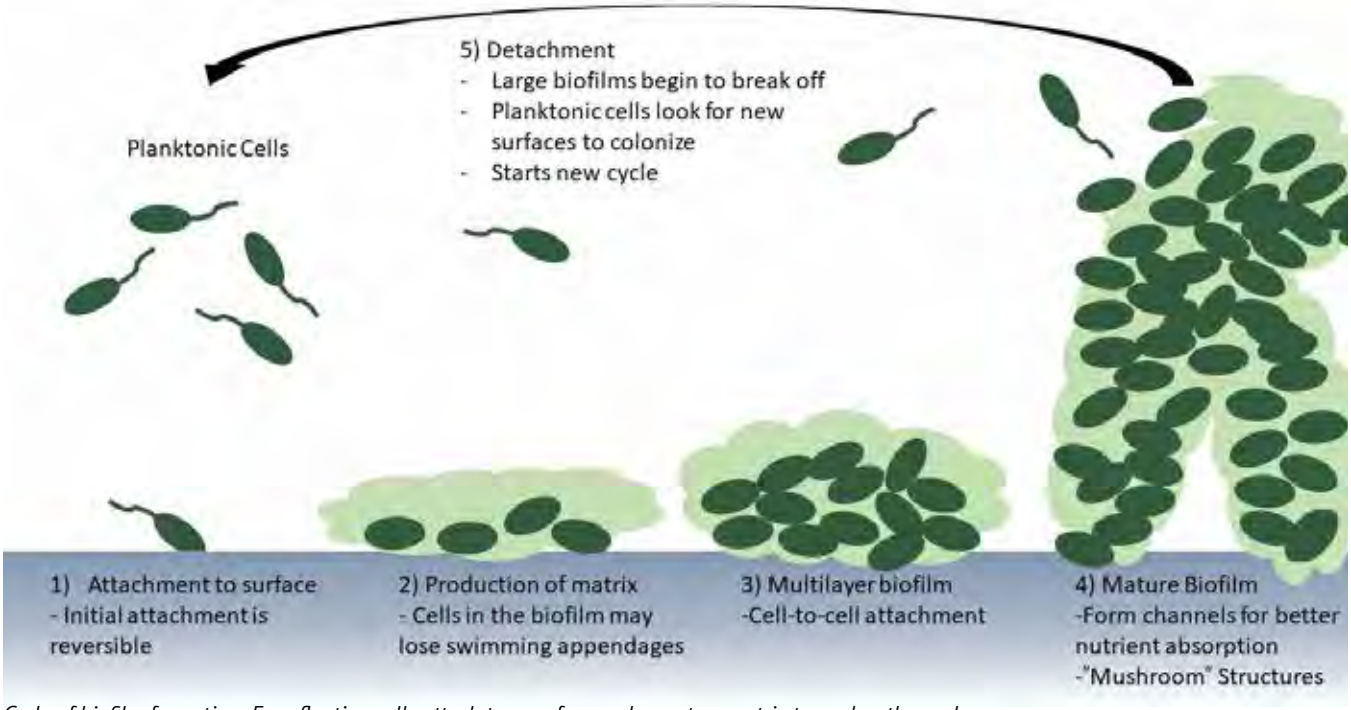

Cycle of biofilm formation: Free-floating cells attach to a surface and excrete a matrix to anchor themselves.

cleaners, and replace damaged and worn equipment.

DISCUSSION

Not all of the strains that tested positive for the STA1 or grew on the selective media actually over-attenuated in finished beer. This could be due to the over-attenuation assay used, which attempts to approximate what happens in a packaged beer. The test for STA1 does not account for the understudied STA2 and STA3 genes. It is not clear how they affect the diastatic ability of the yeast, but this is an area that should be studied further.

Homebrewers should take reasonable precautions to avoid unwanted attenuation by diastatic yeast. Good cleaning and sanitization practices will greatly reduce the risk of any contamination event. Mature biofilms can be visible to the naked eye. Check equipment that is kept in a wet environment for a slimy residue. Take apart equipment regularly to thoroughly clean and allow to completely dry. Watch for unusual characteristics that are not to style if cross-contamination was possible. It is important to keep track of your gravity readings and know where you should be with your chosen yeast. Homebrewers do not need to invest in a laboratory with the capabilities to identify the contaminant species. You probably have already brewed with a diastatic strain and haven't had any problems, but it is something to keep in mind if beers are not turning out as planned.

In the commercial brewing world, in facilities where *diastaticus* is a concern, we recommend a two-pronged approach to assessing potential contamination. Looking at the genotype is important, and a good place to start. Invisible Sentinel makes this relatively easy and larger breweries should make room in their lab budget for this technology. The selective media is an easy and cheap way to monitor the starch metabolizing phenotype. A good QC program rests on consistent monitoring. Raw ingredients (including yeast) should be tested as well as vessels on the cold side of the brewing process. A European study found that of 52 confirmed events, 48 originated in-house. Of those, 70% were traced back to the bottling/canning lines. This area of the brewery should receive additional cleaning after processing a beer fermented with diastatic yeast and should be closely monitored. BYO

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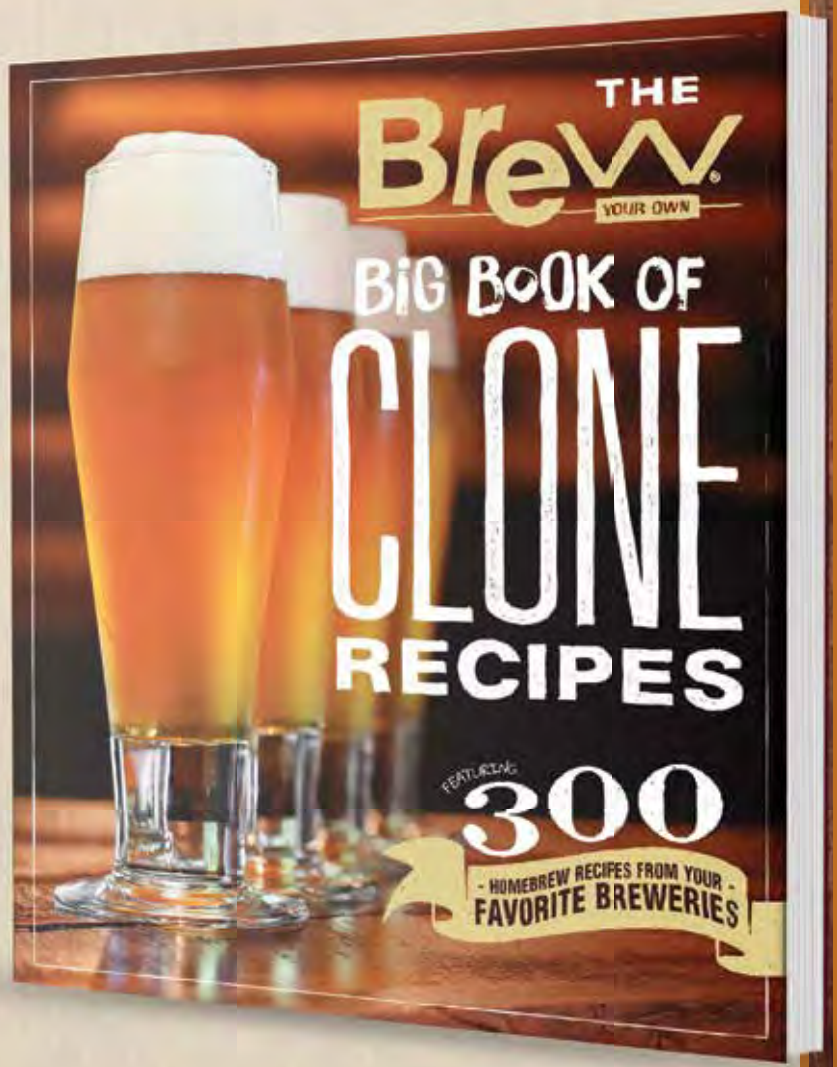

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RECIPE FORMULATION ESSENTIALS – ***with Brad Smith*** – Learn the best ways to jump into creating your own signature recipes and understand the keys to developing a specific grain bill, hop schedule, and ingredient proportions to meet your homebrewing goals. Brad Smith, owner of Beersmith software and a *Brew Your Own* Contributing Writer, has helped thousands of homebrewers design their own beer recipes and now you'll learn first-hand from this recipe building expert how to use both artistic and scientific approaches to beer design to end up with the beer you had envisioned in your glass. You'll explore ingredients, techniques, and even your own brewing system during this practical boot camp that will get you on the right path to craft your own recipes for better beers at home. Please note Brad will also be offering an advanced recipe design workshop on Saturday as well.

CIDERMAKING – ***with Jason Phelps*** – Join professional Cidermaker Jason Phelps to learn all the steps you need to know to successfully craft your own hard cider, both still and carbonated, at home. Jason has taught many hobbyists about making hard cider in addition to making it himself at his New Hampshire Cidery every day. He'll have you roll up your sleeves and take you through the process of crushing, pressing, fermenting, all the way to bottling. You'll learn how to choose apples and get to know cidermaking equipment and the tests you need to run on your cider.

ADVANCED ALL-GRAIN TECHNIQUES – ***with Gordon Strong*** – Pull out the mash tun and get ready to learn advanced all-grain techniques hands-on with *Brew Your Own* "Style Profile" Columnist, book author, and President of the Beer Judge Certification Program, Gordon Strong. Gordon will walk you through a world beyond straight infusion mashing with keys to mastering step mashing, sour mashing, and decoction mashing. Plus you'll learn about playing with mash thickness and other ways to control your all-grain wort production. Please note this workshop will also be offered on Saturday as well.

ADVANCED YEAST TECHNIQUES – ***with Dr. Chris White*** – Join Dr. Chris White of White Labs as he discusses how to master different yeast-related techniques including harvesting yeast, figuring cell counts, the dos and don'ts of repitching including steps such as yeast washing, building up a proper yeast starter, storing your yeast samples, and much more. Here's your chance in a full-day seminar format to learn about getting the most from your yeast from one of the true leaders in the beer yeast field.

ADVANCED HOMEBREW HOPPING TECHNIQUES – ***with Dave Green*** – Join *Brew Your Own*'s Dave Green as he explores when and how to add hops to create awesome hop-forward brews. You'll explore the basics of hop biology (and why it matters to us!); techniques and timing of hop usage including mash hopping, boil hopping, whirlpool/knockout hop stand additions, and dry hopping; hop varietal choice strategies including hop pairing/blending; evaluating hops including hands-on hop rubbing and sensory training; and practical usage techniques including hop extracts, boil-hops "management" (bags, filters, free addition), and water adjustments for hoppy beers. By the end of the full day Dave will make sure you are making informed hops decisions and getting the most out of your hops – and into your glass!

FRIDAY, MARCH 27, 2020
BONUS BOOT CAMP SEMINARS
9:15 A.M. TO 5 P.M.

We are adding a third bonus day to our normal event schedule based on feedback we've received from past attendees who wished they had a chance to learn from all our assembled speakers beyond their Boot Camp workshops. So for 2020, we've scheduled a full day of seven different seminars led by our cast of brewing all stars who will share their knowledge with you on their area of expertise. It will be a full day packed with great tips and techniques from the best in the industry so get ready to learn. Plus you'll have even more time to check out the latest homebrew gear and ingredients with our Boot Camp sponsors located right in the meeting area.

9:15 A.M. – 10 A.M.
Brad Smith on Recipe Design

10:15 A.M. - 11 A.M.
Dr. Chris White on Yeast Propagation for Homebrewers

11:15 A.M. – NOON
Ashton Lewis on Avoiding Brewing's 5 Biggest Mistakes

NOON TO 1 P.M.
Lunch

1:15 P.M. – 2 P.M.
Gordon Strong on Evaluating Homebrew Like a Beer Judge

2:15 P.M. – 3 P.M.
John Blichmann on Layout Designs for Homebreweries

3:15 P.M. – 4 P.M.
John Palmer on Brewing Water Demystified

4:15 P.M. – 5 P.M.
Kara Taylor on Yeast and Fermentation Myths Busted

TURNING PRO & COMMERCIAL BREWERY START-UP: THREE-DAY BOOT CAMP

– with Steve Parkes – By popular demand, we're expanding our past two-day Brewery Start-Up Boot Camp to three full days to better cover more material in more depth for you. When you register for this class you will attend it for Thursday, Friday, and Saturday unlike our other offerings.

Opening up a commercial brewery is a far cry from just ramping up the amount of beer you brew. Steve Parkes, who has trained hundreds of pro brewers as lead instructor and owner of the American Brewers Guild, will walk you through the steps, planning decisions, and keys you need to know if you want to open a successful commercial craft brewery. Learn from his decades of expertise and wide range of experience to help you better achieve your goals of turning pro. Over three full days Steve will guide you in depth through all the various elements you'll have to know for the next big step toward starting a craft brewery.

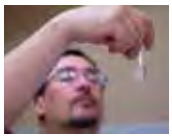
SATURDAY, MARCH 28, 2020 DENVER BOOT CAMPS

Each Boot Camp will run from 9:30 a.m. to 5 p.m. and is limited to just 35 people. Your Boot Camp will include lunch as well as a post-Boot Camp Colorado Beer Reception with local craft breweries pouring samples to wrap up your full day.

ADVANCED RECIPE FORMULATION – ***with Brad Smith*** – Take your recipe creations to the next level by dialing in the specific grain bill, hop schedule, ingredient proportions, and water treatments to meet your brewing goals. Brad Smith, owner of Beersmith software and a *Brew Your Own* Contributing Writer, has helped thousands of homebrewers design their own beer recipes and now he's ready to get in-depth on the details of beer design so you end up with the beer you had envisioned in your glass. You'll explore ingredients, techniques, and understanding your own brewing system during this boot camp designed for advanced homebrewers that will help you craft your own recipes for better beers. This workshop can be taken in combination with Brad's Recipe Formulation Essentials class on Thursday that offers more of an introduction to intermediate and beginning brewers to the concepts of writing your own recipes.

ADVANCED YEAST LAB – ***with Kara Taylor*** – Join White Labs' Laboratory Operations Manager Kara Taylor for some hands-on yeast lab work to develop skills you can bring back home to help you make better beer. Learn how to accurately count yeast using a microscope, culturing yeast, using slants, harvesting yeast, washing and reusing yeast, propagation and determining growth rates, and more. Here's your chance to learn hands-on what you may have read in books and magazines, or listened to in seminars, and Kara's the perfect teacher to lead you through the world of yeast using lab equipment you can source for your home use.

HANDS-ON HOMEBREW SCIENCE – ***with Ashton Lewis*** – Get hands-on with pH meters, slants and loops, stir plates, centrifuges, and other brewing science gear with *BYO* Technical Editor and Mr. Wizard Columnist Ashton Lewis. Ashton will walk you through how to best use scientific gear at home to help you improve the quality of your beer. You will have the chance to understand not only how to use and care for the equipment properly, but also how to take the results and put that data into action to produce better beer in your glass. This workshop will focus only on those pieces of equipment suitable – and affordable – for your homebrewery.



BREWING WATER ADJUSTMENTS – ***with John Palmer*** – Water is the least understood ingredient when making great beer. John Palmer, who literally wrote the definitive book on the subject, *Water: A Comprehensive Guide for Brewers*, will help take the mystery out of water's role in brewing and how to make better beer as a result. You'll learn how to read water reports, understand flavor contributions, and how to adjust your brewing water to make different styles of beer. You'll leave with not only an understanding of the chemistry concepts of brewing water, but also the practical how-to aspects of getting the most from from this critical brewing ingredient.

MEADMAKING – ***with Jason Phelps*** – Interest in mead is on the rise throughout North America. Now you can learn all the steps you need to successfully craft your own homemade meads. Join professional Meadmaker Jason Phelps as he takes you through the keys to making a great mead at home including key techniques, yeast selection, fermentation strategies, and more. Learn how to select and work with different honey varieties as well as best practices for adding ingredients such as fruits and spices to your mead.

ADVANCED ALL-GRAIN TECHNIQUES – ***with Gordon Strong*** – Pull out the mash tun and get ready to learn advanced all-grain techniques hands-on with *Brew Your Own* "Style Profile" Columnist, book author, and President of the Beer Judge Certification Program, Gordon Strong. Gordon will walk you through a world beyond straight infusion mashing with keys to mastering step mashing, sour mashing, and decoction mashing. Plus you'll learn about playing with mash thickness and other ways to control your all-grain wort production. Note: This Saturday workshop is a repeat of the Thursday class and is offered twice due to its popularity.

HOME CHEESEMAKING – ***with Pamela Zorn*** – You make your own beer so now it's time to learn how to make your own cheese to pair with it! Pamela Zorn has been teaching people how to make their own cheese for years from her Colorado cheesemaking retail shop. You'll learn hands-on how to craft soft cheeses as well as be introduced to the world of making your own hard cheese plus understand the keys to making great cheese from a variety of different kinds of milk. Get ready to roll up your sleeves with this full-day introduction to the fun world of home cheesemaking – a perfect fit with your homebrewing!

SUNDAY, MARCH 29, 2020

INSIDER TOUR OF DENVER-AREA CRAFT BREWERIES

You'll tour – and taste – at four different craft breweries in the Denver area during this post-event extra offering. You'll have the opportunity to meet brewers and ask questions in addition to sampling their beers. Includes a beer-pairing meal. A great way to wrap up your BYO Boot Camp experience and check out some of Denver's thriving craft beer scene.

Three-Day and Two-Day Registration Options Available.
Full Event Details Available at: BYOBootCamp.com

BY DREW BEECHUM & DENNY CONN

TRIANGLE TESTING

Trying to find the significance

In our last few columns we've talked about how to think about developing recipes and how to tweak the recipes you've developed to make them exactly the beer you want to drink. But what if you just can't decide if those tweaks are working for you? Is one version of a recipe more pleasing to your tastes than another? Or does that tweak you made really make a difference at all? That's what we're diving into this time around.

Sometimes when you make changes to a recipe the results are so obvious that you simply need to decide if you like it or not. That's called hedonic testing. Do you like it or don't you? To a great many people, homebrewers are already hedonists, so yes, you know how to do that.

And for the record — no matter what else happens with all the other forms of testing that you do — it's always going to finally come down to a sense of enjoyment. Do I enjoy the beer more? Do I enjoy the process more? You're not trying to make a more stable, more universally loved beer or shave pennies and seconds off your brew day for improved profit margins. You're trying to make beer you enjoy.

Remember, we've discussed multiple ways to tweak a recipe in the November 2019 issue's column, aptly named "Tweaking Out." For example, turning an APA into an American brown by adding some sort of dark malt — it's going to be pretty apparent if it's darker or not! Other times, though, it's not so apparent. Subbing one hop or malt variety for another, changing mash time or temperature, or making any kind of subtle change requires comparison between the before and after beers. And since confirmation bias is so unavoidable, the only way to know for sure if your tweak worked is to do a difference test. While there are several different types of discrimination tests, for our purposes, the triangle test has proven to be the perfect fit. A basic triangle test is simple to perform, provides solid results, and they're fun — well at least for the pourer.

WHAT ARE THESE TRIANGLE TESTS?

A chemist at Guinness Brewery named William Sealy Gosset, who went by the pen name "Student," coined the Student's t-test to statistically test a hypothesis. His data analysis makes it possible to use a very small data pool — like a small group of tasters — to tease out potentially statistically significant findings. Gosset developed the t-test to monitor the quality of the stout Guinness makes. Initially Guinness and Gosset were focused on changing barley varieties. Could tasters tell a difference in their stout if they used a new barley variety (maybe it was cheaper, maybe it was hardier, more/less protein/starch). All of these are very important concerns when you're running a huge multinational corporation producing a much-loved product. Since its inception, there have been several variations of the blind tasting test developed, but for our use we'll keep it simple and use the triangle sensory test.

Have someone pour you two samples of one beer and one of the other. You should have 3 glasses each alike in shape and clarity (opaque is best for most purposes). Have the pourer mark them in such a way that they can tell which is which. Avoid "ABC" or "123" — easy sequences like that with a natural order have been shown to influence results. See if you can pick out the one that's different. If you can, the tweak you made had a large enough impact on

We highly recommend doing triangle tests as a club activity. Get people working those tastebuds!

Drawing three geometric shapes helps distinguish to the pourer what beer is in the cup and makes for a non-suggestive reference for triangle tests.

your beer for you to tell the difference. It's up to you to decide, though, if the difference it made is what you wanted the beer to be! Be sure to do the test more than once so you can be sure your choice wasn't a fluke. Sorry, but that means you'll have to drink more beer. Yeah, a shame …

Heck, you can even be stranger and get your friends involved. We highly recommend doing triangle tests as a club activity. Get people working those taste buds! It's an interesting educational experience and one that can reinforce how tricky human perceptions are. Not to mention that the more tasters, the more test iterations you have — the more meaningful your conclusions can be made. Truthfully, this is also the best way for the test to be done. Why? Assuming you don't tell them — these other tasters won't know what you've tweaked. The human brain is such a powerful pattern detection system that armed with a little bit of knowledge — "I changed my dry hop schedule from 10 days to 7 days" — it will start trying to tease out any little sensation and highlight it as the crucial piece of evidence. In other words, you can trust the choice of the unknowing more than you can your own.

> **"When you know the tweaks you've made and the desired results, it's pretty difficult to gauge the tweaks objectively."**

The game remains the same. Create two versions of your beer — tweaked and untweaked. Make sure you keep the beers as similar as possible, including little things like carbonation levels! Pick up some cheap opaque plastic cups. Mark them with symbols like circle, square, triangle. Randomly choose one of the symbols to be the odd beer out. You can use a die to help here. Roll the die — a 1 or 2 means circle, 3 or 4 means square, 5 or 6 means triangle. Then choose whether the tweaked beer or untweaked beer is the odd beer. This may be dictated by circumstances like available beer volume or just use the dice again to pick the beer served only once (odd numbers — tweaked, even — untweaked). Pour a flight of these for your club and present three cups to each member.

Give them no instructions beyond: "Please taste these samples. Please tell me if you can detect which one is different and if so, indicate which one. No talking amongst your fellow tasters."

Stand back and watch the mayhem. It's fun!

Why? Because people will struggle with the tasting and non-serious struggle is kind of funny. They'll be perplexed and outthink themselves. They'll be so rock solid certain of their choice that even when told the "correct" result, they'll insist they noticed something.

Drew's done this test multiple times with a simple setup that every homebrewer claims should be no sweat — can you tell the difference reliably between Budweiser and Bud Light? Surprisingly, despite their confidence, blind tasters have a hard time telling the difference. For a more educational, as opposed to cruel approach, homebrew clubs and judges can purchase off-flavor testing kits and run triangle tests with each off flavor — help your tasters learn what they can't taste!

When doing a triangle test, please remember to be encouraging. The point of the test is that you're likely to fail if the difference is slight. The whole reason the test works is because by making three choices, we drop the chances of a taster being randomly right from 50% to 33%. That 17% is

A significance chart — in this chart, and for many experiments, we use the common p-value (probability value) threshold for significance at 0.05. Anything above that and the test is considered inconclusive (red zone). At that level or below, the findings would be considered significant (green zone).

# Correct	**5 tasters** *p-value*	*% correct*	**10 tasters** *p-value*	*% correct*	**15 tasters** *p-value*	*% correct*
1	0.868	20%	0.983	10%	0.998	7%
2	0.539	40%	0.088	20%	0.981	13%
3	0.210	60%	0.701	30%	0.921	20%
4	0.046	80%	0.441	40%	0.791	27%
5	0.004	100%	0.213	50%	0.596	33%
6			0.077	60%	0.382	40%
7			0.020	70%	0.203	47%
8			0.003	80%	0.088	53%
9			0.000	90%	0.031	60%
10			0.000	100%	0.009	67%
11					0.002	73%
12					0.000	80%
13					0.000	87%
14					0.000	93%
15					0.000	100%

where we derive its significance.

But how do we tell if our findings from our triangle test have any significance? Well for that we refer you back our very first column in May-June 2019 titled "A Bitter Challenge," where we introduced the p-value (you can find the chart on page 96). It's a magical and very misunderstood tool and it all comes down to that silly name, "p-value." Everyone gets it confused and thinks it means "probability" — i.e. "how likely is it that we're right?" But what it really means is how confident you are that your results are more significant than chance would be. In a truly scientific world, it's a way of saying that you've found interesting results and that more testing is needed. There is an outstanding PBS *Nova* episode called "Prediction by the Numbers" that illustrates how statistics work. It's available on several streaming services and we definitely recommend the program to those who would like to dive deeper.

Unfortunately, in the homebrew world, too may homebrewers take a low (significant) p-value to mean a conclusion has been reached. Nothing could be further from the truth! A significant p-value simply means that the idea is worthy of further testing, not that a conclusion has been reached. A low p-value has just shown that the null hypothesis (that there is insignificant difference between the beers) is less likely. In the world of academics, the weight of the p-value is being hotly debated. Expect a lot of ripples to flow through the scientific community.

Science is dependent on repetition. A single trial doesn't prove or disprove anything. An experiment needs to be published along with the methodology and results, so it can be repeated by other researchers. That's where you come in. When you need to make a tweak to your beer, it's useful to look at the experiments that have been done by other homebrewers. Then try what they found and see how it works for you. It might, or it might not . . . that's how science works! Be sure to realize that if you don't duplicate their methods exactly, you might have different results. But no matter what happens, you'll learn something!

To bring it full circle — beyond all the complicated stuff, distant to the groups of tasters, remote from the math — at the heart of all this you're trying to figure out, "did this matter? Did it make the beer better for me?" We're rarely looking for grand and gaudy truths. We are but simple brewers trying to make our beer better for us. But use your friends, your partner, your kids — get them to help you get out of your own head and figure out if the things you're doing really do work. You've been given a powerful tool — let's make some beer with it!

THE BASIC GUIDE TO TRIANGLE TESTING

What You Need:

- 2 beers, treated the same except the variable tweaked
- 3 opaque sample cups, either different colors or marked with a symbol
- 1 die

Step-by-step for making a proper objective analysis:

1. Choose which cup will be the "different" cup by rolling a die. (A result of 1 or 2 means the first cup, 3 or 4 – the second, 5 or 6 – the third.) Repeat the process to choose which beer will go in that cup. (Even number on the die means the "normal" beer. Odd number means the tweaked beer.)
2. Carefully pour the chosen beer in the chosen cup. Fill the other two cups with the remaining beer.
3. Present the beers to your tasters, ideally in a nice quiet space. Ask them to taste the samples and see if they can tell which beer is different. Record their choice.

TRIANGLE TESTING IN ACTION

Like we mentioned in last month's column on tweaking a recipe, when Denny is developing a new recipe he likes to brew multiple test versions and compare them until he gets the beer he wants. Triangle testing is vital to assessing the results. When you know the tweaks you've made and the desired results, it's pretty difficult to gauge the tweaks objectively.

Denny has been working on a recipe for an American mild ale for several years. The objective was to make a beer

DENNY'S AMERICAN MILD (FINAL VERSION, #8)

(5 gallons/19 L, all-grain)
OG = 1.041 FG = 1.012
IBU = 20 SRM = 13 ABV = 3.8%

INGREDIENTS

4 lbs. (1.8 kg) Mecca Grade Estate Malts Lamonta malt (3 °L)
4 lbs. (1.8 kg) Mecca Grade Estate Malts Metolius malt (14 °L)
1 lb. (454 g) Briess organic crystal malt (60 °L)
3 AAU American Noble Citra® pellet hops (first wort hop) (1 oz./28 g at 3% alpha acids)
2.2 AAU American Noble Simcoe® pellet hops (60 min.) (1 oz./28 g at 2.2% alpha acids)
1.85 AAU American Noble Mosaic® pellet hops (60 min.) (0.5 oz./14 g at 2.7% alpha acids)
0.88 AAU American Noble Simcoe® pellet hops (1 min.) (0.4 oz./11 g at 2.2% alpha acids)
3 AAU American Noble Citra® pellet hops (1 min.) (1 oz./28 g at 3% alpha acids)
Wyeast 1450 (Denny's Favorite) or White Labs WLP051 (California V Ale) or Mangrove Jack's M36 (Liberty Bell Ale) yeast
½ cup corn sugar (for priming)

STEP BY STEP

Due to the low gravity of this wort, no yeast starter is needed.

On brew day, mash in the crushed malt at 158 °F (70 °C) in 7.5 gallons (28.4 L) of water in a mash tun brew-in-a-bag setup. Hold at this temperature for 60 minutes. Raise mash temperature to 170 °F (77 °C), hold for 5 minutes then recirculate or remove the grain bag. Do not sparge, run-off wort into the kettle if using a separate mash tun. Bring wort to a boil and boil for 60 minutes, adding hops at times indicated.

Chill the wort down to yeast-pitching temperature, aerate, and pitch the yeast. Ferment around 66 °F (19 °C). Condition for one week then package as normal.

with the qualities of a British mild (malt character, low integrated hop flavor, body, 1.035 OG, under 4% alcohol) but with only American ingredients. For some ingredients, it was an easy choice. Wyeast 1450 would be the perfect yeast (why do you think they call it Denny's Favorite?). So it was time to start figuring out what else would go into the beer. The first several batches were made with Great Western malts. Good flavor, but not enough flavor for such a low-gravity beer, and a thin body. His wife referred to the beer as "hop water."

So he began by manipulating the base malts, starting off with adding more Munich. Doing a triangle test against the first batch showed increased flavor, but not enough and not much increase in body and mouthfeel. Then he tried increasing mash temperature from 153 °F (67 °C) to 168 °F (76 °C). There was pretty much no change in attenuation, body, or mouthfeel. In addition, no matter what he did to increase maltiness, the hop character still came through as harsh even though the IBUs were in the mid-20s.

The next tweak was to try malts from a different maltster. Using craft malt was the breakthrough here. Using Lamonta and Metolius malts (Mecca Grade Estate Malt's versions of pale ale and Munich malts — if Mecca Grade Estate Malt isn't available where you live, look around for a local craft malt) made an enormous difference in the amount of flavor in the beer. This was an easy triangle test. It was immediately obvious that there was a difference, which Denny preferred.

The next tweak was to try American Noble Hop™ pellets from Yakima Chief Hops. American Noble Hops™ are made from the bract material left from the cryo hop process. They are very low alpha and have a unique "soft" character to them, kind of like what you get from European noble hops. Tasting this version against the previous version showed that he had achieved the integrated hop flavor and bitterness that he was going for.

He needed a bit more body and sweetness, so he decided to try adding some 60 °L crystal malt. He didn't have any luck finding that from a craft maltster, but Briess makes a nice organic C60. Adding a hefty dose of that did the trick. Triangle tests performed this time revealed the difference was significant and Denny had a clear preference.

Without using the triangle test when he was developing the recipe, Denny would have had to just make a guess if some of these changes had made a difference. Of the eight test batches he brewed, about half of them resulted in beers with so little change that he would have had to flip a coin. But using triangle testing he was able to clearly tell what factors had made a perceptible difference and if the resulting beer was preferred to the previous version.

You may not be crazy enough to brew eight test batches of a recipe like Denny did, but triangle testing can be a valuable tool in your toolbox when you're coming up with a new recipe, tweaking an old one, or even comparing a "clone" of a commercial beer against the real thing. And at the very least, you'll see that tasting beer is a lot harder than drinking beer! BYO

BY COLIN KAMINSKI

SHIFTING WATER

Understanding brewing water additions

When John Palmer and I were writing *Water: A Comprehensive Guide for Brewers*, many brewers had not taken the time to understand the basic chemistry that establishes mash pH. Now, a decade later the concepts presented in the book have become a normal part of the new brewer's education. Recipes are now sometimes written with the water profile included and water calculators are everywhere online.

It is important that a brewer chooses a water strategy that matches their water source. It would be absurd for a brewer in Pilsen to purchase a reverse osmosis (RO) system for their water as their water is already very soft. It would also be absurd for a brewer in Dublin to try to make a Pilsner by simply adding acid to their water to reduce the alkalinity. So that begs the question . . . how do we make a strategy of our own?

The first thing I would highly suggest is to understand the source of your water. When I was a Head Brewer in Napa, California, I got my water from three sources and they were very different from each other. My water usually came from Lake Hennessy Reservoir that had about 100 ppm alkalinity, 5 ppm Ca^{2+} and 20 ppm Mg^{2+}. This would vary significantly seasonally. When there was a lot of rain this profile would be diluted and if there had been a long dry spell it would be concentrated. My water recipes had to adapt. In the beginning I would measure five key ions every brew: Calcium, magnesium, chloride, sulfate, and alkalinity. After a few years I realized that for the English ales I was making, I was always going to add calcium, no matter if the level was 3 ppm or 10 ppm, the baseline calcium level did not play a significant role in this addition. However, the difference between 50 ppm and 120 ppm of alkalinity was a significant factor in my mash pH. For this reservoir, measuring the alkalinity was sufficient for me to understand where the water chemistry was at that time and allow me to adjust my additions. This was a concept that took me years to fully embrace.

In the winter that reservoir often proved problematic for the water department. Sometimes there was not enough water, or at times there would be an algae bloom that required significant additions of copper to the reservoir, or the water required significant additions of chlorine. During those times of duress, they would switch to a different water supply, the North Bay Viaduct. Their first choice was to bring water in from the Sacramento Delta. This water inlet was in a slough and the water did not move through it very quickly. Above the inlet was a large depression where cattle grazed. During large rainstorms the depression would become a pond and overflow into the inlet. This would spike the coliform count from the cattle and cause the water department to dramatically increase the chlorine levels in my water. The combination of all the organic material and chlorine made for some strong off flavors, not only in the water, but in the finished beer as well.

This water was the hardest for me to work with as the chlorinated organics had flavor thresholds in the ppb range. My strategy for this water was slow passes through fresh carbon filters. Once the water was filtered and collected I would taste the water for a final approval. There were quite a few occasions where I drained the hot liquor tank and started again. There were two occasions in 15 years where I was not able to brew for at least a week. Both times the tap water tasted so bad that Napa residents complained

The first thing I would highly suggest is to understand the source of your water.

Photo courtesy of Shutterstock.com

A reliable pH meter opens a world of discovery for brewers with the ability to track acid levels from the mash right through to the finished product, just like sugar levels are followed via hydrometer.

and the water department would switch to their last option, which was also my preferred water source.

This last choice water for the local water department was a nearly perfect water source, the Milliken Reservoir. Very low in minerals and very low in organics. It was their most expensive choice so we only got it a few weeks a year. When they would switch I would borrow a lager yeast from another brewery and make a Pilsner style beer as it was the only way I could get suitable water without an RO unit, something that was out of my budget.

As you can see, my water was never consistent and as the brewer I was required to adapt to my incoming water. This is not at all uncommon. Learning about the sources of your water and how they change seasonally is an important step to gaining control over your water chemistry and making a recipe consistently.

Even if we had a perfectly consistent water source, different beers require different water profiles. It is not hard to make a new water recipe but it does take some time and experimentation. If we are producing a classic style then it will help us to look at the traditional water from the region. This is not the last word in the water as many brewers are changing the water to fit their style, not the traditional style. I didn't realize this in the beginning and one day I was adding a bunch of gypsum to a kettle when a customer walked by and asked what I was doing. I explained that I was making my IPA and that IPAs came from Burton upon Trent and they had a lot of sulfate in their water. He smiled and said, "I am a brewer in Burton upon Trent and we hate our water." That got me thinking and I started researching how different regions pretreated their water for their local styles. I found that many classic regions also had traditional as well as modern water treatment methods in place.

Also, I was producing very California-esque renditions of English styles and was not married to hitting the British waters. I needed a way to develop water recipes that worked for our brands. I was unable to find anything written about this so I started from scratch. First, I knew I wanted to hit my target mash pH. The literature taught me that mash pH effected the efficiency of the mash. If I maximized the efficiency I would save some money on malt. I looked into the numbers and realized that since I was only producing 750 BBLs per year the money was not worth chasing.

In talking with brewers I was hearing that the boil pH was changing the hop characteristics. One famous brewer taught me that raising the boil pH allowed them to lower the amount of hops they used in the bittering addition. This also was not a financial motive for me but it opened the door to understanding how the pH affected the bitter quality of the beer. I couldn't stop beer production while I learned all of these things so I had lots of batches and good notes to consider while coming up with a strategy.

Of course I had a few mistakes along the way that also gave me good data points. One thing that was clear was when the boil pH got too high (we can use 5.6 as the extreme) the bitterness became harsh. When the boil pH got too low (we can use 5.0 as the other extreme) the beer was "lifeless." I produced beers of all colors and all hop levels so it took some time to sort out a strategy. I finally ended up liking light hoppy beers at a boil pH (measured in a 68 °F/20 °C sample) of 5.4. If I did my homework that morning on the water in the hot liquor tank, no adjustments would be needed at the beginning of the boil, just the hot liquor tank. If I consistently had my West Coast-style IPA at 5.4, as an example, I could adjust the hopping to get the flavors I was happy with. Does that mean it's the only strategy for making an IPA? Absolutely not. If I wanted different bitterness qualities I could have added a larger 60-minute addition at a pH of 5.2 and kept the same perceived bitterness with a different quality.

> **"If you change your grist-to-water ratio, you are changing the weight of the ions added and the dilution rate of the ions derived from the mash."**

This is a good place to mention that when and how you measure your kettle pH must be consistent. I picked the moment the kettle was full and before boil and then chilled my sample. This kettle temperature (180 °F/82 °C) and time was always the same because of the process control I had in place. The reason this is necessary is the calcium and magnesium will continue to bind with phosphates in the boil and settle, effectively lowering the kettle pH. The degree of this change depends on the minerals available at this stage of the brewing and the limiting factor is usually calcium. Some brewers will add minerals at this point to provide more calcium. This has the effect of lowering the kettle pH during boil and provides more calcium for the fermentation. It also very likely lowers the oxalate level in the fermenter but beerstone control is beyond the scope of this discussion.

Once I had a target pH, hitting it was simply a matter of doing the traditional residual alkalinity (R_a) math:

R_a = (alkalinity in ppm x 61) - (Ca in ppm x 20 / 3.5) - (Mg in ppm x 12.1 / 7)

And keeping that value constant with my varying water supply, assuming my grist-to-water ratio remained unchanged. If you change your grist-to-water ratio you are changing the weight of the ions added and the dilution rate of the ions derived from the mash. Remember, adding more calcium or magnesium will lower mash pH and adding more alkalinity will raise mash pH.

The other thing that was clear from these experiments was that chloride and sulfate were making it into the fin-

Photo courtesy of StickerGiant

Brewers who have started to focus on their water know that a reverse osmosis (RO) system can be a game changer when it comes to water treatments.

ished beer and had a significant flavor component. To a limited extent they counteracted each other. So, if I needed more or less calcium and magnesium to hit my mash pH with the water collected that day I could adjust my salt additions as long as I kept the sulfate-to-chloride ratio the same. Some people have tried to take this to the extreme, and try to infer that 500 ppm sulfate to 50 ppm chloride is going to taste the same as 50 ppm sulfate to 5 ppm chloride. This is not at all what I mean. What I am saying is if you need 20% more calcium to hit your pH then you are best getting it from a blend of salts that matches the sulfate-to-chloride ratio if you want the flavor to stay consistent. This ratio is a useful tool . . . with limits.

This begs the question of what sulfate-to-chloride ratio do we want in a beer? Of course the answer is, it depends on what your goal for the beer. This is a great way for a brewer to show his mastery of their ingredients. When I am formulating a new recipe, I brew it to my best guess, making sure the pHs hit my targets along the way and then I make up some spiking solutions. I take a teaspoon of gypsum and mix it into a pint of water and I take a teaspoon of calcium chloride and mix it into a pint. (You will quickly notice how hard it is to dissolve the gypsum by comparison.) By adding a drop of one of the solutions you will find which direction you would like to shift the recipe. At some point you end up with a salty mess and have to start with a fresh pint. It would be easy to do the math of how much sulfate and chloride we are adding but this does not help us formulate the next recipe as the brewing process will cloud the exact contributions. It does, however, give is an idea for where to shift the recipe.

I found that adding gypsum made the beers crisp and bright. Adding calcium chloride made the beers full and round. Interestingly, a significant amount of magnesium also survives into the glass and I found it also had a strong flavor component. For me adding magnesium gave dark malts a fuller, more complex flavor. Using Epsom salt as a spike can also be enlightening, especially in Kölsch and dark beers.

Many brewers save understanding water for last. I strongly suggest you do not delay in learning this important ingredient in beer. BYO

BY DAVE GREEN

THE BARREL CRADLE

Keep your barrels from rolling

For those of you who have caught the oak-barrel love (or just about any barrel type for that matter), you know that once in . . . you're hooked. There really is nothing that compares to inviting a small group of friends over and pulling samples from the barrel for a tasting. Does it need more time? Should I chop up a vanilla bean and toss it in? Are the Bourbon flavors melding? The complexities found from wood-aging beer, thanks especially from the microoxidation that occurs through the staves, can be a thing of beauty when handled with finesse. I love brewing darker beers like browns, porters, and stouts for aging in more freshly purchased Bourbon barrels. I keep two 10-gallon (38-L) barrels in my house, one for the funk-da-fied beers (the older barrel) and one for clean beers (the newer barrel).

But the reality of my house is that it doesn't have unlimited space and enough of it is already taken up by my bar and draft system, grain storage, and brewing equipment (not to mention maybe ⅓ of my garage). This means I don't have a dedicated place for my barrels, so I have to shuffle barrels around my basement to get to things located behind the barrels fairly regularly. Also, I keep the barrels in separate locations in my basement to prevent cross-contamination from wild organisms in the funky barrel. This means one barrel needs to be moved through two rooms when it is filled or when needing to be racked. Long story short . . . moving my barrels is a fairly regular occurrence. Add in the fact that I don't have a peristaltic pump for racking, which means I need to lift my barrels up on top of a stable chair to get gravity to work for me, and it just seemed like I was asking to throw my back out. After years of muscling my full barrels through this system, I knew I had to come up with a better solution.

Doing some quick math, 10 gallons (38 L) of water clocks in at 83.4 lbs. (38 kg). If it's an imperial stout with a terminal gravity that clocks in at 1.034, that's an additional 2.8 lbs. (1.3 kg) of sugar at that volume of beer. I don't have my exact weight of my empty barrels, but that size barrel typically runs in the 40–45 lb. (18–20 kg) range according to an online search. This means I've been hoisting roughly 125–130 lbs. (57–59 kg) from awkward positions many times a year. That needed to change.

So my solution was a two part design: A mobile cradle for each barrel that rides on caster wheels and a hoist system for lifting the barrels for racking. While my hoist system is just one way to skin this cat, any secure hoist system would work. I almost splurged on an electric lift, but figured that might be more headache than it was worth. A basic power puller (or come-along) ratchet hung from the ceiling provided the perfect hoist and can be removed and used for a plethora of other tasks around the house and yard.

The cradles have been very handy. I can easily pull my barrels out of their nook for racking, topping off, or like last night, when my wife needed me to pull the winter clothes from the far back corner of the laundry room. If you are dealing with moving barrels, I highly recommend this project.

This means I've been hoisting roughly 125–130 lbs. (57–59 kg) from awkward positions many times a year. That needed to change.

Photos by Dave Green

Oak barrels are heavy and awkward to move around when full. A barrel cradle built on caster wheels is an easy solution to this problem.

Tools and Materials

- (1) 2-in. x 6-in. x 8-ft. spruce board
- (4) 90-lb. (40-kg) caster wheels
- Hoist system (I used a Maasdam 1-ton Pow'r puller)
- Large diameter screw eye
- Chop saw
- Tape measure
- Wood screws

STEP BY STEP

1. BARREL MEASUREMENTS

I solely work with 10-gallon (38-L) barrels, so if you want to design your own, you may need to adjust the board length and reinforcements in order to fit and support your barrel size and weight, bigger or smaller. I cut the beams to the length of the barrel, then the supports to 2 in. (5 cm) longer on each side than the barrel's maximum girth.

2. CREATE THE BASE

I placed the beams on the bottom and the supports on top and secured them together with several 2.5-in. (6.4 cm) wood screws. I then secured the caster wheels on the bottom. I used two free-rolling casters and two locking casters; this allows me to secure the cradle in place when I don't want them to move.

3. CUT THE WEDGE PIECES

With the remaining 2x6, I first cut it in half, then gave each half a 45° mitre cut creating 4 wedges. With the help of my wife, I centered the barrel on the base and I eyeballed where to cut each of the wedges. I decided to chop the boards down to 2x4 size, so if you have some 2x4 board handy, you may consider using this size instead for the wedges. I used two 3-in. (7.6 cm) screws to secure each wedge to the base. I performed steps 2 and 3 twice, one cradle for each barrel.

4. SECURE YOUR ANCHOR

Next up was to create my hoist. While I was almost tempted to purchase an electric hoist, the reality was that a come-along ratchet device would be much more handy around the house. So I pre-drilled a hole into a secure joist in the basement ceiling and placed a large-diameter eye screw in the hole. The come-along ratchet can then be returned to my garage when not in use.

5. CREATE YOUR HOIST CRADLE

This step is one that I will be improving in the future with a better hoist cradle for the barrels, but for now simply winding the strap from the ratchet three times around the barrel to create a sling-like seat for the barrel has done the trick. But something like a wide-lifting nylon sling would probably be preferential.

6. TEST

This one is a rather easy step but one that I perform with each barrel lift to make sure that the lift cradle is properly secure. With the two caster wheels locked, I lift the barrel just about an inch (2.5 cm) off the base and let it hang for a minute. Once I feel comfortable that the barrel is properly secured, I can then complete the lift up to the chair where I rack the beer into kegs. BYO

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BY STEVE SCHWEITZER

A HOMEBREW RUNS THROUGH IT

The homebrew of fly fishing guides

It's no secret that fishing and beer go together like glitter and glue, hot rods and fuzzy dice, Disney and mice, bacon and um . . . anything. It's easier for the spin fisher to enjoy a beer, but it's tough to hold a beer and fly fish at the same time. So, after a long day on the river, fly fishers make up for this lost time by being one of the unofficially largest support groups of homebrews and craft beer — especially the guides.

Not many know that a guide's day starts at 4 a.m. preparing gear, making lunches, packing drinks, tying the latest hot pattern and cleaning out the rust-is-the-bond-that-keeps-us-together tan 1987 Toyota Pre-Runner. All to be Benjamin-worthy — to get that coveted $100 tip.

At the end of the day we fly fishing guides gather at a secret spot for a brew. The beers have usually been on ice since 4 a.m., since it IS the first thing a guide will pack before anything else. It's usually a homebrew made by himself, which is the second-most braggart thing a guide will discuss amongst his peers, second only to how good of a guide he is. And if he is a salted homebrewer, he would make his own labels to one-up the other guides' boring brown bottles of fermentation. A guide/brewer wants to avoid that stiletto-sharp question "what exactly is in this bottle." And it's worse to say "I don't know . . . some homebrew I made last year." As for me, the labels helped make my homebrew the most identifiable and oft requested by the other guides, and thus making me a legendary guide, even if it is in my own mind.

After that first secret-spot homebrew, the guides will string up a rod, choose one fly and go fish for big-fish bragging rights. Once the fly is lost, the guide is out of the competition. Time limits are usually ignored and there's never a belief the truth is told about the biggest fish caught — it's more like a competition of whose story is the best — not the most believable. All this told whilst picking the banjo or guitar and having another tailgate homebrew. Or if the cooler ran dry, it demands a quick trip to the local craft beer joint in town. It's a given — a great fly fishing town will have a great craft brewery, maybe two or three — it just goes hand-in-hand with where God's fish live. A guide's day ends when the last beer is consumed and they all agree it's time to go home. Because you know, there's another trip to prepare for at 4 a.m. tomorrow morning.

And it's with an ale in-hand at the end of each day, guides gather, tout their own greatness, laugh at the client that fell in the water, and burn the day's events into fabled stories that will be passed around for years, making great fodder for the next beer label (see my label on the left as just one example of many). There is a moral to this story: It just takes a homebrew, a story-enshrined label, and some willing clients to get started as being the best fly fishing guide ever. And best homebrewer.

I ain't the world's best brewer.
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And I ain't the worst one either.
Same can be said for my beer labels.
But I am a derned-good beer tasterer.
Because I am a fly fishing guide. BYO

There is a moral to this story: It just takes a homebrew, a story-enshrined label, and some willing clients to get started as being the best fly fishing guide ever.

Label courtesy of Steve Schweitzer

A label inspired by four traveling Canadian salesmen who wanted to experience a day of fly fishing in the Rocky Mountains. Turns out they were bull semen salesmen (not making this up) and one guy in the group, Bruce, was especially accident prone.

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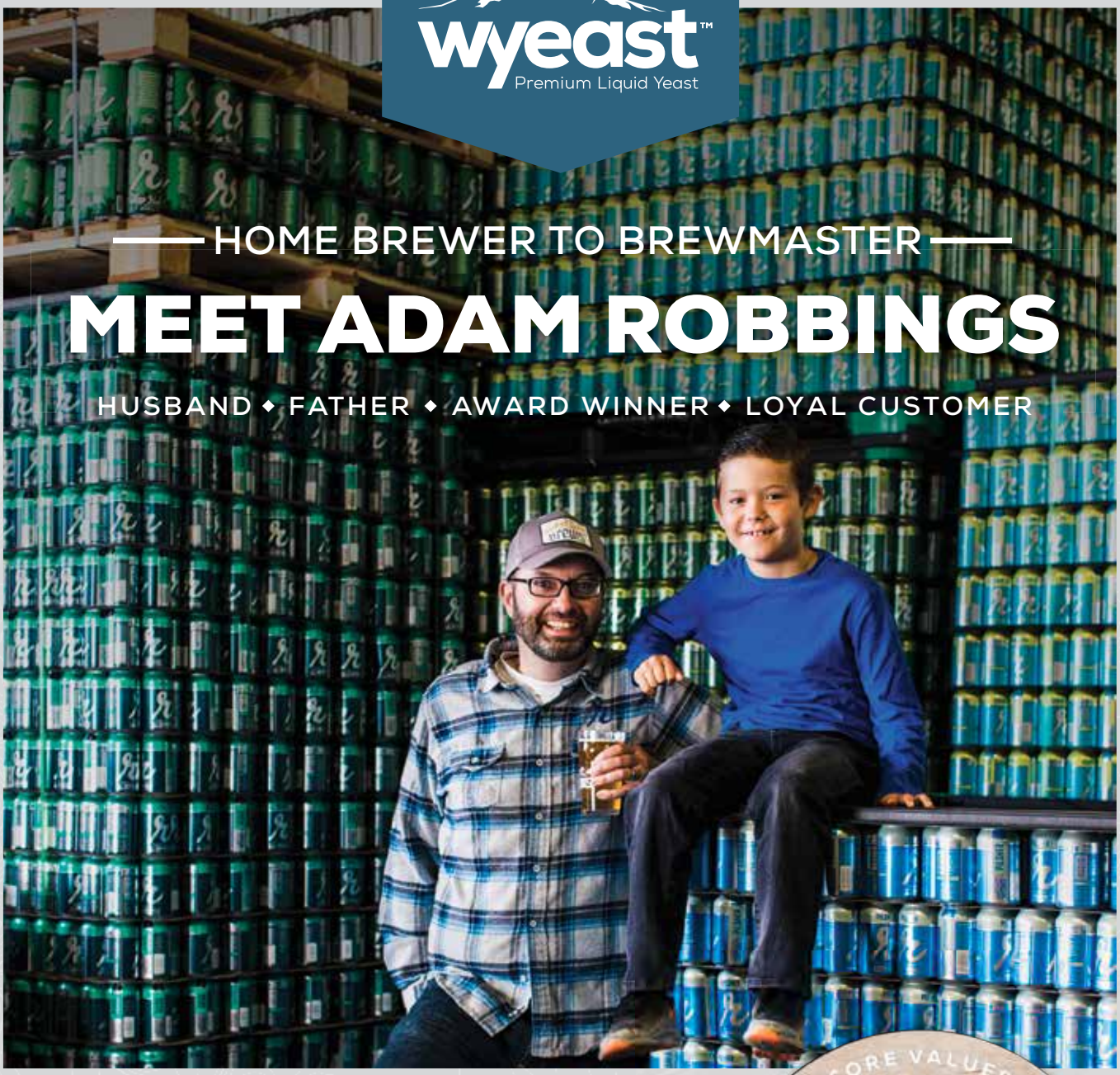

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Not only is Adam a master of his craft, but he has found success without ever losing site of what's important—the same values that serve as the foundation of Wyeast.

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