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MAY-JUNE 2019, VOL.25, NO.3

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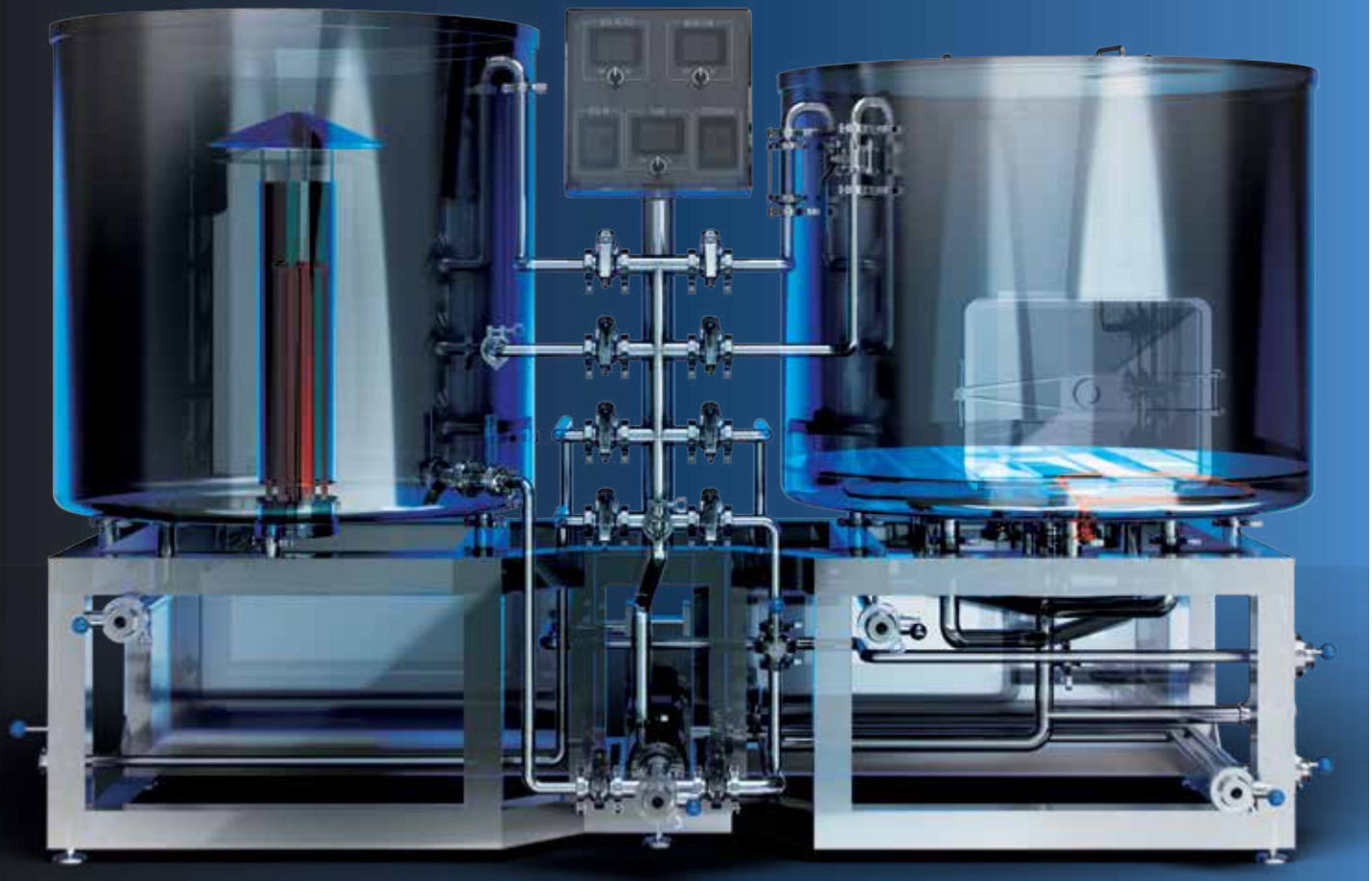

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Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

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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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Cover Photo:
Charles A. Parker/Images Plus

Q What's your favorite Belgian-inspired beer style as a summer sipper and why?

For me summer is the season for saison. I love the thirst-quenching dryness and the wonderful aromas of this beer when the weather finally warms up here in Vermont. Saison is one of my go-to styles I enjoy especially after summertime activities like hiking, biking, or kayaking. With those temperature-tolerant Belgian yeasts it is also a forgiving style to brew in the warmer summer months so I can have a fresh batch in regular rotation ready to pour all summer long.

I love a great saison-styled beer. So my answer would have to be Saison Dupont. While I have never backed a tractor out of the shed to till the fields, I have to imagine if I ever did, that would be the reward for a long day's work. The thought of sitting on a porch enjoying the fruits of my labor would be so much better with that beer in hand.

I've always been a fan of tripels. Although they aren't the lightest brew for the summer, they are delicious, complex, and easy drinking. I'll enjoy them during the daytime sunshine or around a campfire on a cool night!

Volume 25, Number 3: May-June 2019

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Tips for Making Mead

Gluten-free grains are one way for those with gluten sensitivity to still imbibe on their own homemade beverages, but they should not overlook alternatives like mead. For those that may be interested in exploring the world of mead, we offer tips from three professional meadmakers. https://byo.com/article/making-mead-tips-from-the-pros/

MEMBERS ONLY

Smoking and Roasting Malts

While homebrewers have access to several smoked malts, there is nothing quite like trying to smoke your own malts. From experimenting with different wood types to smoking duration, author Terry Foster provides readers with the basics of creating smoked malts at home. https://byo.com/article/techniques-6/

Conquer Chill Haze

Chill haze can be the bane of many brewers existence who are attempting to produce a clear and bright beer such as Pilsner or Kölsch. If this sounds familiar, learn some key concepts and steps you can perform — from recipe design through final packaging — to keep chill haze at bay. https://byo.com/article/conquer-chill-haze/

MEMBERS ONLY

Kegerator Troubleshooting

Having your beer on draught is a thing of beauty when things go according to plan, but when problems with the kegerator arise, it can become a giant headache. Find some troubleshooting guidelines to help keep your beer flowing smoothly every pour. https://byo.com/article/tune-your-taps/

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MAIL

EUKANOT TELL ME WHAT TO DO CLONE

The March-April 2019 issue has the clone recipe for Mirror Twin Brewing's Eukanot Tell Me What To Do. Looks interesting, as I have not used Ekuanot™ hops before. The recipe calls for an 8-oz. (227-g) dry-hop addition. I have never used more than 4 oz. (114 g) in a 5-gallon (19-L) batch. Is this accurate?

Mike Grace • *via e-mail*

BYO *Recipe Editor Dave Green responds: "Hi Mike, It is indeed accurate. Some of the dry hopping rates of the really hopped up commercial beers in this IPA world we live in will amaze you . . . reports of hopping rates upwards to 10 lbs. (2.4 kg) of hops per barrel of beer, which equates to about 27 oz. (765 g) of hops used per 5 gallons (19 L). I would estimate at least half of those would be dry hops, so 8 oz. (227 g) is not even close to reaching the max that brewers are using. With that said, there are a few keys to making this level of hopping work for you and not against you. First is minimizing the contact time between the beer and hops. You want to extract the hop oils but don't want to leave them long enough to extract the majority of polyphenols from that much hops. 2–3 days would be all I would give them. You may even want to consider using one of the new hop products like Cryo® hops for this task (I believe you use 50% of what you would with pellet hops . . . so 4 oz./114 g in this recipe). Commercial brewers often recirculate the beer in the fermenter to shorten that contact time even more.*

"Introducing oxygen (even in tiny amounts) is the other issue that can have detrimental effects on the final beer. So special care needs to be taken when adding this much dry hops. I like to purge an empty keg or fermenter with CO_2, then add the dry hops and let that rest for about half an hour, hit it with a bit more CO_2, then rack the beer into the vessel. Let that rest for 2–3 days (I flip my kegs over once or twice a day to help the hop oils to disperse), then rack beer into the serving keg (or remove the hops if I bagged them)."

ALL-GRAIN CLONE RECIPE FOR KERNEL BREWERY'S TABLE BEER

With much joy and interest I read the clone recipe to The Kernel Brewery's Table Beer (which was a part of the "10 Summer Extract Recipes" story in the July-August 2018 issue, available

contributors

Kristen Kuchar is a Colorado-based freelance writer and editor who covers her greatest loves in life – craft beer, travel, and other craft beverages, such as cider. She is a Cicerone Certified Beer Server, currently working towards her Cicerone and Beer Judge certification. Her byline has appeared in and on *The Beer Connoisseur*, *Beer Advocate*, *Zymurgy*, *VinePair*, *CraftBeer.com*, *MiBREW*, *DRAFT*, *All About Beer*, and dozens more. When she's not writing about beer, you can find her exploring new breweries, hiking in the Rocky Mountains with her sweet cattle dog, traveling any chance she can get with her husband, and working on her soon-to-be launched drink and travel blog, travelinaglass.com.

Beginning on page 44 of this issue, Kristen explores the rising trend of beer cocktails with advice and recipes from breweries that are embracing beer as an ingredient in their mixed drinks.

Karen Fortmann received both her Master's and Doctor of Philosophy in Biochemistry from UC-San Diego. Rather than going the traditional biotechnology route she decided to explore fermentation sciences and in 2014 became the first Postdoctoral Research Scientist at White Labs, Inc. Her postdoctoral studies focused on the various "omics" of fermentation as well as internal applied sciences. In 2016, Karen was hired on as a Senior Research Scientist with White Labs. In this position she is continuing her postdoctoral studies and manages the Cell Biology Lab.

Karen makes her *BYO* writing debut in this issue sharing ways to conduct yeast trails at home and sharing results of some such trials conducted in the White Labs laboratory, beginning on page 70.

Amy Todd is the Owner and Analyst for Zymology Labs, an analytical testing lab for beer and hard cider breweries and homebrewers based in Burlington, Vermont. A self-proclaimed chemistry nerd for her entire life, Amy began homebrewing with her grandfather while attending the University of Vermont. She later received her Master's in food science from the University of Illinois at Urbana-Champaign. Among other positions, Amy led the quality assurance program at Magic Hat Brewing Company for three years before opening Zymology Labs in 2016. Amy was a speaker at *BYO*'s inaugural NanoCon in 2018.

In her first articles for *BYO*, Amy discusses what homebrewers need to create their own homebrew laboratory beginning on page 78 and starting a quality control program in the "Nanobrewing" column on page 107.

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online at: https://byo.com/recipe/the-kernel-brewerys-table-beer-clone/). Because it was an article on extract recipes there was no all-grain option mentioned. Is there any chance for an all-grain recipe? I'm especially interested in the role of the maltodextrin powder. Would it be used in an all-grain recipe too?

Tim Dierkes • *via e-mail*

BYO *Recipe Editor Dave Green responds: "For the Kernel's Table Beer, you're just going to be swapping out the extract for a base malt. The question then is — which base malt? Well, lucky for us we ran another Kernel recipe in a feature on London breweries (from the October 2017 issue) in which Maris Otter pale ale malt was used as the base grain for their Export India Porter."*

So swapping out the 4 lbs. (1.8 kg) of dried malt extract with approximately 7 lbs. (3.2 kg) (or based on your system's efficiency) of a Maris Otter pale ale malt or other English pale ale malt should get you in the same vicinity. And yes, keep the maltodextrin in the recipe since that ingredient will boost the body and mouthfeel of the beer, keeping it from being too light. Also, don't be afraid to mash warmer than normal, up around 158 °F (70 °C) to promote those dextrins in the mash. Best of luck brewing this, Tim!"

LOVE FOR *BYO*'S NEWSLETTERS

(In response to our weekly e-newsletter that included a barrel-aged stout recipe.) We moved to Mississippi from Burlington, Vermont a couple years ago. We began homebrewing with kits because of the lack of good local craft beers. I really miss #9 from Magic Hat in the summer, but have expanded to enjoying some homemade stouts and porters, even an old English ale that has aged well. My last one was a nice oak barrel "Rebel Yell" porter that we bottled a few weeks ago. I refuse to use corn sugar due to GMO and pesticide concerns, so it's strictly maple syrup for me to prime. I wish I'd taken up this hobby sooner. As I love amending cooking recipes, I've found the same liberty in doing so in beer making. Spices galore, birch syrup, maple syrup, and grain teas all found their way into some pretty tasty homebrew versions. Even though we're in Mississippi, we are not lacking for a nice homebrew by the pool, or fireplace. I enjoy your emails and your info — I still have so much to learn.

Pam Beam • *via e-mail*

It's never too late to start a hobby, and we can't think of a better hobby to start than homebrewing, no matter what the local beer selection is like. As a company based in Vermont, we salute your use of maple syrup and mourn your loss of easy access to #9. This is probably a good time to also mention to the wider readership who do not already receive our weekly newsletters that you can sign up for them at byo.com BYO

BEGINNER'S BLOCK

BY DAVE GREEN

FERMENTER ADDITIONS

Adding ingredients to your fermenter is a common practice in brewing (e.g. dry hops or cacao nibs) and there are some general guidelines that brewers should follow when such additions are being made. The two leading factors that brewers should emphasize are sanitation and oxidation.

SANITATION

Spoilage from microorganisms introduced to your wort or beer should be a concern with every fermenter addition that you make. But luckily for us, alcohol is lethally toxic to the vast majority of microorganisms found in our world. But organisms such as *Pediococcus, Lactobacillus,* and wild yeast can survive and multiply in these environments. That is why many instructions for fermenter additions will include some form of sanitation step, whether by boiling, pasteurizing, or soaking in a high-alcohol environment (such as a tincture). While it may seem prudent to sanitize everything that goes into your fermenter, you'll find that not everything needs to be sanitized.

OXIDATION

Minimizing the amount of oxygen that makes its way into the beer after fermentation is one of the challenges to make great beer. Luckily though, any fermenter addition made prior to the completion of fermentation will allow the still active yeast to scavenge most, if not all, of the oxygen that accidentally tags along. But if you wait until after fermentation is complete, simply dumping additions like coffee beans or dry hops into the beer will most certainly allow oxygen to be absorbed into solution. Brewers go to great lengths to minimize this, but a gentle approach to these additions is always a good idea.

Now let's walk through various additions that brewers may utilize in their brew and how these two factors play into the decision-making process.

DRY HOPS

In this IPA-laden era, dry hops are being added at almost any point in the fermentation and aging cycle. The timing of your dry hop addition will clue you into which of the two factors to focus on. Dry hops are almost never sanitized by brewers and do contain microorganisms that feasibly could spoil a batch of beer. Luckily, the microorganisms found on hops don't like alcohol and will not survive even a moderately alcoholic environment as those found in standard beers. But when hops are added very early in the fermentation cycle, these organisms could potentially gain a foothold. While I have never heard of this actually happening, it is not something I want to leave to chance. So a sanitation step may be advised if you plan to add dry hops at the beginning or very early in the fermentation cycle. Soaking the hops in a neutral spirit bath would be your best sanitation method as boiling the hops would drive off the volatile oils found in hops.

Fermentation will also drive off many of the aforementioned volatile oils, so most dry hop additions are made at the end or after fermentation ceases. At that point, the sanitation step can now be overlooked, but oxidation is now of the greatest concern. Racking the beer onto the dry hops in a carbon dioxide purged vessel or a gentle submersion of the hops, are two popular methods among homebrewers.

FRUIT ADDITIONS

Adding fruit brings its own challenges since their skins are often loaded with microorganisms waiting for their turn to flourish on the fruit's sugars. Canned purees can often be added direct to the fermenter, but for brewers using fresh produce, a sanitation step is needed to rid these fruit of their microorganisms. Unlike hops, I would advise this step be done no matter what part of the production cycle you are in. Soaking in a neutral spirit, or potassium metabisulfite solution, or pasteurizing the fruit are common ways brewers will sanitize their fruit additions. Oxidation is not often a concern since the yeast will become active thanks to the fruit's natural sugars causing refermentation to occur, even if added after active fermentation. Racking the beer onto the sanitary fruit is a common practice by brewers.

SPICE ADDITIONS

Spice additions are similar to dry hop additions, with one notable exception . . . I would advise brewers to utilize a sanitation step no matter when you are adding the spice to the fermentation. Tinctures are not only a great sanitation step, but also coax the essential oils out of the spice as well as make it easy to fine-tune the spice level for each beer.

SUGAR ADDITIONS

Most often, sugar is added to the boil kettle and should not be added to the fermenter. There are exceptions to this rule, like priming sugar. Priming sugar should be boiled to create a simple syrup before adding to the fermenter or bottling bucket. Honey is another one of my exceptions. A boil can drive off those delicate aromas, so I will always add honey near the end of active fermentation. Finally I'll add sugars to the fermenter for big imperial-style beers where yeast health can suffer if the starting gravity is too high. Pasteurizing the sugar is a good practice and, just like with fruit addition, oxidation is of lesser concern since the yeast will become active again after the sugar addition.

BACKYARD BREW PUB

BRIAN BLOSSFELD • BRIGHTON, MICHIGAN

I have been brewing since 1993 and always wanted to own a brewery. I started brewing all-grain, on a home-built gravity-fed system and always struggled hitting and holding my mash temperatures. So one day in late 2011 I decided it was time to upgrade. I have always wanted the BrewMagic® by SABCO. Their facility is only 1.5 hours from me. I drove down to inspect one. A few hours later I was the proud owner of a new brewing system!

While driving back I thought to myself, "I can't put this in the garage. I know, I will build a building for it." So that spring and summer with the help of friends and family we built what has become Beerhead Brewing.

It is a 24 ft. x 24 ft. (7.3 m x 7.3 m) 576 sq. ft. (53.5 sq. m) building. It is heated, has a bathroom, three TVs, WiFi, and an integrated sound system. For the bar there are four dedicated taps, but I have had as many as seven different brews available at one time by adding a few picnic taps. The brew area is tiled off, so any spillage is easy to contain. There are two temperature-regulated coolers for storage of secondaries and kegs waiting to go on tap. I also have one temperature-controlled cooler so I can brew lagers.

I brew 10-gallon (38-L) batches and brew days are great because I never have to deal with the weather — just open a window, turn on the exhaust fan, and fire the brewhouse up. I can do a variety of mash processes and control my temps perfectly to achieve what I want. Cleanup is a breeze, thanks to my pump and PBW. For emptying the mash tun I use a scoop and then a small shop vac works great for cleaning out the rest of the spent grain.

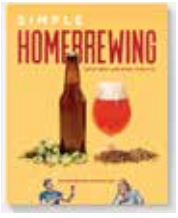
So that is my backyard brewpub, I live in a great neighborhood, which by the way loves having a place to come by for a fresh brewed beer. Thanks to *BYO* for letting me share my place with all the fellow homebrewers out there, Cheers and brew on!

WHAT'S NEW

BREWMAGIC® PREMIER ALL-ELECTRIC BREW SYSTEM

SABCO Craft Equipment has been building brewing systems for 3 decades and now has an all-electric system in their lineup. The new BrewMagic® Premier 20-gallon (76-L) RIMS system is turnkey and requires (240 V) power supply. Available in both 30 amp and 50 amp versions and capable of brewing 5 gallons (19 L) to 18 gallons (68 L), it's designed for homebrewers. Optional network connectivity allows operation to occur from phone, tablet, or PC. There is automated temperature control on all 3 vessels.

The new system completes a full suite of new RIMS brewing systems released by SABCO this year — The 20-gallon (76-L) Premier, the 30-gallon (114-L) Pilot, and the 56-gallon (212-L) Pro. Additional details and all of the system features and specs can be found at brewmagic.com.



SIMPLE HOMEBREWING

Brewing beer doesn't need to be complicated. *BYO*'s "Techniques" columnists Drew Beechum and Denny Conn have once again teamed up to teach brewing in its basic form. *Simple Homebrewing* peels away the layers with tips and tricks on topics such as water adjustments, working with adjuncts, and making wild beers. Denny Conn is a nationally–ranked Beer Judge Certification Program judge and served on the American Homebrewers Association Governing Committee for nine years. Several commercial breweries in both the United States and Europe have brewed his homebrew recipes. Drew Beechum is the author of *The Everything Homebrewing Book*, *The Everything Hard Cider Book,* and co-authored *Experimental Homebrewing* and *HomeBrew All-Stars* with Denny Conn. They co-host the Experimental Brewing Podcast. For more information or to purchase, visit www.brewerspublications.com.

Beech tree galls found in the forests of Patagonia where the missing parental yeast species to modern lager strains was discovered.

COLD LAGERED?

Research delving into the origins of modern lager yeast strains and why they have a preference for colder environments has opened up a new world of scientific exploration. In 2011 a team of scientists from the University of Wisconsin-Madison announced that lager yeast (*Saccharomyces pastorianus*) was actually a cross between *S. cerevisiae* (ale yeast) and *S. eubayanus* (a wild yeast). The same team of scientists later discovered that it is the mitochondria from the wild *S. eubayanus* that has the cold preference. For those that don't remember their high school biology class, mitochondria is the powerhouse of the cell. The mitochondria contain its own set of DNA, making it independent from the rest of the cell. In a paper published in *Science Advances* early in 2019, the team removed the mitochondria from several different *Saccharomyces* yeast varieties. This left them a blank slate to build hybrid yeast types. The scientists were able to cross these yeast cells with the various mitochondria types. The mixed offspring with various parentage cells and mitochondria were able to thrive at a wider range of temperatures than their parent organisms. Not too surprisingly, they found that leaning more heavily on the *S. eubayanus* allowed a stronger cold-tolerance while more *S. cerevisiae* parentage meant better performance in warmer temperatures.

While you may not be seeing new strains with a hybridized yeast-mitochondria mix coming out from White Labs or Wyeast this year, it is something to keep track of. There is a lot of brewing potential if a clean, crisp lager could be brewed faster and at warmer temperatures thanks to a trick played on their mitochondria. To read more, check out the paper at http://advances.sciencemag.org/content/5/1/eaav1869

Upcoming Events

MAY 7 — National Homebrew Day returns with events hosted throughout the country on the weekend leading up to the official day. Be sure to brew or at least raise a homebrew to the occasion. Check in with your local homebrew shop or visit: https://www.homebrewersassociation.org/aha-events/national-homebrew-day/

JUNE 27–29 — Homebrew Con 2019 takes place in Providence, Rhode Island this summer. The 41st annual convention will feature over 70 seminars and 50 homebrew clubs. You must be a member of the American Homebrewers Association to attend. To learn more, visit: https://www.homebrewcon.org

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REPLICATOR

BY MICHAEL BURY

DEAR REPLICATOR, One of my favorite beers is Croydon is Burning from Neshaminy Creek Brewing in Croydon, Pennsylvania. It is a fantastic Bamberg-style smoked lager that I think the readers of the Replicator would enjoy. It's not quite as assertive as some traditional rauchbiers but has plenty of smoke character and complexity that starts in the aroma and continues through the finish. Would love to get their recipe!

John Putnam
Exton, Pennsylvania

It's not every day that I receive requests for lagers let alone a smoked one. But the fact is that all beers used to be smoky to some degree, owing their smokiness to the fires that were used for drying malt.

Although Neshaminy Creek Brewing Company (NCBC) doesn't smoke their own malt, they have nonetheless produced top-notch beers across a range of styles on their 22,000-BBL-per-year system located in Croydon, Pennsylvania. Founded in November of 2010, they didn't start production brewing until nearly two years later in 2012, under the leadership/brewership of Jeremy Myers alongside buddies Rob Jahn and Steve Capelli. As Jeremy would tell you, just brew good beer. Cut the crap, the gimmicks, and just execute — and never stop learning. He routinely travels abroad for market research in order to improve the beers that NCBC produces; but he knows there's always room for improvement.

NCBC also seems to be quite comfortable brewing across the gamut of beer styles: Whether it's an intense double IPA like The Shape of Hops to Come, or an English barleywine called Concrete Pillow, or a simple Vienna lager called Churchville Lager, which won a gold at the 2013 Great American Beer Festival (GABF) and a bronze in 2016. They're one of the few breweries in the Philadelphia region to have dedicated horizontal lager tanks, which based on the hardware they've garnered in the lager categories, has been a boon for them. In addition, they've got a barrel program with over 400 barrels alongside multiple foudres. Their 1.5-BBL pilot system allows the brewers to try new recipes or tweak a few favorites without running the risk of wasting a full batch of beer, as well as time and money, on mediocre product. But they aren't shy when they've missed the mark. If a beer doesn't live up to their expectations or is over-carbonated due to additional refermentation after packaging, they don't hesitate to push the pause button. It's a testament to the brand.

They also are quite active in their community, hosting nearly weekly events while their taproom is both children- and dog-friendly. Some of these events are charity movie nights that have benefited the local watershed partnership (Tookany/Tacony-Frankford Watershed). They also help out by brewing specialty charity beers. One such beer, Bee(r) School, was a wheat pale ale brewed with local orange blossom honey from Fruitwood Orchards and fermented using a Norwegian farmhouse yeast called Kveik. It was released during this past year's Philly Beer Week with the proceeds being donated to the Kutztown-based Rodale Institute, which specializes in organic farming research. They also organize numerous social events to bring the local beer community together, events like Hot Rods & Hops, their yearly Oktoberfest, anniversary parties, as well as executing collaborative beers with other local breweries.

Croydon is Burning is a classic Bamberg-style smoked lager. So, your brewing emphasis should be placed on both the smoked malt character as well as the clean, lager fermentation. According to Jeremy, "One of the things that makes this beer unique is that you can't be afraid to use A LOT of smoked malt. 85% is low, even by German standards. It doesn't always have to be 100% smoked malt because you don't want to lose some of the complexity that you can get with this beer from the use of other malts. But people tend to get scared using a lot of smoked malt. Don't be shy, go big or go home."

As for the lager portion, that's a bit trickier. For Croydon is Burning, NCBC uses the Andechs Lager strain, which is available only as a commercial strain through Brewing Science Institute (BSI) in the United States. It attenuates well but won't overly dry out a beer either, allowing for the malt to really shine through. The closest comparison available to the homebrew market through White Labs is WLP835, which is named German X Lager yeast. Depending on your own results, you might find that Wyeast 2206 (Bavarian Lager) or White Labs' WLP830 (German Lager) may come close to hitting the mark.

Finally, if we're talking about German lagers then inevitably the conversation will drift towards mashing protocols, specifically single infusion versus decoction. NCBC went the way of experimentation and tried out both. Their results? Both single infusion as well as decocted versions won GABF medals (Bronze in 2016 and 2017). So, they brewed it again using the single infusion mash protocol in 2018 and it supposedly was better than in 2016 and 2017 according to taste testers. What did they win in 2018? Nothing. Here's to hoping that your attempts at crafting this authentic rauchbier are met with success. Prost!

NESHAMINY CREEK BREWING COMPANY'S CROYDON IS BURNING CLONE

(5 gallons/19 L, all-grain)
OG = 1.063 FG = 1.016
IBU = 21 SRM = 16 ABV = 6%

INGREDIENTS

11 lbs (5 kg) rauch malt
0.75 lb. (0.34 kg) light Munich malt
0.75 lb. (0.34 kg) Carapils® malt
0.5 lb. (0.23 kg) melanoidin malt
3.2 oz. (91 g) Carafa® III malt
4.5 AAU Herkules hops (60 min.) (0.3 oz./8.5 g at 15% alpha acids)
3.4 AAU Tettnanger hops (10 min.) (0.75 oz./21 g at 4.5% alpha acids)
White Labs WLP835 (German X Lager) or Wyeast 2206 (Bavarian Lager) or White Labs WLP830 (German Lager) or SafLager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mill the grains, then mix with 4.1 gallons (15.6 L) of 166 °F (74 °C) strike water to achieve a single infusion rest temperature of 152 °F (67 °C). Hold at this temperature for 60 minutes. Mashout to 170 °F (77 °C). Vorlauf until your runnings are clear before directing them to your boil kettle. Batch or fly sparge the mash to obtain 6.5 gallons (24.6 L) of wort. Boil for 60 minutes, adding hops at the times indicated above left in the boil. At 15 minutes left in the boil, add a kettle fining agent of your choice.

After the boil, rapidly chill the wort to slightly below fermentation temperature, which is 52 °F (11 °C) for this beer. Pitch yeast and aerate well. Ferment cold for about 36 to 48 hours, ramping to 65 °F (18 °C) once the beer is about two thirds of the way through fermentation, about an SG of 1.034 (8.5 °Plato). Hold this temperature until terminal gravity is reached. Cold crash to 35 °F (2 °C) before transferring to lagering vessel for approximately one month. Bottle or keg the beer and carbonate to approximately 2.5 volumes.

NESHAMINY CREEK BREWING COMPANY'S CROYDON IS BURNING CLONE

(5 gallons/19 L, partial mash)
OG = 1.063 FG = 1.016
IBU = 21 SRM = 16 ABV = 6%

INGREDIENTS

6 lbs. (2.7 kg) rauch malt
3 lbs. (1.36 kg) extra light dried malt extract
0.75 lb. (0.34 kg) Carapils® malt
0.5 lb. (0.23 kg) melanoidin malt
3.2 oz. (91 g) Carafa® III malt
4.5 AAU Herkules hops (60 min.) (0.3 oz./8.5 g at 15% alpha acids)
3.4 AAU Tettnanger hops (10 min.) (0.75 oz./21 g at 4.5% alpha acids)
White Labs WLP835 (German X Lager) or Wyeast 2206 (Bavarian Lager) or White Labs WLP830 (German Lager) or SafLager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Bring 2.3 gallons (8.8 L) of water to roughly 166 °F (74 °C). Steep the milled malts in a nylon bag for 45 minutes before removing and allowing the bag to drain. Add enough water to bring the total volume to 6.5 gallons (24.6 L) before adding the dried malt extract. Add extract while stirring. Once fully dissolved, heat wort to a boil. Boil for 60 minutes, adding hops at the indicated times left in the boil. At 15 minutes left in the boil, add a kettle fining agent of your choice.

After the boil, rapidly chill the wort to slightly below fermentation temperature, which is 52 °F (11 °C) for this beer. Pitch yeast and aerate well. Ferment cold for about 36 to 48 hours, ramping to 65 °F (18 °C) once the beer is about two thirds of the way through fermentation, about an SG of 1.034 (8.5 °Plato). Hold this temperature until terminal gravity is reached. Cold crash to 35 °F (2 °C) before transferring to lagering vessel for approximately one month. Bottle or keg the beer and carbonate to approximately 2.5 volumes.

TIPS FOR SUCCESS:

Croydon is Burning uses traditional German malts including lots of rauch malt. Fear not extract brewers because you can easily perform a partial mash using a medium-sized nylon bag to harness the unique, complex character that comes from rauch malt. Currently, there's no commercial extract versions of the malt and liquid smoke will give you only a shadow of the actual beer.

The second tip is to remember that rauchbiers are lagers; you can't rush them. "Be patient, and let the yeast do the work," as Jeremy mentioned to me. NCBC has been able to go from grain to glass in 42 days but there's no rush. A strong, healthy pitch for a lager and the use of pure oxygen for aeration will go a long way to ensure a fermentation without faults. BYO

BY DAWSON RASPUZZI

TURNING RED INTO GOLD

Award-winning Irish red ales

Irish red ale is a rather simplistic style to brew. It often only has one hop addition for the sake of bitterness, it doesn't require any unique ingredients or brewing methods, and can be turned around pretty quickly. However, there's a big difference between a beer that simply meets the requirements, and an Irish red ale that is an exemplary example of the style. To shine some light on what makes an Irish red special, we interviewed the three brewers who took home awards for their interpretations at the 2018 Great American Beer Festival (GABF). Just because a beer style is simpler to brew, doesn't mean it has to be ordinary.

I try to stay fairly traditional for our Irish red ale, Redcon, regarding style guidelines, with the exception of using American ale yeast and the current hop choice of Simcoe®.

To achieve the sweetness and color that we are looking for we incorporate a decent percentage of crystal or caramalt, then we add the very small percentage of chocolate or black malt . . .

Photo by Erica Faith

Marks Lanham is the Brewmaster at Comrade Brewing Co. in Denver, Colorado. He began professionally brewing in 2002, starting at a 15-barrel brewpub in Lubbock, Texas. He has traveled the country, brewing at Grand Teton Brewing, Boneyard Beer, and Barley Brown's. Since 2007, Marks has won 12 medals at the Great American Beer Festival (GABF) and 2013 GABF Very Small Brewing Company and Brewer of the Year (along with Eli Dickison). Comrade's Irish red ale, Redcon (previously named Defcon Red), won a bronze at the 2018 GABF.

This beer is supposed to have low bitterness and leave an almost candy-like sweetness on the palate, which is what we have captured.

We've made this beer with a lot of small tweaks to the malt bill, but I really like what we're doing currently which is a base of American pale ale malt, about 6% light caramalt, 6% Simpsons Double Roasted Crystal malt (DRC™), 6% Simpsons Imperial Malt, and 0.5–1% pale chocolate or black malt, depending on how dark you like it.

To achieve the sweetness and color that we are looking for we incorporate a decent percentage of crystal or caramalt, then we add the very small percentage of chocolate or black malt to make sure we get the nice red color instead of falling too far in the direction of amber. It's all mashed in together in a single step infusion.

One of the areas we stray from tradition is with the use of Simcoe® hops, which, to be honest, the reason we use Simcoe® is because we have so much of it. This is not a hoppy style, so we use the hops to achieve a low IBU of 18 and add them with 70 minutes to go, so no Simcoe® character remains by the end of the boil.

When it comes time to ferment, ideally, you'd look for an ale yeast from the UK with only moderate attenuation, leaving some residual sugars in the finished product. In our case, we like the versatility of an American ale yeast for most of the beers we make, but it has a high attenuation. To combat this, we mash at a higher temperature (156 °F/69 °C) than other beers we make and use more crystal/caramalt than normal to keep the sweetness this style requires.

Redcon is a relatively easy beer for us to brew with only one small hop addition compared to some of the hop-driven beers we are know for. The hardest part is nailing that beautiful red color without being too amber/copper or going too far and ending up in the brown spectrum. At Comrade, Redcon stands out for its easy drinkability and lack of noticeable hop character. It turns out not everyone is into IPA.

The best advice for someone looking to brew an Irish red ale is to look at the style guidelines for the specs, then dial in the color and go easy on the hops. It helps to use authentic ingredients when it makes sense.

Bruce Dir (left) was a homebrewer of about 20 years when he dropped out of corporate America to open Tighthead Brewing Co. in Mundelein, Illinois in 2011 after attending the Siebel Institute. As the owner and Brewmaster, Bruce makes final decisions on beers. Billy Oaks (right) was brought in on day one to be the Head Brewer and manage brewery operations. Billy is responsible for most recipe design and for the quality of the beers brewed at Tighthead. Billy got his Brewing education from The American Brewers Guild in 2009 and was a longtime homebrewer and manager of the local homebrew shop before starting at Tighthead. Tighthead's Scarlet>Fire Irish red ale won gold at the 2018 GABF.

Scarlet>Fire (named after the Grateful Dead songs Scarlet Begonias and Fire on the Mountain, which are often played together and are a deadhead favorite) was the first batch of beer we brewed on the brewhouse when we started in September 2011. The recipe was one of Bruce's that he had brewed and called many things over the years as a homebrewer depending on the event and party he was brewing it for (ranging from Missiles Red, Mustang Red, and Rick's Retirement Red). It is a little bigger than a traditional Irish red and leans toward the drier, hoppier end of the spectrum, which is sort of the Tighthead trademark.

There are four different grains in the recipe, with each having a distinct purpose. The recipe consists of 85% base malt (a 50/50 split of 2-row and Maris Otter) to lay the foundation of a grainy/biscuity palate, 12% Briess caramel 60 °L that contributes color, sweetness, and caramel flavor/aroma, and 3% Briess roasted barley that adds color, roasty flavor/aroma, and enhances the perception of dryness. For hops, we rely on East Kent Golding to lend a subtle earthiness. The IBUs in Scarlet>Fire are slightly higher than a traditional Irish red, which helps accentuate the dry, roasty finish and a small late addition adds a touch of earthiness to the caramel and coffee notes.

When it comes to yeast for this style, what we are looking for is a clean strain with good attenuation. Our house yeast is a clean, well-attenuating American ale yeast that works great for Irish red. Fermenting in the low end of the temperature range will help produce a clean fermentation.

Beyond the ingredients, just practicing good brewing and packaging techniques to minimize dissolved oxygen in the can is the most important thing to making your Irish red stand out. We serve a cask-conditioned version at our taproom that really enhances the malt flavor and smoothness of the mouthfeel — which if you have the ability to do at home is a fun and tasty project you'll find worth while with this style.

Kyle Manns is the Director of Brewing for TAPS Fish House & Brewery, overseeing everything beer-related for their three breweries and five locations. He got his first taste of professional brewing as a volunteer at The Bruery and later became an Assistant Brewer at BJ's Brewery, West Covina in California. The next year, he took a Brewer position at TAPS, where he aided in the development of an award-winning barrel-aging program and back-to-back GABF Brewpub of the Year awards. After some time as the Head Brewer at Bottle Logic Brewing, Manns returned to TAPS in 2014. Since then, TAPS has received another GABF Brewpub of the Year and brewed many award-winning beers, including TAPS Irish Red, which received a GABF silver medal in 2018 (and gold medals in 2015 and 2006).

TAPS Irish Red is an incredibly balanced, approachable, and smooth beer, and this is right in line with what one would should expect with the style.

Our Irish Red recipe is pretty simple. It gets its ruby red hue from a small addition of chocolate malts; caramel sweetness from the 60 °L crystal malts, and a toasty smooth finish from the Maris Otter base malt. We don't use any American malt in this recipe, instead relying solely on English malts.

To achieve the beautiful color you expect with an Irish red ale we use a blend of chocolate malts, at just under 1% of the total grist. We have found this to give a rounder, smoother finish, over the sharper flavors from the traditional addition of roasted barley. This is added to the whole grist, and mashed normally.

Malt is the start of this beer while hops and yeast play a lesser role. We use a single addition of a clean bittering hop for 15 IBUS. We aren't looking for any hop character — just enough bitterness to balance out the sweetness and let the malt shine. Then we ferment our Irish Red with our neutral house ale strain, which keeps the beer clean and focused on the malt.

While an Irish red isn't the most difficult style to brew, it is pretty easy to end up with a beer that isn't very balanced if you get too heavy handed with ingredients. As a homebrewer, you need to know what each of your ingredients is bringing to the table and keep them in check.

The TAPS house flavor is often referred to as "clean," and we feel this is a huge contributing factor that helps our Irish Red stand out. This is a style in which the malt needs to do the talking, and starting with the finest ingredients possible is key. We focus on the balance between sweetness, toast, and roast, and try not to have any one of those stand out any more than the other. This style tends to lean one of two ways: Too sweet, or too roasty, and we try to avoid both.

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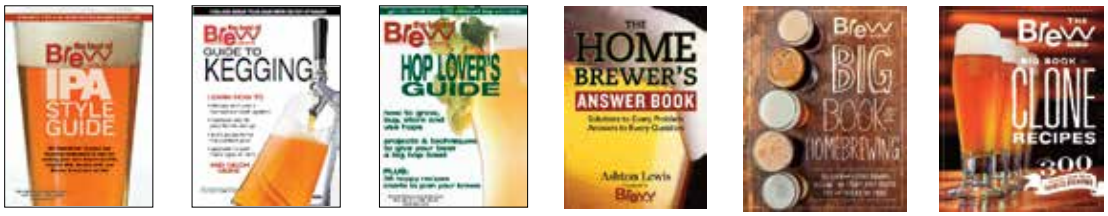

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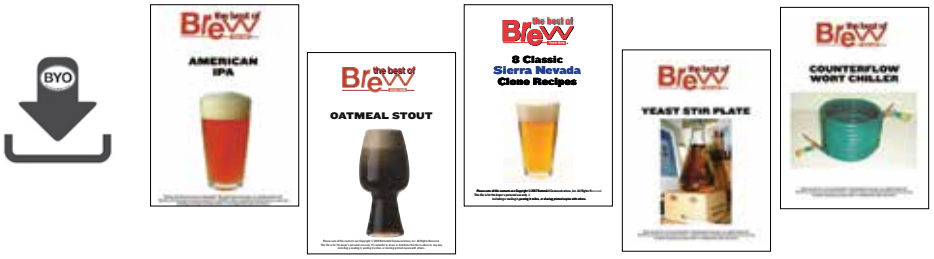

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BY ASHTON LEWIS

BOTTLE-CONDITION LIKE A CHAMP

Also: Over-carbonation issues and hop creep

Q I RECENTLY ENJOYED A CHAMPAGNE-STYLE BOTTLE OF BOTTLE-CONDITIONED AFFLIGEM BLONDE, AND I NOTICED THIS BOTTLE WAS WITHOUT RESIDUE FROM THE SECOND FERMENTING. I ASSUME A SECOND FERMENTATION WITH FRESH YEAST AND SUGAR IS HOW THEY MANAGE TO CREATE THE HIGHER CARBONATING PRESSURE THESE BEERS HAVE. BUT HOW DO THEY GET THE BEER IN THE BOTTLE WITHOUT CREATING ANY RESIDUE? DOES THIS MEAN THAT THE SECOND FERMENTATION OCCURS SOMEWHERE OTHER THAN IN THE BOTTLE?

I AM NOW BREWING A CLONE. I PLANNED TO RACK FROM THE SECONDARY FERMENTER TO A KEG, AND ADD FRESH YEAST AND SUGAR. THEN USE A PRESSURE GAUGE/SPUNDING VALVE TO REGULATE THE CARBONATION BEFORE BOTTLING FROM THE KEG. I JUST WONDER IF THIS METHOD COULD WORK OR DO YOU HAVE ANY OTHER SUGGESTIONS? I'M ALSO BOTTLING SOME NORMAL BOTTLES WITH THE YEAST AND SUGAR TO CHECK ANY DIFFERENCES. LOOKING FORWARD TO HEARING YOUR COMMENTS.

ROBERT AVELING
SLIMMINGE, SWEDEN

A I am not sure how Affligem goes about bottling their beers, but your question generally applies to bottle-conditioned beers, especially those that have very little yeast sediment in the bottle. There are a few unrelated topics that address your question, so I will cover this topic in two short vignettes.

PRODUCING CLEAR, BOTTLE-CONDITIONED BREWS

This may seem like an oxymoron as yeast is required to bottle condition, but it is relatively easy to produce clear, bottle-conditioned beer without having an excess amount of sediment in the bottom of your bottles. The first step is to forget about what is going to happen in bottle, and to focus on producing clear beer. This means considering all of the clear-beer tools and methods available to the homebrewer; thorough mashing using the appropriate temperature rests to match your grist bill, vigorous wort boil, kettle finings, flocculent yeast strain for primary fermentation, complete fermentation (no residual fermentable extract is wanted), finings to remove yeast and haze proteins, cold aging, and perhaps filtration. The objective is to produce clear beer.

Once you have produced clear beer, you now need to prepare for bottle-conditioning. This is a separate process and is independent from what has been done up to this point. The three variables that require definition at this point are: 1) beer volume, 2) carbon dioxide content, and 3) fermentable extract remaining in your beer (should be zero to make this process easiest and most consistent). This information is used to calculate the amount of priming sugar required. You also need a small amount of yeast for the process; 500,000 to 1,500,000 cells/mL is all that is needed to

Purging empty bottles with carbon dioxide and capping beer on foam are the two most important steps a brewer can take to minimize beer degradation in the bottle.

Photo by Charles A. Parker/Images Plus

Bottle-conditioned beer doesn't have to come with a lot of sediment in the bottle.

condition most beers (high-alcohol and/or low-pH beers may require more yeast). I suggest using a special strain intended for this purpose, such as Fermentis SafAle F-2 or Lallemand CBC-1 that are flavor-neutral, robust, and tend to stick to the bottle surface upon settling. Assuming that you have 4.75 gal. (18 L) of beer with 4.4 g/L of residual carbon dioxide, and you want to have 8 g/L after conditioning is complete, you need to add 133 grams of priming sugar and about 1 gram of yeast before bottling.

MINIMIZE OXYGEN IN YOUR BOTTLES

Proper bottling is critical to excellent beer. Brewers often jest that the best beer from the brewery is messed up by the packaging department. Throwing stones is never a great idea when you live in a glass house, but there is truth to this parable. Seemingly minor errors during packaging can cause major problems with beer quality. Purging empty bottles with carbon dioxide and capping beer on foam are the two most important steps a brewer can take to minimize beer degradation in the bottle. This is as true for bottle-conditioned beers as it is of beers that are fully carbonated and devoid of yeast when bottled. Capping on foam requires sufficient carbonation for the beer being bottled to actually foam. A nice carbonation level at the time of bottling is somewhere between 2–2.5 volumes or 4–5 g/L; enough carbonation to make foaming before capping easy, but not so much to make for difficult filling.

This discussion may seem out of place in an answer about bottle conditioning. After all, bottle-conditioning replaces carbonation prior to packaging, right? While it is true that "flat beer" can be completely carbonated using bottle-conditioning, this method does not prevent beer oxidation because the damage caused by oxygen usually occurs before the yeast in the beer has a chance to help. This is especially true when very low cell counts are used for conditioning. So why should brewers bottle-condition if they are going to bottle beer using methods that also work for fully carbonated beer? Simple; highly carbonated beer, like Affligem Blonde, is nearly impossible to bottle. The practical carbonation limit to bottling carbonated beer is about 3 volumes or 6 g/L, because the fill tube must be removed from the bottle and anything other than extremely slow bottle de-pressurization results in gushing bottles. The method you describe is a perfect fit for this process, and you can certainly jump start the process in your keg and bottle when your carbonation is high enough to cap on foam.

In short, bottle-conditioning is a specialist's tool allowing the brewer to easily and consistently produce highly-carbonated, Champagne-like bottles of exquisite beer. And if you begin with very clear, even filtered, beer, the yeast in the bottle can go almost completely unnoticed.

Q I SEEM TO BE HAVING TROUBLE WITH MY BEER WHEN I BOTTLE AND LEAVE THE BOTTLES FOR A WHILE. THEY FROTH WHEN I OPEN THEM AND KEEP SLOWLY FROTHING AFTER UNTIL HALF THE BOTTLE IS FINISHED. WHAT CAN I DO ABOUT THIS?

GREG HUTCHINSON
ESSENDON, AUSTRALIA

A This general phenomenon is loosely referred to as gushing and has numerous causes in beer. Typically there is a primary culprit in a case of gushing, but it is not unusual for a single case of gushing to be caused by multiple factors. In order to keep this answer from becoming jumbled, I will address each cause separately.

COMMON CAUSES OF OVER-CARBONATION

Excessive carbon dioxide is the most common cause of gushing in homebrewed beer. This normally happens when too much priming sugar is added before bottling, but can also be caused by bottling beer with residual, fermentable extract. Most commercial beers that are bottle conditioned have been tested using the forced fermentation method to determine the final gravity while the batch is being fermented. This is an easy method where the test sample of wort is pitched with a very high concentration of yeast to accelerate fermentation; kind of a crystal ball approach that helps to see into the future. Although this method can be used at home (see page 82), it requires the brewer to sacrifice a bit of beer. Brewers can comfortably omit this method provided sufficient fermentation time and a stable hydrometer reading on 2–3 samples tested over 3–5 days at the end of fermentation.

Over-carbonation can easily be avoided by paying attention to the common causes. Here are a few tips on how to prevent this pesky problem:

1. Always measure your beer volume before adding priming sugar. All too often, homebrew recipes prescribe the amount of priming sugar to be added to a batch. For example, add ⅔ cup priming sugar to your 5-gallon (19-L) batch. This sort of instruction is prone to error. A more precise and accurate instruction is to dose based on sugar weight and beer volume, for example adding 5.7 grams of priming sugar per liter of beer. The reason this is a better way of defining priming sugar additions is that granulated solids, like priming sugar, are compressible and should be measured by weight instead of volume, and a batch of beer does not magically yield a pre-determined beer volume to the bottling bucket.

2. Use a carbonation calculator that takes into account the approximate amount of carbon dioxide in the beer you are bottling and the target carbonation level after conditioning

has occurred. I am a bit old-school and like to grind through calculations using chemistry, paper, pencil, and a calculator. 1 mole of glucose (180 grams) yields 2 moles of carbon dioxide (88 grams), most beers after fermentation contain about 3 g of carbon dioxide per liter of beer, and most bottled beers contain between 5–6 g carbon dioxide/liter. Whatever the method, it should be robust.

3. Unless you are an advanced brewer and really want to brew completely in accordance with the Reinheitsgebot, don't use wort or "speise" as your priming sugar. This method requires the brewer to know how much fermentable sugar is present in the speise and requires a forced fermentation test and more math.

4. Make sure your beer has stopped fermenting before cold crashing (if this is done) and bottling. Although this sounds like simple advice, there are many brewers who rely on airlock observations to determine when fermentation is complete. A stuck fermentation may appear to be complete, but add a bit of fresh bottling yeast, or simply rouse, and the fermentation may resume. This is why it is important to check your batch with a hydrometer; not only will this simple method indicate if the terminal gravity is stable, it also prompts the brewer to consider of the actual gravity is aligned with the expected gravity.

OVER-CARBONATION ASSOCIATED WITH DEBRANCHING ENZYMES

Most beers contain dextrins (branched carbohydrates) that cannot be hydrolyzed by alpha or beta amylase during the mashing process. Dextrins contribute body, some flavor, and calories to beer. Amyloglucosidase (Amylo for short) is a debranching enzyme that can be added to the mash and/or in fermentation to reduce or eliminate dextrins. Light beers and brut IPAs are produced using this type of enzyme. However, debranching enzymes have multiple exogenous sources; like the Amylo used for light beer, or found in hops, as well as diastatic yeast.

So what about those funky yeast? Diastatic yeast strains do not normally cause problems in beer when they are used as the primary fermenting strain, for example in the production of saisons or funky *Brett* beers, they do contribute to increasing levels of carbon dioxide during bottle storage if added late in the game. Some beers, such as Orval, are dosed with *Brettanomyces* shortly before bottling and others are inadvertently contaminated with diastatic yeast strains. Over time, diastatic yeast strains will lead to increased levels of carbon dioxide in the package. Extreme gushing and even exploding bottles can result from the inadvertent inclusion of diastatic yeast in packaged beer. Diastatic yeast are almost always phenolic-off-flavor positive, or POF+; these yeast strains produce phenolic aromas during fermentation and are fairly easy to smell when present.

BEER GUSHING

Some beers gush, and the cause has nothing to do with over-carbonation. The term "gush" when applied to beer means that carbon dioxide uncontrollably escapes from a bottle or can when opened, oftentimes resulting in the entire contents of the package turning to foam. Gushing in beer is typically caused by one of two factors; oxalates and hydrophobin proteins. Malt contains oxalates that can survive into finished beer, where they precipitate as crystals. These oxalate crystals act as nucleation sites for carbon dioxide release, and can cause gushing. Oxalate is normally precipitated with calcium during wort boiling, and the most common method of oxalate removal is a vigorous boil in the presence of sufficient calcium.

Hydrophobin proteins are produced by certain fungi and, like oxalate crystals, act as nucleation sites for carbon dioxide release. When found in beer, hydrophobin proteins come from grain that has been infected with *Fusarium* in the field. Because *Fusarium* produces mycotoxins, unmalted adjuncts and malted cereals are tested for mycotoxins by suppliers. Even so, *Fusarium*-induced gushing is not uncommon. Grains can mold when stored in humid conditions, or when grain is accidentally wetted before or during storage. It is important for homebrewers to take note of any changes that occur during storage of grains at home, and to discard any suspect ingredients.

> **"Diastatic yeast strains do not normally cause problems in beer when they are used as the primary fermenting strain . . ."**

In summary, foaming bottles of beer can be caused by numerous factors. The good news is that good brewing practices will minimize this type of problem from occurring at home.

Q I WAS READING THE MR. WIZARD ANSWER TITLED "HOP CREEP EXPLAINED" AND HAVE HAD THE ISSUE OF OVERCARBONATION WITH A COUPLE IPA BATCHES THAT I DRY HOPPED. I THOUGHT THAT I HAD MADE A MISTAKE WITH THE PRIMING SUGAR, BUT AFTER READING THAT ARTICLE, I BELIEVE HOP CREEP WAS THE PROBLEM. WOULD IT MAKE ANY SENSE TO ADJUST THE AMOUNT OF PRIMING SUGAR TO COMPENSATE FOR THE HOP CREEP? I DID A LITTLE MORE RESEARCH AND READ ABOUT LOWERING THE WORT pH IN ORDER TO COMPENSATE FOR HOP CREEP. DO YOU HAVE ANY SUGGESTIONS ON HOW TO MEASURE AND ADJUST pH TO COMPENSATE FOR HOP CREEP?

GREG STONER
ELIZABETHTOWN, PENNSYLVANIA

A I rarely answer similar questions in a single column, but this question pairs well with Greg Hutchinson's question (previous question) about over-carbonation and is a good follow-up to my "Hop Creep Explained" answer from January-February 2019 issue. This is kind of like beer and food pairing, but it is rather a topical pairing!

OK, so you are thinking about adjusting your priming dose for beers that have been dry-hopped. There are several challenges with this proposition. The first is that not all hops have the enzymes that cause hop creep. Research into this phenomenon is limited and there seems to be little known about what hops contain active, debranching enzymes that lead to the production of fermentable sugars from dextrins. If you don't know whether your hops contain debranching enzymes, you cannot adjust priming rates because not all hops contribute these enzymes to beer. And even if you knew that your hops did contain debranching enzymes, you cannot determine how much carbon dioxide will be added to beer as a result of the enzymes without running a trial test, and then using this information to determine how much priming sugar is needed to achieve your target carbonation level.

In practice, you need to allow sufficient time after dry hopping for any enzymes from the hops to do their thing and for the yeast in the fermenter to metabolize any boost in fermentable sugars that may come late in fermentation. How do you know that things are complete? This is where your handy hydrometer comes to use; monitor your beer gravity and consider fermentation complete when the gravity is stable for about 5–7 days after dry hopping. This does not mean that you must keep beer in contact with hops for 5–7 days, it just means that you need to keep your beer at fermentation temperature with yeast for long enough to confirm final gravity has been achieved. If you like to clarify beer before packaging by cold-crashing, hold off on this step until your gravity is constant.

The idea of manipulating wort or beer pH to affect enzyme activity is interesting, but is not a method I would advocate. Although enzymatic rates are influenced by pH, it is not practical to change the pH of the wort/beer system enough to prevent the activity of this enzyme group without causing major changes to overall flavor and character of the beer. A similar method to pH manipulation is the use of heat to thermally denature enzymes. Although beer pasteurization is not considered cool in certain beer circles, it does work well to kill bacteria and yeast, and to denature enzymes in beer. This method is not practical at home, and does not make sense for control of hop creep in bottle-conditioned beer unless pasteurization is performed when proper carbonation is achieved. BYO

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BY GORDON STRONG

CALIFORNIA COMMON BEER

Nothing to get steamed up about

Sometimes called one of America's true original beer styles, California common is a more recent term for what was historically called steam beer.

CALIFORNIA COMMON BY THE NUMBERS

OG:	1.048–1.054
FG:	1.011–1.014
SRM:	10–14
IBU:	30–45
ABV:	4.5–5.5%

Photo by Charles A. Parker/Images Plus

Beer writer Stephen Beaumont recently promoted #FlagshipFebruary, on his Twitter account, a campaign to draw attention to those long-time craft beer examples that caused many of us to become beer enthusiasts in the first place, and to recognize the contribution of flagship beers to the health of the industry. Perhaps a backlash against the notion of never trying the same beer twice, or to always seeking the latest trendy example, this harkens back to the day of enjoying old favorites and well-regarded brands. So I thought I'd show my support by talking about one of my first craft beer loves, California common as exemplified by one of the original craft flagships, Anchor Steam.

The Beer Judge Certification Program (BJCP) Style Guidelines group California common in Category 19 (Amber and Brown American Beer), along with American amber ale and American brown ale. California common is style 19B. In older versions of the guidelines, it was grouped as an Amber Hybrid Beer, which was a style category created to help describe beers that mixed ale and lager yeast and techniques. Although California common judged well against Düsseldorf altbier, there wasn't any historical relationship between them and it tended to confuse people since the hybrid terminology wasn't used in commercial examples.

HISTORY

Sometimes called one of America's true original beer styles, California common is a more recent term for what was historically called steam beer. Anchor Brewing Company trademarked the Anchor Steam beer name in 1981 and aggressively protects the name, so California common was adopted by both commercial brewers and homebrewers to describe essentially the same style. So I'll follow that convention, referring to the style as California common and using steam beer only when discussing Anchor Steam.

It's widely accepted that California common beer was made in California from the Gold Rush days up to Prohibition. At the end of the 1800s, there were at least 25 breweries in San Francisco making the style and it was widely available throughout California. Anchor Brewing Company first made their Steam beer in 1896, but it was not the first example, just the only surviving one.

In the second half of the 1800s, proper refrigeration was not common in California, so adaptations had to be made to local conditions. German brewers were common, but they used alternate techniques for cooling wort (coolships) and fermented using lager yeast at warmer-than-normal temperatures (but still not as warm as most ale fermentations).

The style became less popular as modern lager brewing was introduced into California, and also by Prohibition and changing tastes. In a story widely told by Michael Jackson, Fritz Maytag purchased the nearly-bankrupt Anchor Brewing Co. in 1965 and embarked on a program to bring back its pre-Prohibition beers. Their first modern brewing of Anchor Steam was in 1971, and it has served as the flagship beer for the brewery ever since.

So while the origins and re-establishment of the style are understood, the name steam beer is not. Several theories have been advanced, including escaping gas from venting carbonation when tapping the beers in bars, to the steam rising from the coolships as the wort cooled, to steam power used in production. If I had to pick, I'd go with the coolship theory but there is no evidence to support this supposition.

The modern use of the name common beer is apt, though. Common beers were running beers, or quick-to-market products that were enjoyed fresh in the local area. Kentucky common beer has a similar heritage. So it's certainly likely that the historical beers were well-carbonated and did produce audible gas when tapped. However, steam is warm and vented carbonation is not, so that's why I tend to give more credence to the coolship story.

SENSORY PROFILE

A California common is a highly carbonated, dark amber beer that combines a firm bitterness with a toasty and caramelly malt flavor and a light fruitiness. Rustic, woody hop flavor and aroma accentuate the grainy malt flavors to give a historical, traditional impression. As style definitions go, this one is fairly narrow since there are few commercial examples and Anchor Steam is so well known.

The color can range from medium amber to light copper, but the beer is almost always clear. The head is off-white in color and shows good retention. The hop aroma is woody and rustic, sometimes minty, while the malt has a toastiness and caramel aspect with a background fruitiness. Hops are usually most forward in the balance, particularly in fresh versions.

The flavor is similar to the aroma in character, but with a moderately high bitterness. The beer finishes dry and crisp, with lingering hop and malt flavors. Toasty, caramelly, fruity, woody, and rustic flavors blend together to form the flavor profile. Despite a dry finish, the beer retains a medium body and a relatively high carbonation. As a standard strength beer, it should not have a noticeable alcohol character.

The beer can be sometimes mistaken for an American amber or pale ale, although the ingredients in a California common are more rustic in nature and lack the citrusy or tropical character of many modern American beers.

BREWING INGREDIENTS AND METHODS

There are a few key ingredients and methods that help distinguish this

CALIFORNIA COMMON

(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.013
IBU = 35 SRM = 11 ABV = 5%

INGREDIENTS

7.7 lbs. (3.5 kg) North American pale ale malt
1.25 lbs. (567 g) Vienna malt
1.5 lbs. (680 g) crystal malt (40 °L)
6 AAU Northern Brewer hops (60 min.) (0.75 oz./21 g at 8% alpha acids)
8 AAU Northern Brewer hops (10 min.) (1 oz./28 g at 8% alpha acids)
1 oz. (28 g) Northern Brewer hops (1 min.)
Wyeast 2112 (California Lager) or White Labs WLP810 (San Francisco Lager) or Fermentis SafLager S-23 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 0.5 tsp each of calcium chloride and calcium sulfate to the mash.

Mash the pale ale and Vienna malts at 144 °F (62 °C) for 60 minutes. Raise to 158 °F (70 °C) for 15 minutes by infusion or decoction. Begin recirculating the wort. Add the crystal malt and raise the temperature to 168 °F (76 °C) over the course of 15 minutes. Sparge slowly and collect 6.5 gallons (24.5 L) of wort in the brew kettle.

Boil the wort for 90 minutes, adding hops at the times indicated in the recipe.

After the boil is complete, chill the wort to 62 °F (17 °C), pitch the yeast, and aerate. Ferment at this temperature until complete. Chill the beer to 38 °F (3 °C) and lager for 2–3 weeks, or until beer falls clear. Rack the beer, prime and bottle condition, or keg and force carbonate to 2.4 volumes.

CALIFORNIA COMMON

(5 gallons/19 L, extract with grains)
OG = 1.050 FG = 1.013
IBU = 35 SRM = 11 ABV = 5%

INGREDIENTS

6 lbs. (2.7 kg) pale liquid malt extract
1.5 lbs. (680 g) crystal malt (40 °L)
6 AAU Northern Brewer hops (60 min.) (0.75 oz./21 g at 8% alpha acids)
8 AAU Northern Brewer hops (10 min.) (1 oz./28 g at 8% alpha acids)
1 oz. (28 g) Northern Brewer hops (1 min.)
Wyeast 2112 (California Lager) or White Labs WLP810 (San Francisco Lager) or Fermentis SafLager S-23 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Start with 6.5 gallons (24.5 L) of water in the brew kettle. Heat water to 158 °F (70 °C).

Turn off the heat and place the crushed grains in a muslin grain bag. Submerge the crystal malt and steep for 30 minutes. Remove the grain bag and allow the liquid to drain back into the kettle. With the heat off, add the malt extract and stir thoroughly to dissolve completely. You do not want to feel liquid extract at the bottom of the kettle when stirring with your spoon. Once dissolved, turn the heat back on and bring wort to a boil.

Boil the wort for 60 minutes, adding hops at the times indicated in the recipe.

After the boil is complete, chill the wort to 62 °F (17 °C), pitch the yeast, and aerate well. Ferment at this temperature until complete. Chill the beer to 38 °F (3 °C) and lager for 2–3 weeks, or until beer falls clear. Rack the beer, prime and bottle condition, or keg and force carbonate to 2.4 volumes.

style. The first and most important is that a warm-fermented lager yeast is used for fermentation. Some strains work better than others; those that ferment around 60 °F (15 °C) are typically used. Lager yeast strains that are strong sulfur producers are inappropriate.

Northern Brewer hops are the signature hop of Anchor Steam. While not a strict requirement for the California common style, those hops that have a woody or rustic character are desired. Modern American or New World hops are inappropriate, as they often have citrusy or tropical flavors and aromas.

Sometimes, if I want more of a bready flavor, I'll use a little bit of biscuit or Victory® malt, or blend US and UK pale ale malts for the base. If you want to make something closer to Anchor Steam®, replace the Vienna malt with more of the pale ale malt.

Some caramelly malt flavors are present in the style, and to my taste, they have a crystal 40-like flavor. This somewhat approximates the flavors you'd get from those cube-like caramel candies without having overly sharp or roasted flavors.

Northern Brewer hops are a must for an Anchor Steam-like beer, but other hops that have a woody or rustic character can be used. I might use some Spalt hops, as I do with altbier, or Styrian Goldings. But I would definitely steer clear of modern citrusy or fruity hops. Save your Cascade hops for trying to recreate Anchor Liberty not Anchor Steam. Use bittering, flavor, and aroma additions.

> **If you make the right malt, hop, and yeast choices, you are most of the way home.**

Anchor Steam is made with pale ale and crystal malts, according to their website. I sometimes add other grains to enhance some of the natural flavors such as biscuity or toasty flavors, including bringing in some English malts or a small amount of American 6-row. With a crisp, dry finish, step mashing or mashing with a lower beta amylase saccharification temperature makes sense.

After fermentation is complete, Anchor Steam is kraüsened and warm-conditioned. Adding a portion of actively-fermenting yeast helps complete the fermentation and clean up fermentation byproducts. A warm conditioning (at fermentation temperature or slightly higher) also helps carbonate the beer. Anchor uses three weeks for this step. A cold lagering wasn't traditionally done, but I do like to follow the warm conditioning with a short lager phase (2–3 weeks) below 40 °F (5 °C). With a low-sulfur yeast and a rustic quality, this stage isn't strictly necessary but I like the little extra smoothness it provides.

HOMEBREW EXAMPLE

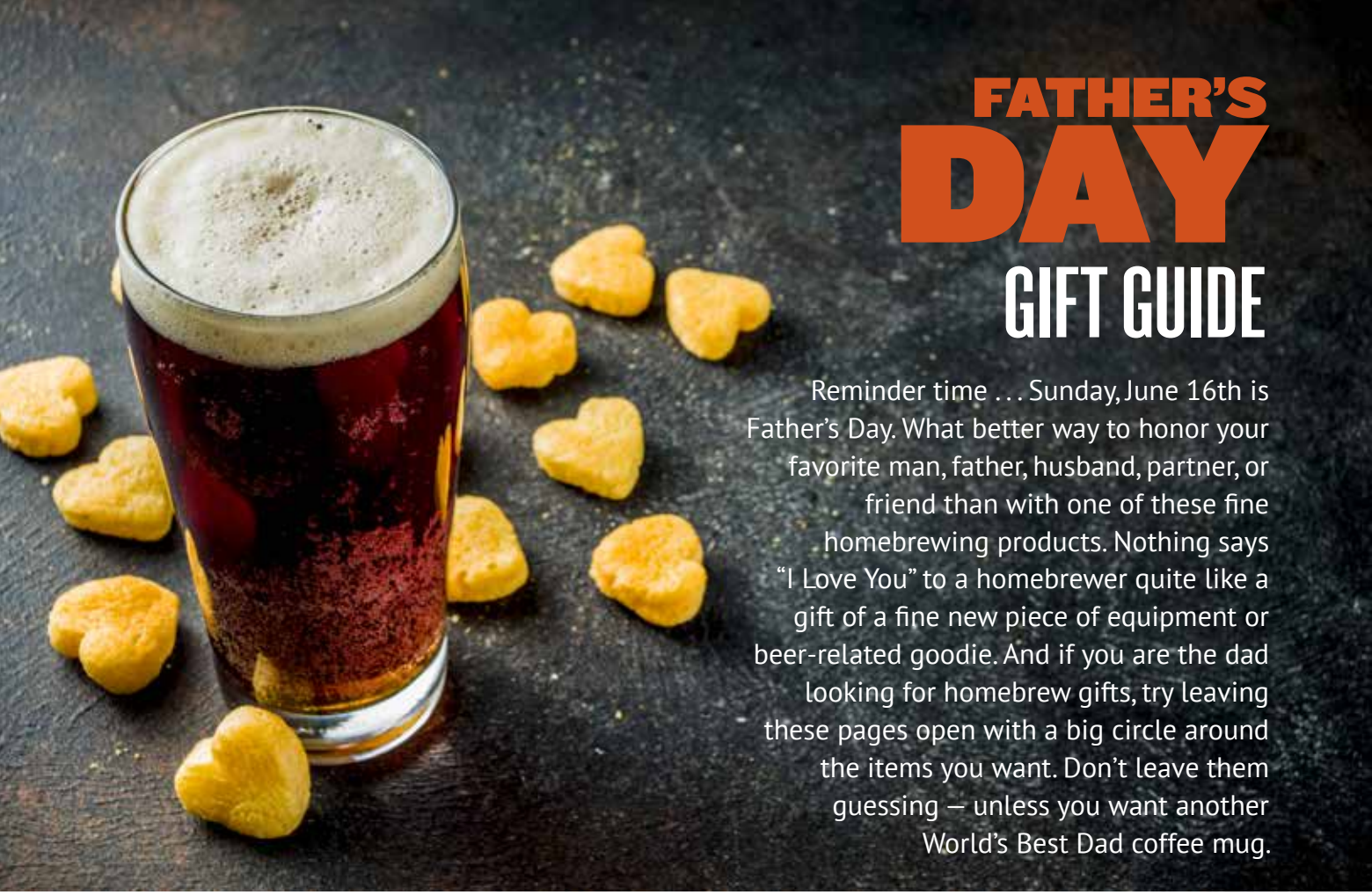
I offer a straightforward example in the style of Anchor Steam. Although Anchor uses only pale ale and crystal malt, I'm adding a bit of Vienna malt to increase the toastiness. The base is North American pale ale malt, which gives more of a bready, toasty flavor than Pilsner malt or brewer's 2-row.

The final major ingredient is a California lager yeast strain; my preference is Wyeast 2112 (probably because I'm a Neil Peart fan . . .). I ferment it at cool ale temperatures. I still like the smoothness of the lager yeast, but it does need to produce some esters to have the right flavor profile. If you make the right malt, hop, and yeast choices, you are most of the way home.

I balance the recipe similar to the specs of Anchor Steam, available on their website. I'm looking for about a 5% ABV beer with around 35 IBUs. The beer needs to be relatively dry and definitely well-carbonated. The IBUs won't come through cleanly if the beer is on the sweet and heavy side. So I use a step mash with a fairly low primary conversion temperature to encourage fermentability and attenuation. The crystal malt will still give body so don't worry about producing a beer that is too thin.

Anchor Steam is warm-conditioned and kraüsened to produce a lively carbonation level (2.8 to 3.0 volumes), so if you're interested in making the closest example possible, follow those procedures. BYO

Photo courtesy of Anchor Brewing Company



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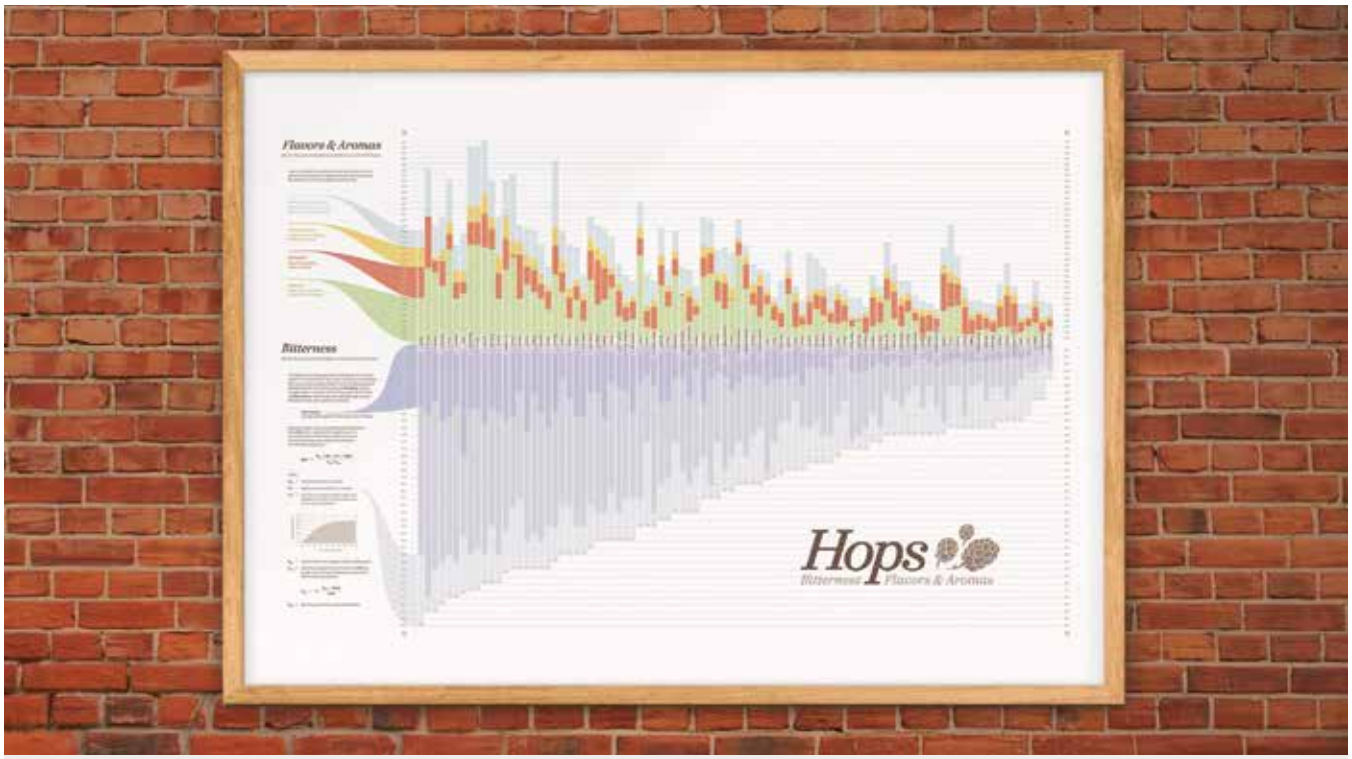

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HOLD THE GLUTEN

by Robert Keifer

Brewing gluten-free beers

Hi, I'm Bob and I have a gluten intolerance. I hadn't been aware of the concept of "gluten intolerance" until my mother was diagnosed as a celiac. From there, I started to notice some things. I had been in and out of the doctor's office my entire life with sinus infections, ear infections, etc. — sicknesses that are caused by inflammation due to mildly allergic responses. When I went on to college, it actually got worse, and this was while I was trying to play Division 1 water polo (a pool is no place to have head pressure problems). However, the moment I stopped eating gluten-containing foods in 2010, pretty much all inflammation was naturally gone within two weeks, and in 60 days I had lost 30 pounds without even working out. It was as though a switch had been flicked! I was running and swimming faster, didn't get as sore, or even as hungover when I drank. Then came this "gluten-reduced" beer, which sounded intriguing. Hey, at least they were thinking of us.

It's time to acknowledge that there has been some confusion in the brewing industry recently as to what makes a beer gluten-free. Definitively, a beer can *only* be called "gluten-free" if it does not use any gluten-containing ingredients from start to finish. There are some that label themselves as "gluten-reduced," which means that the beer still contains gluten as it comes from gluten-containing ingredients and is unfit for anyone who is completely avoiding gluten.

In fact, gluten-reduced beers are what got me into homebrewing in the first place, as I still react the same to gluten-reduced beers, as do many people with gluten-intolerance (it should be noted that not everyone who has a gluten intolerance has the same reaction to these gluten-reduced products, and some reportedly enjoy them with no ill effects. That said, this article is going to focus on brewing *gluten-free* beer). Even ciders are not all safe as many mass market and craft ciders use beer yeast propped up on gluten-containing mediums (which means the resulting cider contains gluten).

Some good news is that there are more grains that don't contain gluten than grains that do. Grains like millet, corn, buckwheat, rice, amaranth, quinoa, certified oats (oats grown in a field that has not grown wheat before), teff, and sorghum, just to start the list off, are all safe for celiacs to consume. And the vast differences in flavors are sure to keep your imagination running wild. That being said, there is still education necessary for the wheat-eaters, as many can't wrap their heads around the fact that all these grains can be malted and used to make great beers. One thing that is important to consider is that gluten-free brewing has been going on since the days of ancient cultures. Many ancient cultures were making gluten-free alcoholic beverages before gluten was really a concern. They also didn't write much stuff down, so it is understandable that there is a learning curve when it comes to this type of brewing.

Today there's even more hope for both the gluten-free brewer and the gluten-free beer drinker: At the time of writing this article there are 12 dedicated gluten-free breweries in the US, and many 100% gluten-free brands on the market as well (links and references at the end of this article). A dedicated gluten-free brewery doesn't allow any gluten even on their premises, whereas a 100% gluten-free beer uses no gluten-containing ingredients from start to finish, but may share a brewing space with barley beer.

Photo by Robert Keifer

A beer can only be called gluten-free if it does not use any gluten-containing ingredients (such as barley and wheat, which beer is traditionally brewed with). However, there are many substitutes such as pale millet malt and crystal rice (pictured here).

SIMILAR, BUT NOT THE SAME

Nomenclature is important when considering how to educate people on this style of brewing — one thing that is in debate at this time is how to name gluten-free beers. You can get pretty close to classic styles with gluten-free ingredients, but since they are different ingredients, they also have different tastes. For example, some say a bright, lager-aged gluten-free beer made with millet and Saaz hops should not be called a Pilsner. However, because it is made without Pilsner malt, my preferred term for this beer is a "millsner" instead. While what it is called may not seem of great importance to some, I've noticed first-hand how much difficulty regular brewers have with understanding the flavor differences within these grains in certain styles, and usually just chalk it up to an inferior product or something wrong with my fermentation (even when I followed the fermenting guidelines exactly) — however their tongues are expecting to taste barley and wheat malt when those grains aren't involved in the process.

That being said, I've still made gluten-free beers that have placed top 3 in regular Beer Judge Certification Program (BJCP) categories, so the most important thing as a homebrewer is understanding what your beer actually tastes like and then describing it as that instead of what you intended to brew (i.e. I've made a lager or two that really tasted more like Belgians due to the use of adjunct sugars).

ENVISIONING YOUR OWN GLUTEN-FREE BREW

When I first got started homebrewing I had no idea what I was doing and really hadn't done my homework; I just had a friend that was willing to let me mess around with their homebrew equipment. My first brew turned out to be a dismal failure (got poured down the drain), but I did some quick research and found an all-extract recipe that had been published in a blog by Ghostfish Brewing (a gluten-free brewery in Seattle, Washington). I was able to make a beer that I would call "passable" and took it with me to a music festival. When my friends didn't spit it out, I knew I had found my new hobby and dove head and shoulders in. And that's where it grew to a passion — I could drink beer again! And I also wasn't forced to only drink what the local stores had available, which was also passable, but I knew something more could be done.

I really wanted to understand everything I could about brewing science. I immediately downloaded a bunch of podcasts on barley brewing (as that was all that was available), started following gluten-free threads on homebrewtalk.com and eventually found out about a website called www.glutenfreehomebrewing.com, which really changed the game. Just about everything on their website is a malted and/or roasted version of a gluten-free grain. My jaw dropped through the floor, and I went nuts as it were. I began brewing up to four times per week and brewing more beer than I could drink, which was accelerated further when I inherited a Keezer from a friend. At this point, about any flavor was on the table for me. I jumped leaps and bounds quickly. And the rest they say, is history.

GLUTEN-FREE METHODS AND INGREDIENTS

The next section will go into some tips and tricks that I've picked up along the way. It is important to note that none of what I'm saying is doctrine, and based on your system, equipment, and brewing space, some of these suggestions will be more feasible than others.

Photo by Robert Keifer

My classic "millsner" — a Pilsner-like beer that substitutes millet for Pilsner malt.

Layering Your Grain

There are plenty of single-malt gluten-free recipes you can do, but to get the fullest and most traditional expression of flavor in your gluten-free homebrew you should consider adding a couple character malts. Also, certain grains do different things. Millet is a common base grain in this style of brewing — it lends incredible breadyness and has a nice cracker bite. However, it can be a little bit light in body or a bit seedy at times, so rounding it out with a touch of buckwheat or rice can help smooth that mouthfeel out and unify the taste that you want your yeast to express.

Additionally, overall, gluten-free malts can be up to 99% fermentable, meaning you should plan to add unfermentable dextrins to your brewing wort. For example, the starch structure in rice is mostly comprised of amylopectin, which can be converted easily by enzymes into glucose and maltose. Maltodextrin is a great choice (typically derived from corn or tapioca), so are buckwheat, certified oats, teff, and quinoa. Flaked ingredients are also great for texture and creating a lacy head, just make sure you trust the suppliers and the products are truly gluten-free (if they also use that same machine to make flaked barley, you might want to avoid buying from that supplier).

Roasts

Anyone who has tried making gluten-free toast at home knows this struggle — gluten-free grains go from pale to dark in a matter of seconds, and it is the same in the malt roaster. So much so that malts like Munich and Vienna millet malt look more layered in their color palate than 20 °L and 40 °L outright — some suggest that these current millet malts top out around 3–10 °L. Where they get their name is from the taste and not their operative color — which is something important to note. In order to do traditional styles you will likely need to employ crystal malts and other roasts to get close to those flavors you're trying to mimic, say, in a Vienna lager or doppelbock.

The good news is that I hear about a new roast coming out just about every month, so I know we'll have a malt menu that rivals barley very soon!

Mashing and Enzymes

It's no secret; barley and wheat basically want to be beer with their high enzyme content. Where 2-row barley malt has an enzymatic score of 120, millet malt has a score of 30 — which is why these gluten-free grains have always been seen as adjuncts instead base grains. I talk with gluten-free brewers all the time who are worried they're not getting the right sugar extraction from the grains and that's entirely normal, as opposed to brewing with barley where that is rarely the case.

When brewing with gluten-free malts you will need to add exogenous alpha and beta amylases in order to extract the correct amount of fermentable sugars into your wort. There is always the option of doing a cereal decoction and not using external enzymes, and we can get into that in advanced brewing articles.

There is some discussion on mash temperatures and how long to rest or recirculate, and that's where understanding more about the contents of the grains you're using comes into play. Techniques like step mashing can make a lot of sense depending on your grain bill, as un-malted grains or specifically grains like quinoa and buckwheat have high instances of beta-glucan, which can really gum up your lauter (I once had a lauter take me four hours! But that was only one time). Doing at least a beta-glucan rest between 120–135 °F (49–57 °C) has really done wonders for my brew days, and I've been able to make beers with 90% buckwheat.

Peculiar Ingredients

Reinheitsgebot be damned! I literally lost my mind the first time I started interacting with other gluten-free homebrewers when they would talk about the ingredients they use. You really start to loosen your definition of what a beer can be. To name of few of the oddities: Lentils, chestnuts, dates, sweet potatoes, cassava, elder catkins, carrots. Notice that this list didn't even included pumpkin or molasses as historical colonial-American recipes contained. Basically, adding anything that can lend a malty note or a fermentable sugar that doesn't contain gluten and you're well on your way to making a fantastic gluten-free beer.

Photo by Robert Keifer

There are lots of choices when it comes to gluten-free ingredients. This mash includes pale millet malt, caramillet, pale buckwheat, chocolate roast millet malt, American roast millet, buckwheat crystal (30 °L), James Brown rice, biscuit rice, roasted lentils/chestnuts, and cacao nibs.

Yeasts

Dry yeasts are currently the safest option on the market, as basically all of them are grown on gluten-free mediums. I have played around with liquid yeasts, but the washing process can be long and involved, and is not recommendable as those yeasts are made on gluten-containing mediums and could mean that gluten is getting into your finished beer; proceed at your own risk.

Hops

The same basic rules around hopping techniques apply, but realize that you will likely finish just about all of your beers dryer than barley beers, so make adjustments as you go. I've made a lager that tasted more like a triple IPA before, and some of the best beers I've made used a continuous hopping method as opposed to two hop additions at the beginning and end of the boil.

FUTURE

So where does this leave us in a modern context? I don't think it gets any more creative or progressive than the gluten-free brewing space. There are new gluten-free beers hitting the market every week it seems, each with its own unique element. Brewing is in a renaissance, with so many classic styles being mashed-up and modified it begs the question why we even have styles in the first place? In that same vein, if you ask any three gluten-free brewers their methodology, you'll likely get five different responses! And that's what makes it that much more fun, and that much more of a science experiment.

Another interesting thing to consider when looking at gluten-free grains is that they also help promote diversity in agriculture, instead of the mono-culture that is the case in certain regions. Furthermore, grains like millet require a tenth of the water that barley does and are even drought-tolerant making them more sustainable as we consider things like global warming in our farming practices. I've been as bold as to say that maybe gluten-free brewing is the future of brewing.

GLUTEN-FREE RECIPES

NOT YOUR AVERAGE KILKENNY STOUT

(5.5 gallons/21 L, all-grain)
OG = 1.064 FG = 1.025
IBU = 23 SRM = 40 ABV = 5.1%

This recipe is near and dear to my heart as someone of Irish descent. My inability to drink Guinness Stout was the cause of a great deal of sadness for myself, my friends, and my family when I first changed my diet. This recipe was highly complimented at Club Night at HomebrewCon, and one person described it as "a quintessential dry Irish Stout." I believe this recipe works for two reasons: 1) Such a layered blend of malts, 2) A high finishing gravity. With a final gravity of 1.025 you may ask, "how is it a dry Irish stout?" These grains always seem to taste on the dry side, so you need the residual sugars to balance the roasts in this beer, otherwise it can feel like drinking liquid ash. Feel free to use other adjuncts like cacao nibs or other flaked ingredients if you want to play around with the mouthfeel and use less maltodextrin.
All of the grains in the following recipes are available for purchase on Glutenfreehomebrewing.com, produced by Eckert Malting and Brewing and Grouse Malting & Roasting Co.

INGREDIENTS

5 lbs. (2.3 kg) pale millet malt
2 lbs. (0.9 kg) buckwheat malt
2 lbs. (0.9 kg) chocolate roasted millet malt (140 °L)
1 lb. (0.45 kg) roasted CaraMillet malt (20 °L)
1 lb. (0.45 kg) French roast millet malt (325 °L)
1 lb. (0.45 kg) biscuit rice malt (5 °L)
1 lb. (0.45 kg) Goldfinch millet malt
0.5 lb. (0.23 kg) roasted buckwheat
0.5 lb. (0.23 kg) flaked quinoa
2 lbs. (0.9 kg) maltodextrin (15 min.)
1 lb. (0.45 kg) rice hulls
1 Tbsp. Termamyl Endo-Alpha Amylase
1 Tbsp. SEBamyl L
5 AAU East Kent Golding hops (60 min.)
(1 oz./28 g at 5% alpha acids)
1 oz. (28 g) East Kent Golding hops (whirlpool)
Whirlfloc tablet (15 min.)
Yeast nutrient (15 min.)
Mangrove Jack's M15 (Empire Ale) or
Lallemand Nottingham Ale yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 6 gallons (23 L) of strike water to 165 °F (74 °C), add 1 heaping Tbsp. of Termamyl Endo-Alpha Amylase. Mash in grains. The temperature of the mash will drop to about 150 °F (66 °C). Add 1 heaping Tbsp. of SEBamyl L. Rest for 1.5–2 hours, or until mash passes iodine test. You may want to raise mash temperature to 160 °F (71 °C) after an hour. Recirculate and heat mash to 168 °F (76 °C). Sparge with about 2.5 gallons (9.5 L) of water or enough to collect 6.5 gallons (25.6 L).

Boil for 60 minutes, adding hops according to the ingredients list. With 15 minutes remaining in the boil, mix maltodextrin with warm water before adding directly to boil — enough water to make it aqueous. Also add the Whirlfloc and yeast nutrients. At the end of the boil, turn off the heat and add the Kent Golding hops. Give the wort a long stir to create a whirlpool and let settle for 15 minutes.

Chill wort to yeast-pitching temperature and transfer to fermenter. Ferment at 68 °F (20 °C) until the gravity falls to 1.030 or below. Rack to secondary. Cold crash after one week, add biofine if you desire and hold until it's as bright as you like. Bottle or keg as usual. Serve at cellar temperature for best malt expression.

NOT YOUR AVERAGE KILKENNY STOUT

(5.5 gallons/21 L, partial mash)
OG = 1.064 FG = 1.025
IBU = 23 SRM = 38 ABV = 5.1%

INGREDIENTS

4.5 lbs. (2 kg) gluten-free syrup
(sorghum, brown rice, or tapioca)
2 lbs. (0.9 kg) chocolate roasted millet malt
1 lb. (0.45 kg) roasted CaraMillet malt
1 lb. (0.45 kg) French roast millet malt
1 lb. (0.45 kg) biscuit rice malt
1 lb. (0.45 kg) Goldfinch millet malt
0.5 lb. (0.23 kg) roasted buckwheat
0.5 lb. (0.23 kg) flaked quinoa
2 lbs. (0.9 kg) maltodextrin (15 min.)
1 lb. (0.45 kg) rice hulls
½ Tbsp. alpha amylase
5 AAU East Kent Golding hops (60 min.)
(1 oz./28 g at 5% alpha acids)
1 oz. (28 g) East Kent Golding hops (0 min.)
Whirlfloc tablet (15 min.)
Yeast nutrient (15 min.)
Mangrove Jack's M15 (Empire Ale) or
Lallemand Nottingham Ale yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Buy milled grains or mill grains at home (I use the triple blade Ninja blender at home for a few seconds because the grains are so small you need three passes in a mill). Place crushed grains in a muslin bag. Heat 7 gallons (27 L) of water to 135 °F (57 °C), then submerge the grains in the water and add ½ Tbsp. alpha amylase. Hold at this temperature for 30 minutes, then heat to 150 °F (66 °C). After 30 minutes, begin to heat to boil. Remove grains when the temperature hits 170 °F (77 °C), then stir in the syrup.

Bring to a boil and add hops according to the ingredients list. Follow the post-boil instructions in the all-grain version of this recipe.

GLUTEN-FREE RECIPES

GLUTEN-FREE PALE ALE

(5.5 gallons/21 L, all-grain)
OG = 1.058 FG = 1.012
IBU = 36 SRM = 7 ABV = 6%

This is a recipe I have brewed many times in many ways and is a great starting recipe for anyone trying to get their start in brewing, let alone gluten-free brewing. If you're using sorghum for the extract version recipe, my advice is to lean into the phenols that sorghum tends to produce (e.g. some describe it as metallic, chlorophenolic, or "twang-y") with hops that complement its natural flavors. I chose Cascade for this recipe as it is one of the easiest to source and it will likely bring back memories for those who drank barley beer before being diagnosed or changing diets. The grapefruit/resin-y taste that Cascade and other hops like Cascade emit are a great pairing with Sorghum and help to make an excellent all-around pale ale for any season – quaffable and tasty.

INGREDIENTS

9 lbs. (4.1 kg) pale millet malt
2 lbs. (0.9 kg) CaraMillet malt (3 °L)
1.5 lbs. (0.68 kg) biscuit rice malt
1 lb. (0.45 kg) pale buckwheat malt
0.5 lb. (0.23 kg) crystal rice malt
1 lb. (0.45 kg) maltodextrin (15 min.)
1 Tbsp. Termamyl Endo-Alpha Amylase
1 Tbsp. SEBamyl L
Whirlfloc tablet (15 min.)
Yeast nutrient (15 min.)
5 AAU Cascade hops (60 min.)
(1 oz./28 g at 5% alpha acids)
1 oz. (28 g) Cryo® Cascade hops (0 min.)
1 oz. (28 g) Cascade hops (dry hop)
SafAle S-04 or Mangrove Jack's M15 (Empire Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 6 gallons (23 L) of strike water to 165 °F (74 °C), add 1 heaping Tbsp. of Termamyl Endo-Alpha Amylase. Mash in grains. The temperature of the mash will drop to about 150 °F (66 °C). Add 1 heaping Tbsp. of SEBamyl L. Rest for 1.5–2 hours, or until mash passes iodine test. You may want to raise mash temperature to 160 °F (71 °C) after an hour. Recirculate and heat mash to 168 °F (76 °C). Sparge with about 2.5 gallons (9.5 L) of water or enough to collect 6.5 gallons (25.6 L).

Boil for 60 minutes, adding hops according to the ingredients list. With 15 minutes remaining in the boil, mix maltodextrin with warm water before adding directly to boil — enough water to make it aqueous. Also add the Whirlfloc and yeast nutrients. At the end of the boil, turn off the heat and add the Cryo® hops. Give the wort a long stir to create a whirlpool, then let settle for 15 minutes.

Chill wort to yeast-pitching temperature and transfer to fermenter. Ferment at 68 °F (20 °C) until the gravity falls to 1.015 or below. Rack to secondary with 1 oz. (28 g) of Cascade hops. Cold crash after 3 days and then hold until it's as bright as you like. Bottle or keg as usual.

GLUTEN-FREE PALE ALE

(5.5 gallons/21 L, extract only)
OG = 1.058 FG = 1.012
IBU = 36 SRM = 7 ABV = 6%

INGREDIENTS

6.6 lbs. (3 kg) gluten-free syrup
(sorghum, brown rice, tapioca)
2 lbs. (0.9 kg) golden Belgian candy syrup
1 lb. (0.45 kg) maltodextrin (15 min.)
Whirlfloc tablet (15 min.)
Yeast nutrient (15 min.)
5 AAU Cascade hops (60 min.)
(1 oz./28 g at 5% alpha acids)
1 oz. (28 g) Cryo® Cascade hops (0 min.)
1 oz. (28 g) Cascade hops (dry hop)
SafAle S-04 or Mangrove Jack's M15 (Empire Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Begin heating 7 gallons (26.5 L) water, stir in both syrups when the water gets hot. Boil for 60 minutes, adding hops according to the ingredients list. With 15 minutes remaining in the boil, mix maltodextrin with warm water before adding directly to boil — enough water to make it aqueous. Also add the Whirlfloc and yeast nutrients. At the end of the boil, turn off the heat and add the Cryo® hops. Give the wort a long stir to create a whirlpool, then let settle for 15 minutes.

Chill wort to yeast-pitching temperature and transfer to fermenter. Ferment at 68 °F (20 °C) until the gravity falls to 1.015 or below. Rack to secondary with 1 oz. (28 g) of Cascade hops. Cold crash after 3 days, and hold until it's as bright as you like. Bottle or keg as usual.

GLUTEN-FREE RECIPES

GLUTEN-FREE RED IPA

(5.5 gallons/21 L, all-grain)
OG = 1.057 FG = 1.014
IBU = 85 SRM = 9 ABV = 5.8%

Looking for something amber, caramelly, and hopped up? Another fun recipe that is reminiscent of the IPAs of a decade or two ago, with modern hopping techniques. I get a nice spicy pine off the bittering hops and amazing resin and fruit notes off the late hop additions, which complement a caramelly malt profile (especially in the all-grain version of this recipe). You can add more extract syrup to make this a double IPA if you feel that suits the color of this beer better. It's designed to be fun to make and fun to drink!

INGREDIENTS

9 lbs. (4.1 kg) pale millet malt
1 lb. (0.45 kg) CaraMillet malt
1 lb. (0.45 kg) biscuit rice malt
1 lb. (0.45 kg) buckwheat malt
1 lb. (0.45 kg) crystal rice malt
1 lb. (0.45 kg) amber rice malt
1 lb. (0.45 kg) maltodextrin
1 Tbsp. Termamyl Endo-Alpha Amylase
1 Tbsp. SEBamyl L
15 AAU Columbus hops (60 min.)
(1 oz./28 g at 15% alpha acids)
2 oz. (57 g) Centennial hops (0 min.)
2 oz. (57 g) Simcoe® hops (0 min.)
1 oz. (28 g) Centennial hops (dry hop)
1 oz. (28 g) Simcoe® hops (dry hop)
Whirlfloc tablet (15 min.)
Yeast nutrient (15 min.)
SafAle US-05 or Lallemand BRY-97 (West Coast Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 6 gallons (23 L) of strike water to 165 °F (74 °C), add 1 heaping Tbsp. of Termamyl Endo-Alpha Amylase. Mash in grains. The temperature of the mash will drop to about 150 °F (66 °C). Add 1 heaping Tbsp. of SEBamyl L. Rest for 1.5–2 hours, or until mash passes iodine test. You may want to raise mash temperature to 160 °F (71 °C) after an hour. Recirculate and heat mash to 168 °F (76 °C). Sparge with about 2.5 gallons (9.5 L) of water or enough to collect 6.5 gallons (25.6 L).

Boil for 60 minutes, adding hops according to the ingredients list. With 15 minutes remaining in the boil, mix maltodextrin with warm water before adding directly to boil — enough water to make it aqueous. Also add the Whirlfloc and yeast nutrients. At the end of the boil, turn off the heat and add the hops. Give the wort a long stir to create a whirlpool, then let settle for 15 minutes.

Chill wort to yeast-pitching temperature and transfer to fermenter. Ferment at 68 °F (20 °C) until the gravity falls to 1.017 or below. Rack to secondary with 1 oz. (28 g) each of Centennial and Simcoe® hops. Cold crash after 3 days, add biofine if you so desire and hold until it's as bright as you like. Bottle or keg as usual.

GLUTEN-FREE RED IPA

(5.5 gallons/21 L, partial mash)
OG = 1.057 FG = 1.014
IBU = 85 SRM = 9 ABV = 5.8%

INGREDIENTS

6.6 lbs. (3 kg) gluten-free syrup
(sorghum, brown rice, tapioca)
1 lb. (0.45 kg) biscuit rice malt
1 lb. (0.45 kg) buckwheat malt
1 lb. (0.45 kg) crystal rice malt
0.5 lb. (0.23 kg) roasted CaraMillet malt (20 °L)
1 lb. (0.45 kg) maltodextrin
½ Tbsp. alpha amylase
15 AAU Columbus hops (60 min.)
(1 oz./28 g at 15% alpha acids)
2 oz. (57 g) Centennial hops (0 min.)
2 oz. (57 g) Simcoe® hops (0 min.)
1 oz. (28 g) Centennial hops (dry hop)
1 oz. (28 g) Simcoe® hops (dry hop)
Whirlfloc tablet (15 min.)
Yeast nutrient (15 min.)
SafAle US-05 or Lallemand BRY-97 (West Coast Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Buy milled grains or mill grains at home (I use the triple blade Ninja blender at home for a few seconds because the grains are so small you need three passes in a mill). Place crushed grains in a muslin bag. Heat 7 gallons (27 L) of water to 135 °F (57 °C), then submerge the grains in the water and add ½ Tbsp. alpha amylase. Hold at this temperature for 30 minutes, then heat to 150 °F (66 °C). After 30 minutes, begin to heat to boil. Remove grains when the temperature hits 170 °F (77 °C), then stir in the syrup.

Bring to a boil and add hops according to the ingredients list. Add the Whirlfloc and yeast nutrients with 15 minutes remaining in the boil.

At the end of the boil, remove from heat and add the final hop addition. Give the wort a long stir to create a whirlpool, then let settle. Chill the wort to yeast-pitching temperature before adding the yeast. Ferment at 68 °F (20 °C) until the gravity reaches 1.017 or below. Rack to secondary with 1 oz. (28 g) each of Centennial and Simcoe® hops. Cold crash after 3 days, add biofine if you so desire and hold until it's as bright as you like. Bottle or keg as usual. BYO

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Beer Cocktails

WHERE HOMEBREW AND COCKTAILS COLLIDE

Whether you find the idea of a beer cocktail exciting and brilliant, or if you haven't quite jumped on the bandwagon yet, there is no denying that beer cocktails are gaining steam. Scroll through the almost 19,000 photos tagged #beercocktail on Instagram and find a sea of creative concoctions with every type of beer style and liquor you could imagine.

The combination of beer and spirits may seem like the latest trend, but these boozy beverages have actually been around for quite some time. In the 1700s, there is belief that in a newly born America, sailors drank dark beer, like a porter, mixed with nutmeg, rum, and lime juice. A Flip was beer mixed with sugar, rum, and eggs, and it was served hot. We all know the more modern-day classics, many of which are encountered during the college years, including the sake bomb (a shot of sake dropped into a beer), the lunch box (beer mixed with orange juice and a shot of amaretto), and the coronarita or beerita (a mix of a Corona or another light lager with a margarita). Possibly most famous is the poorly named Irish car bomb (a dry stout, which is often a Guinness, mixed with half a shot of Irish whiskey and half a shot of Irish cream liqueur, such as Bailey's.) But in today's world, those don't even make up the tip of the beer-cocktail iceberg.

Photo courtesy of Kona Brewing Co.

Two popular beer cocktails at Kona Brewing Co.'s Koko Marina Pub are their Blue-Wave Martini and Strawberry Longboard (recipes on page 50).

A COLLISION OF CRAFT BEVERAGES

The dance between the beer world and the liquor world is very much alive. Brewers turning to spirit artisans for use of barrels that once housed Bourbon, rum, brandy, tequila, and wine is extremely popular. High-alcohol barrel-aged beers are highly sought after with tons of buzz and often are the most expensive. Goose Island's Bourbon County line, Sam Adam's Utopias, Founders Brewing's Kentucky Breakfast Stout, and The Bruery's Bourbon-barrel aged Black Tuesday are just a handful of the most searched-for brews by beer lovers.

It makes perfect sense that as the craft beer world has exploded and continues to evolve incredibly over the last couple of decades, beer cocktails would follow suit. Drinkers demand a higher quality of craft beer today and are constantly seeking out beers brewed with innovative ingredients, with fresh techniques, and beers that push the limits. Mixing beer with other well-made products can take it to a whole other level.

"The cocktail world, like any other art form, is always looking for the next best thing," says Jon Yeager, co-author of *The Ultimate Guide to Beer Cocktails* and Co-Owner of PourTaste, a Nashville-based cocktail menu consulting company he owns with his wife, Lindsay. The two have been studying mixology for years and help develop fresh new cocktail recipes for bars, hotels, restaurants, festivals, and retail stores.

"Beer cocktails are like the equivalent of punk rock. There are no rules," he says. For him, it's all about trial and error and embracing the process of experimentation when he is coming up with recipes for a menu and as he and his wife did with the 50 recipes highlighted in his book. While he believes there are truly no set "guidelines" for beer cocktails, the mixologist does feel there are generally two starting points. He also says that while what works and what doesn't work may often surprise you, there are definitely some styles of beer that work better with certain spirits and flavors.

Essentially, he says you either start with a cocktail for inspiration that you'll add beer to, or you let the beer be the star of the show as the base of the drink, making up the majority of the cocktail. "For the novice beer cocktail drinker, start with the kind of drink you would normally make, and simply try to make it effervescent though the beer," he says.

Even though it's really to each their own when it comes to making a satisfying cocktail, Yeager finds that lighter beers, such as hefeweizens and other wheat beers, generally work well with sweeter fruit juices. These styles of beer mix well with the bright, acidic flavors found in shaken cocktails, including margaritas. In his recipe for a Frozen Brandy Crusta, for example, he combines a hefeweizen with Cognac (a variety of brandy), curacao (a citrusy liqueur), lemon juice, simple syrup, bitters, and then blends with ice.

Beer cocktails aren't just for lighter beers, however. Yeager gladly offers ideas for various beer styles. Beers with a dense malt flavor, such as Scotch ales and old-style English ales, work well in stirred cocktails like a Manhattan or an old fashioned. Because stouts and porters generally have a lot of body and texture, Yeager says both styles lend to be great bases. An espresso Stout is mixed with Woodford Reserve Rye, bitters, simple syrup, and orange zest in his Southern Drum cocktail. In another stout cocktail, he mixes the beer with rum, bitters, crème de cassis (a sweet liqueur made with black currants), and orange zest.

He combines a barleywine with cachaça, simple syrup, and lime juice in one recipe, and a pale ale with bitters, simple syrup, lemon juice, and vermouth in another. A smoked beer is added to pineapple, whis-

key, simple syrup, and bitters in the Gilded Trophy.

Part of the allure of creating beer cocktails is finding out for yourself what works, and on ocassion, what doesn't work.

"There are always going to be things you try to put together that don't work," he says. A cocktail mixing a banana beer with a ginger liquor was one miss that he recalls.

LATIN-INSPIRED BEER COCKTAILS

For Max-Antonio Burger, President and Co-Founder at Veza Sur Brewing Co., a Latin-inspired brewery in Miami, the feedback on their beer cocktails has been phenomenal. "There is always an inherent tension between tradition and innovation that pushes the boundaries," says Burger.

Veza Sur serves a beer cocktail created from staples in Latin America called the Michelada, often made with light beer, lime juice, hot sauce, tomato juice, and spices. But the team wanted to continue to push the limit and create beer cocktails that show beer can be even more than it already is. Besides all that innovation in creating beer cocktails, Burger explains there are the added benefits for him. By serving beer cocktails, they are offering non-beer drinkers something to enjoy with their beer drinking friends as well as helping newcomers explore and find a beer style they like.

The Tremendo Arroz Con Mango starts with a strong ale, one of their highest ABV beers at 10.8%. It's brewed with mango, ginger, habanero, and rice flakes. The beer is mixed with fresh Florida citrus, a housemade ancho pepper reduction, mango, and rosemary. The Lulo Bird takes their 3.8% ABV sour beer, which starts fruity and sweet and ends with a slight tartness, and mixes it with citrus, sage, pink peppercorn, and dried orange reduction made in-house.

As far as the process of creating the beer cocktail at the brewery, Burger says there is no one exact way, and it's a very open and creative process. A former cocktail, Special Jimmy's Colada, was made by simply mixing two of their brews – their Horchata Cream Ale and a Per' La Coffee Porter, a 5.6% ABV traditional porter cold-infused with a blend of medium and dark roasted Brazilian coffee. When choosing styles and flavors that work well together, he says it all depends on what you're going for. He's found that lagers work best for the Micheladas and Cheladas because they carry the spices best and mix well with lime, and sours work great with fruit-forward cocktails.

Burger says that bringing together brewers with mixologists and experienced bartenders is magic. "It energizes the team every time we explore and tinker with new ideas," he says.

FRUIT-FLAVORED BEER COCKTAILS

Kerri McGinley, bartender at Kona Brewing Co.'s Koko Marina Pub in Oahu, agrees with Burger's view that beer cocktails are popular because they are a great way to introduce non-beer drinkers to beer and also because they allow bartenders to get creative and shake up their menu.

It's a lot of trial and error, explains McGinley. "When crafting the cocktails, I think over which flavors I want coming forward in the drink and which beers would best make that happen," she says. Usually she opts for a lighter style, such as a lager or golden ale, so it doesn't overpower the other flavors in the cocktail.

Photo courtesy of Jon Yeakger

Jon and Lindsay Yeager, authors of The Ultimate Guide to Beer Cocktails, *suggest lighter beers pair well with sweeter fruit juices and maltier beers work well with stirred cocktails. Ultimately, however, beer cocktails are about breaking the rules and experimenting to find out what works.*

However, she says they do make a mean spicy Bloody Mary that's topped off with Kona's Blacksand Porter, a full-bodied beer with pronounced bittersweet chocolate.

McGinley has noticed that leaning more towards fruity flavors seems to work best, especially living in a tropical paradise. She avoids cream-based concoctions as she found these have a tendency to curdle.

TEXAS-STYLE BEER COCKTAILS

Owner of Mountain Cowboy Brewing in Frederick, Colorado, Ron Yovich is excited that beer cocktails are becoming more popular. "We believe that it is just another part of the evolution of the craft beer industry and craft beverages in general," he says.

His team is constantly experimenting with new beer cocktails, inspired by the season, holidays, and events. A fun way they gather inspiration is getting feedback from customers who take advantage of the "Putting The Spurs To It" option, which allows people to add a shot of any spirit to any of their beers. "If it sounds good and the customer likes it, we'll try it and possibly make it one of our new beer cocktails," he says.

Their take on an amaretto sour is the Go Where No Mangoes Sour Ale, a 7% ABV kettle sour brewed with fresh mango puree and local hops, mixed with amaretto and grenadine and garnished with maraschino cherries.

The Shot in the Dark mixes a double shot of espresso with the Coffee Milk Stout, a 6.25% ABV beer brewed with 10 pounds (4.5 kg) of their freshly roasted house coffee. The Red Eye Beer is the Plainsman Pilsner, a 5% ABV smooth-drinking Pils, mixed with tomato juice.

GET ADVENTUROUS

Beer cocktails are underrated, according to Gregg Buczkowski, Bar Manager at ThirstyBear Brewing Co. in San Francisco. "They can really be the best of both worlds," he says.

For him, beer cocktails are a logical choice to put on the menu at the brewpub. When creating one, he usually starts with a recipe of a classic cocktail and deconstructs it to work beer in. Although, he explains, that not every beer lends itself well to cocktails. "The beer cocktail slot (in our menu) is always the trickiest to fill," he says. "The most recent menu, I ended up using my fourth attempt."

Bitters or juices are the most essential ingredients in beer cocktails, he says. Stouts and IPAs have been the easiest for Buczkowski to work with. "More esoteric beers can be difficult as they don't often resemble the flavor profile of other liquids," he explains. "We currently have a strong brown ale that was just clicking with anything."

Buczkowski has found in his experience that it is more the liquor fans that are reluctant to try a beer cocktail rather than beer drinkers. He says feedback has been positive for beer cocktails. "As a small brewery, we tend to attract more adventurous drinkers," Buczkowski says.

Jon Yeager echoes the apprehension but from beer drinkers instead of spirit enthusiasts. "Beer lovers can sometimes cringe at the idea of adding something to beer since brewers put so much time into the beer," he says. Yeager feels that combining a beer with other producers' well-made ingredients embraces the idea of creativity that brewing is really all about anyway. "By this collaboration, you're giving the beer a whole new life and really opens up the product to a whole new crowd."

Adding spirits and other ingredients to a beer can completely transform it and make it into an entirely different drink. Beer can do astounding things for a cocktail. Depending on the beer, it can add bitterness or malty, roasty notes. It can tone down the sweetness to sugary drinks and even add carbonation to a drink. While some beer purists may feel the idea of adding anything to a beer they've worked so hard to create is ruining it; consider what you're adding to it. The same way brewers add herbs, or fruit, or coffee to a beer to take it to its full potential, so is true for cocktails. Adding a spirit from a local purveyor of a finely made whiskey can do the same.

Regardless of excitement or hesitation, beer cocktails aren't going anywhere, and you don't have to go to a hip bar or brewery to try your own when you make your own beer. Who has more control when it comes to creating a beer perfect for a cocktail than a homebrewer?

Mountain Cowboy Brewing's Shot in the Dark mixes a double shot of espresso with a coffee milk stout.

Photo courtesy of Mountain Cowboy Brewing Co.

Beer Cocktail RECIPES

Recipes from Thirsty Bear Brewing Co.

The method to make all of these cocktails from Thirsty Bear Brewing Co. is to combine all ingredients into shaker with ice, stir, and strain over ice (optional) into your favorite glass.

#17

INGREDIENTS

1.5 oz. (45 mL) Anchor Old Tom Gin
0.5 oz. (15 mL) lemon juice
0.25 oz. (7 mL) simple syrup
2 oz. (59 mL) golden ale

#18

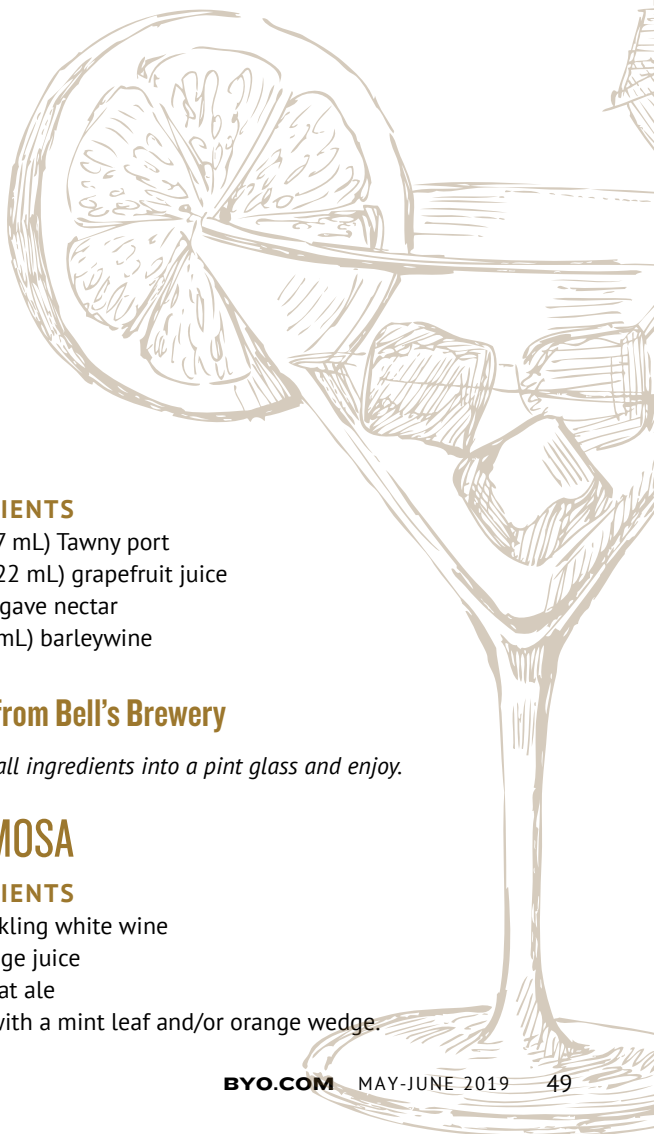
INGREDIENTS

1 oz. (30 mL) Amaro CioCiaro
1 oz. (30 mL) espresso
2 oz. (59 mL) imperial stout
0.5 oz. (15 mL) Xocolatl mole bitters

#22

INGREDIENTS

1 oz. (30 mL) Lunazul tequila
0.75 oz. (22 mL) jalapeño syrup
0.25 oz. (7 mL) grapefruit juice
0.25 oz. (7 mL) lime juice
2 oz. (59 mL) West Coast style IPA



#23

INGREDIENTS

0.25 oz. (7 mL) Tawny port
0.75 oz. (22 mL) grapefruit juice
0.25 oz. agave nectar
2 oz. (59 mL) barleywine

Recipe from Bell's Brewery

Combine all ingredients into a pint glass and enjoy.

BEERMOSA

INGREDIENTS

25% sparkling white wine
15% orange juice
60% wheat ale
Garnish with a mint leaf and/or orange wedge.

Beer Cocktail RECIPES

Recipes from Kona Brewing Co.

The method to make both of these cocktails is to combine all ingredients into shaker with ice, stir, and strain over ice (optional) into your favorite glass.

STRAWBERRY LONGBOARD

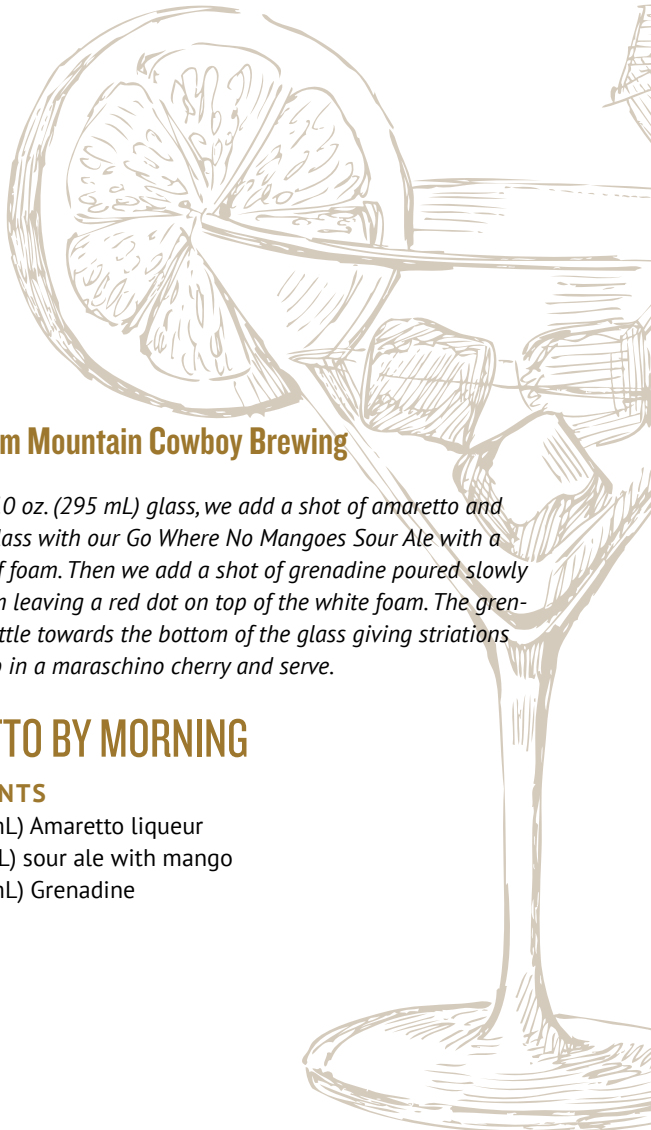
INGREDIENTS

1.5 oz. (45 mL) Stoli Strasberi Vodka
0.5 oz. (15 mL) Triple Sec
0.5 oz. (15 mL) orange juice
0.5 oz. (15 mL) pineapple juice
Splash grenadine
1 oz. (30 mL) American lager

BLUE-WAVE MARTINI

INGREDIENTS

1 oz. (30 mL) Stoli Blueberi Vodka
0.5 oz. (15 mL) Blue Curacao
0.5 oz. (15 mL) Midori
1 oz. (30 mL) pineapple juice
Fresh lemon squeeze
1 oz. (30 mL) golden ale



Recipe from Mountain Cowboy Brewing

Served in a 10 oz. (295 mL) glass, we add a shot of amaretto and top off the glass with our Go Where No Mangoes Sour Ale with a good head of foam. Then we add a shot of grenadine poured slowly into the foam leaving a red dot on top of the white foam. The grenadine will settle towards the bottom of the glass giving striations of color. Drop in a maraschino cherry and serve.

AMARETTO BY MORNING

INGREDIENTS

1.5 oz. (45 mL) Amaretto liqueur
7 oz. (207 mL) sour ale with mango
1.5 oz. (45 mL) Grenadine

Beer Cocktail RECIPES

Recipes from Veza Sur Brewing Co.

The method to make both of these cocktails is to build ingredients one by one in a glass, add ice, and then add the beer. Stir to combine all of the ingredients and then add the garnish.

SHOOT THE MOON

(This recipe gets its name because it uses Veza Sur's Shoot the Moon Berliner Weisse. If you want to use your homebrew, brew a Berliner weisse with guava that rings in around 3.8% ABV.)

INGREDIENTS

0.75 oz. (22 mL) Campari syrup
0.5 oz. (15 mL) lemon juice
0.25 oz. (7 mL) guava puree
12 oz. (350 mL) Guava Berliner weisse
8 mint leaves (garnish)

SEASONAL MICHELADA WITH PICKLED SWEET BELL PEPPERS

INGREDIENTS

0.5 oz. (15 mL) Buffalo Mexican hot sauce
0.5 oz. (15 mL) lime juice
0.5 oz. (15 mL) Pickled Bell Pepper Juice
Dash of Tajin classic seasoning
12 oz. (350 mL) Mexican lager
Dehydrated lime wheel (garnish)
Pickled bell pepper (garnish)

The Little THINGS to Brew Award-Winning Beers

Photo by Shutterstock.com

What separates the *best* from the *rest*

by Nicholas McCoy and Jeff Poirot

"What's your secret?"

It's a question we get asked all the time and even more often since winning the National Homebrew Competition's Ninkasi Award in 2017. But even before that, when we were consistently medaling at our local homebrew competitions in Texas, people would insist there must be some secret knowledge or ingredient we possess to keep winning. Sometimes we mess with people and say we only brew with holy water or source rare malt from the deepest forests of Madagascar.

But for *BYO* readers, here it is, the true secret to brewing beer worthy of winning competitions. Are you ready for it?

There is no secret! That's right, despite what you may be thinking, there is no one big secret that separates the average homebrewer from the person that always wins your local competition or is your area's regional homebrewer of the year.

So how do they keep winning every time in a blind taste test, in different competitions, over multiple categories? The difference is in all "the little things" that he or she does that, when added up, make a big difference in the quality and consistency of their beer.

So, we thought it would be a good idea to level the playing field a bit and write down the most important little things we (and many respected homebrewers who we know) do to make consistent high-quality beers that are of an award-worthy quality. (Note that the purpose of this article is to help you brew beer good enough to win — not necessarily on how to win at competition, which often takes into account a number of other factors we will just touch on in a sidebar on page 55). The great thing about this list is that most of these points you've probably already heard before or even read about in this magazine. You don't have to completely change your brewing process. Simply start implementing a few of these tips and processes to taste real results in your next batch. One last note of emphasis before we dive in; these are our tips that we employ, but by no means is there just one way to brew great beer.

INGREDIENTS

Water

If there is one idea we could remove from the (all-grain) brewing world, even on a professional scale, it's "if your water is good enough to drink, it's good enough to make great beer." This couldn't be further from the truth. All the great beer styles of the world you've come to know and love started in one way or another because of the content of their water. Pilsners were invented in the modern-day Czech Republic because of the soft water profile available in that area. Same goes with stouts from Ireland, altbiers from Germany, and even our beloved IPAs in England.

Water has changed, and we drink locally-sourced, filtered water that comes from a processing plant and not straight out of the stream. But there are all sorts of extra minerals and chemicals that are added to the process that aren't in the water naturally. Maybe you've noticed that for some unknown reason you make really solid porters, but your pale ales are lacking that essential hop punch; it might just be because of your water.

Furthermore, adjusting our water is the single most dramatic improvement we've made to the quality and consistency of our beer. The mineral content of your water affects the pH of your mash, which ultimately determines mash efficiency. Water also contributes to the overall taste of the finished product. It can make beers sharp and dry for hoppy flavors or smooth and round for malty ones.

The good news is you don't need to memorize every word in John Palmer's *Water* book just yet (although that is a great source of info). Here is a simple approach that doesn't require much additional knowledge to get started:

1. Get your water tested to know what mineral content you have in your local supply or, like us, just buy or make your own reverse osmosis (RO) water.

2. Download a free copy of Bru'n Water by Martin Brungard.

3. Input your starting water profile, and then based on your recipe, select the color profile that matches your SRM and select the desired finish in the beer (full, balanced, or dry).

4. Calculate the minerals needed to match that profile. To start, try using only a few minerals like calcium chloride, gypsum, epsom salt, and baking soda to match the profile. Avoid the use of chalk as it doesn't dissolve well in the typical homebrewer's process.

As a general rule of thumb we typically don't match a given city's water supply when making a regional style (ie. Munich or Burton) as you really don't know what those breweries are doing with the water once they get ready to brew. Once you get past the basics you can try using different water recipes to achieve those specific beer styles like Pilsners and dark milds. Give it a try — we think you'll be amazed by the results.

Malt

Malt choice is obviously an integral part of any recipe, but don't take for granted the source of your ingredients. Not all base grains are the same, even of the same type. Despite what some may tell you, there can be a big difference between maltsters. We have found that Rahr 2-row has the flavor profile we want in our beers as well as Weyermann when Pilsner malt is necessary, although others' preferences may differ.

We see a lot of homebrewers simply go to the store and ask for 2-row. If you do nothing else, figure out which one you prefer to use and stick with that maltster so that when you try to make changes to your recipe you're not attempting to hit a moving target. The same goes for specialty grains. If the first time you make a recipe you use Briess Caramel Malt 40L, make sure you use that again when rebrewing — it makes a difference.

Hops

When it comes to quality control, hops are probably the most common ingredient homebrewers fail to understand or control. Unlike malt, which has a very long-term shelf life, and yeast, which has the manufactured date right on the package, hops degrade quickly if not properly stored, and typically there is no date on the package at the

Photo by Charles A. Parker/Images Plus

The best way to store bulk hops — both whole leaf and pellets — is in vacuum-sealed bags, which will prevent oxidation. Bags made of material like mylar (above) will also prevent exposure to light. Store hops in a freezer to help them retain bittering and aroma properties.

homebrew shop. Most brewers simply grab an ounce of Mosaic® as needed and never think twice.

Think about this: John Mallett from Bell's Brewery spends 3–4 weeks every year securing the right Centennial hops from hop farms to make Two Hearted Ale. He, and many other brewers, go and smell each crop yearly. Hops are plants, and as such they don't taste the same every harvest, or even from one growing site to another.

For this reason, we buy hops in bulk from Yakima Valley Hops and Hops Direct. Here we know the crop year and can buy the same hops from the same farm if we find a crop we like. As a bonus, hops by the pound are typically priced 60–70% less than buying them by the ounce. You just need to be able to store them properly, and for that we use a vacuum sealer and deep freeze.

Yeast

Yeast is an area most homebrewers have a good deal of knowledge about but here is what we typically do for our batches. We always use liquid yeast. We find the variety of styles and quality of the finished beer superior to dry yeast, at least for now. Hopefully one day dry yeast will overcome liquid yeast as the shelf life and viability is much better, but for now, we stick to liquid yeast.

When buying from the store, make sure to choose a yeast that is as fresh as possible. For example, given a choice between Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale), choose the fresher pack. Sometimes there are no substitutes, like with Wyeast 3499 (Belgian Wit) or White Labs WLP833 (German Bock), but most of the time you can find a comparable substitute for most strains.

Also, you don't always need to make starters if you can buy the yeast fresh and double pitch, or if the gravity of the beer is low enough. We have had multiple beers that have placed and even won gold at the National Homebrew Competition (NHC) that were made without a starter. It is better to pitch two packets of yeast versus

BREWING FOR COMPETITIONS

OK, we said this story was going to be about brewing award-winning quality beer, but here is some advice to actually *win* awards once you've brewed that deserving beer.

Make a Competition Brewing Schedule

If you're serious about medaling at a competition you need to brew for that specific event so that each beer is at its optimal flavor when being judged. Don't expect your 3-month-old IPA to medal over the same beer that is made fresh. This can often mean brewing a bunch of beers in a relatively short period of time as many ales are in their prime 3–4 weeks after fermentation.

To help with this, make a few bigger beers that age well like imperial stouts or dark Belgian ales that have a longer shelf life. We will typically make a few of these batches a year and bottle most of the keg just for entering in competitions.

Power in Numbers

This is one of the best kept secrets of award-winning brewers; power is in the number of entries you submit. Depending on the quality and size of the competition, even the best brewmaster will only place with around a third of their entries. So if you see a good brewer win 3 or 4 medals, he or she probably entered 10 or more beers unless it is a smaller competition or they got lucky.

This is mostly because of the variables within a competition flight. Quality of the judging and order in the flight are massively important. Maybe you had a perfectly balanced IPA that was judged right after a 100 IBU double dry hopped competitor making your beer seem too malty. Or maybe the beer in front of yours got infected during bottling and the judges did not fully cleanse their palate and overlooked your entry.

We try to only enter larger competitions. Usually the following holds true: The larger or more well-known the competition, the better the judging will be. This means the better brewer will usually find it easier to place at a larger competition than the smaller one. This is because the better judges can usually pick out the best beer no matter the placement or variables within the flight (there are exceptions, of course, as there are some smaller competitions in which the quality of judges are very high).

Go Big with Flavors

As a general rule, beers on the higher end of a style profile do better than the subtler examples. For instance, IPAs with higher hop flavor or witbiers with bolder spices tend to place more often. If you're trying to make a dark mild, shoot for a really light porter; or for a pale ale make a small IPA. At the end of the day you are trying to separate your beer from the competition and big flavors usually do the trick.

Along this line, it is important to enter a beer in the category where it fits best, not where you intended it to enter. Let's say you made a brown ale and it came out lacking the hop punch you were going for. Maybe that beer will do better in the amber ale category where it is a little big for the style. Better yet, enter the same beer in both categories.

An Element of Luck

Like most things, there is also an element of luck involved in taking home top honors at competitions. It could be the beer was judged inaccurately, or maybe it was competing against a perfect example. That's all part of the deal when entering competitions. The best you can do is brew the best beer you are able to and then cross your fingers.

making a starter in too short of time (not having enough time for proper growth and decanting the spent liquid.) However, sometimes starters are unavoidable, like on high-gravity and lager beers.

RECIPE FORMULATION

Drink BEFORE You Think

Before we ever start to design a recipe we have a very specific beer and flavor profile in mind. The best brewers can think up a specific beer and make a recipe just like a great chef. Good news, the only way we know to achieve this is by drinking more beer! You must train your palate to a point where you can taste a beer and analyze its complex and subtle flavors.

A good starting point is to drink the beers listed for a given Beer Judge Certification Program (BJCP) style before creating a recipe. For example, before we make a Trappist dubbel we will go to great lengths to drink side-by-side as many of the commercial BJCP-listed dubbels as we can get our hands on. When you try these beers together you notice the different nuances that really make a style, and also what characteristics set certain examples apart from others.

Start with a Proven Recipe and Think in Percentages

Now that you have tasted a number of examples and narrowed down the beer you are trying to create, try to find a recipe that closely matches the beer or flavor you are trying to emulate — a great place to start is in the archives of *BYO* or another reliable resource. Often the information in these recipes comes from the commercial brewers themselves trying to help homebrewers. For example, if you are trying to make a cream ale similar to New Glarus Brewing Co.'s Spotted Cow, start by making a clone recipe or combine the common ingredients in the different recipes you find. If you're just trying to make a style, try a kit from your homebrew shop or choose a recipe from a reliable source.

When putting together the recipe for your equipment, think in percentages. Percentages make things a lot easier once you get better at recipe formulation. We hear many homebrewers talk about their recipes in pounds, but a pound of crystal 40 is relative to equipment and gravity, while percentages are constant.

Judge Your Beer and Rebrew

By this point you've made your beer and it turned out pretty good because you started with a solid or proven recipe. Here is the part we find most homebrewers skip — go back to the beginning. Drink your beer together with the beers you first tried when making the recipe decisions or against the beer you are trying to clone. How does it compare? Don't limit yourself with phrases like, "well, I am a homebrewer, and this is commercial beer, how could they possibly compare?" That's nonsense! Homebrewers have more flexibility and less constraints than the limits commercial brewers must stay within.

If you make a West Coast IPA, pour your favorite example and yours in a couple of glasses and drink them side-by-side. How are they different and what would you change? Maybe the difference is a small recipe tweak or maybe it's process-related. Now adjust your original recipe accordingly and rebrew it. Make sure to do this within a short enough period of time so that you can remember how the original recipe tasted. Better yet, have both the original and rebrew at the same time to see how the changes made a difference on the outcome (remembering that the age of each may have some impact, especially for hoppy beers). Now just keep repeating this process and don't stop until you're happy with the result.

Avoid the "Ugly Baby"

Homebrewers love making beer and after they have made a few good batches we find many brewers stop drinking their own beer critically. We've all been there; you're at a party or homebrew club meeting and someone hands you a Czech Pilsner and it's terrible. I mean scrub your tongue bad. There are only two reasons this happens — either they don't know what a clean example of the style tastes like or they have fallen victim to ugly beer syndrome — a beer so bad, so ugly, that only its brewer could love it. To avoid this, have as many people try your beer as possible and ask for honest feedback, enter competitions, or brew with a partner that will be honest about the results. The best brewers never stop drinking critically.

REPEATABILITY IN YOUR BREWING PROCESS

This is probably the number one difference between the top brewers and the rest. The ability to make a great beer and then being able to remake the same beer consistently is the hardest part of brewing beer. Here are some steps to help lock down your process:

Ingredients

We touched on this earlier, but when trying to brew the exact same recipe over again, make sure the ingredients you use are consistent. Use the same water, use the same base malts, use the same hops, and buy the same and freshest yeasts. Don't take for granted anything when selecting ingredients. If you're buying anything in bulk, be sure to store them in optimal conditions and don't be afraid to throw them out if they get too old.

Efficiency

Efficiency is a rabbit hole for many brewers, and admittedly was the part we struggled with the most when going from making average beer to winning medals. One myth to dispel is that the efficiency of your homebrew needs to be high; specifically mash efficiency. The only thing that matters when referring to efficiency on a homebrew scale is hitting the same numbers. It doesn't matter if your efficiency is 60% or 90% as long as you are able to repeat it.

Efficiency throughout the brewing process does have a huge effect on the overall flavor of the beer. If the first time you made that award-winning pale ale you started with a pre-boil gravity of 1.038 and on the rebrew your number was 1.032 then the beer and subsequent hop-to-malt balance

Milling affects the ability to lauter and the yield from the grist. If you want to be able to repeatedly brew a recipe, making sure the grains are milled in the same way is an important first step.

will be different.

We also find many brewers confused about the terminology. Mash efficiency is the amount of sugar you net from a given amount of grains in your mash. Brew house efficiency is the amount of finished beer you net from the entire brewing process. So, if you use BeerSmith, the number you input is brewhouse efficiency and contrarily mash efficiency is only a piece of that equation.

Mash Efficiency

Mash efficiency is the larger of the factors to focus on throughout the process. We implement a few simple steps to control the variables:

1. Mill your own grain. Many brewers have their local homebrew shop mill their grains and don't even think about the quality of the crush they are getting. Milling affects the ability to lauter and the yield from the grist. If your shop adjusts their mill or if you use multiple shops and online retailers, the milling will be different. Additionally, once the grain is milled the shelf life greatly diminishes. A fresher crush is always better.

2. Build water for your mash. We mentioned this earlier in depth, but your water recipe ensures you hit proper mash pH every time. For example, beers with roasted specialty grains can have a lower mash pH if not adjusted correctly, which will result in less sugar extraction.

3. Batch sparge or no sparge. There is nothing wrong with fly sparging and it is more efficient than batch sparging, but there are more variables. The speed of your lauter and pH of runnings all affect efficiency. So, we use batch sparging and even no sparge frequently. We have found this makes hitting our pre-boil number much more consistent.

4. Control the mash temperature precisely. We have both a heat exchange recirculating mash system (HERMS) and recirculating immersion mash system (RIMS) to control the strike and mash temperatures. Both setups are beyond the basic homebrew setups and can get pricey fast. If you must use a cooler or pot, be sure to preheat it with hot water before mashing in and avoid opening the top throughout the process. You might even want to go ahead and wrap the outside with a blanket or insulating

material. Try to keep the temperature within 1–2 °F (1 °C) of your target number. The HERMS and RIMS systems also continually recirculate the grain bed throughout the mash, which gives you crystal clean wort and an even mash.

Measurements and Notes

It is very important that everything you do during brew day is repeatable. So get a good digital scale for your grains, not the one you use in the bathroom. For hops, use a smaller, more accurate scale. You can get a blade scale that is accurate to the 100th decimal place inexpensively and they last for years.

Also, take gravity measurements throughout brew day. Make sure to measure your pre- and post-boil gravity numbers. It might be time to retire that $4 hydrometer that came with your starter kit and get a temperature-adjusting refractometer or even a digital version.

Take note of and write down anything that is different on brew day. You might just be making the best beer you've ever brewed, and it would be a shame if you cannot remember exactly what you did to make it.

Boil-Off

One of the most challenging aspects of brewing is controlling the boil-off or evaporation rate. Especially when you are making beer outside. Where we live in Texas the seasons change daily. Humidity and temperature both greatly affect the numbers. So don't boil as hard if brewing on a cold dry day vs. a hot humid day. If things are variable, we have a simple spreadsheet we use to chart the gravity from the pre- to post-boil numbers. Using this tool, we will check the gravity half way through the boil to see if we need to boil harder or softer the last half.

Drinking on Brew Day

There is an unsettling rumor floating around out there that you shouldn't drink on brew day. Blasphemy! It is our firm belief that you must drink beer to make beer (aka: A liquid offering to Ninkasi). However, do everything that is critical to the brew process before hitting the sauce. Typically this means we measure all ingredients for the day and sanitize all of our post-boil equipment before cracking a bottle open.

Boil-off rate can be affected by not only the amount of heat used to get a boil, but other factors such as the humidity and temperature. For consistent brewing, try to monitor the amount of wort lost to evaporation and make adjustments as needed.

AVOIDING OFF-FLAVORS

Infected beers or ones with off-flavors seem to derail many new brewers and even a few veterans. Here are some of the little things we do to help avoid the dreaded dumper:

Cleaning

Unfortunately, a large part of the brewing process is cleaning equipment. The best brewers learn to love cleaning and keeping everything organized throughout the process. The messy brewer seldom makes better beer than his cleaner counterparts. Take pride in keeping things well organized and squeaky clean.

Sanitizing

Nothing is worse than infected beer and new brewers seem to really struggle with sanitation. There are three easy steps we follow:

1. Clean everything to sight before sanitizing.

2. Sanitize items that don't touch the boil for at least 15 minutes. Use the boil to sanitize anything that will touch the wort post-boil if possible. This includes spoons, tubing, pumps, and chillers.

3. Use a no-rinse sanitizer. We have been using Star San for years and never have infected beer.

Longer Boils

We got this tip from Mike "Tasty" McDole at Homebrew Con a few years back. Boil all your beers for 90 minutes or longer. Every batch for us has an uncovered 90-minute boil. It eliminates all Dimethyl Sulfide (DMS). It also breaks up the brew day a bit, allowing us time to clean the mash tun, have a few beers, or check those ribs on the smoker before the hops start going in the boil.

Yeast Health and Oxygen

We mentioned earlier that it isn't al-

ways necessary to make a starter, but it is always necessary to pitch the proper amount of yeast. We typically use Brewer's Friend Yeast Pitch Rate and Starter Calculator (www.brewersfriend.com/yeast-pitch-rate-and-starter-calculator/) or Mr. Malty (www.mrmalty.com/calc/calc.html) for this calculation.

In addition to the right amount of yeast, you need the right amount of oxygen. We use pure oxygen and a stone to infuse our wort with the proper amount. Typically this is one minute of pure oxygen at 1-liter per minute for normal gravity ales. Higher gravity beers require more oxygen. If this equipment is not in your process then you need to agitate the wort aggressively before pitching. This means shaking the carboy as hard as possible for a minute or two. We can't understate the importance oxygen plays in yeast health and avoiding off-flavors.

Also, try using a yeast nutrient if you didn't make a starter using nutrients already. Wyeast has a great nutrient blend that we add in the last 15 minutes of the boil along with whirfloc tablets for fining.

Controlling Fermentation

We cannot stress enough the importance of temperature control during fermentation. Typically, brewers do this with a dedicated fridge and temperature controller, but you can use other methods. Whatever you do, make sure that you keep your fermenting beer at a temperature within the yeast's suggested temperature range to avoid unwanted esters and phenols.

Moreover, we almost always adjust the temperature of our beers during fermentation. Most yeasts benefit from a lower pitching temperature and slight temperature increase at the end of fermentation to help clean up any unwanted byproducts. Some styles also require temperature fluctuation during fermentation for proper flavor, like Belgian ales.

HAVE FUN AND BREW OFTEN

All these little tips and tricks aside, the best brewers love making beer and do it often. Tinkering with recipes, ingredients, equipment, and processes are what we love doing the most. Just like anything else, the more you do something the better you get at it.

Try to brew a few times a month even if it means throwing a little get together to get rid of some beer. The best part about homebrewing is sharing it with others. So get out there, have fun, and brew on! BYO

RELATED LINK

• There are many ways to control fermentation temperature. If you don't have space for another fridge, Byo.com Digital Members can get plans for this DIY temperature control system that utilizes an ice bath, temperature controller, fermentation jacket, and pond pump to keep your fermentation at a precise temperature: https://byo.com/project/build-fermentation-temperature-control-system/

The hardest Styles to brew

by Gordon Strong

Photo by Charles A. Parker/Images Plus

We at *Brew Your Own* recently posed a question to the readership on social media asking what styles they find hardest to brew, and why. The answers, as you'll see, varied from lagers to traditional ales, to newer styles and specialty beers. Well, the editors of *BYO* aren't just going to leave you hanging and questioning why you can't get that elusive style just right! So, we recruited "Style Profile" columnist Gordon Strong to see if he can get you past the landmines these styles pose with some pointed and quick-hitting advice, so your next batch is your best batch. While we couldn't get to every style readers offered up, we chose the ones that were repeated the most often and pose the biggest problems. So, here are the hardest styles to brew, and how you can brew them to perfection every time.

Tips to perfect the styles homebrewers struggle with

Pilsner

"You can't hide off-flavors." – Bob Savage

Photo by Charles A. Parker/Images Plus

I like judging Pilsners in good competitions because it seems to draw the best brewers for much the same reasons that Bob notes — you just can't hide a bad beer. Some of the more common problems I see when judging Pilsners involves yeast and fermentation issues (acetaldehyde, diacetyl, esters), insufficient lagering (lack of smoothness, overly sulfury), balance problems (too much body, not crisp enough in the finish, overly hoppy), lack of character (ingredients with too neutral a flavor profile), and issues that come from packaging/handling (oxidation, not fresh enough).

There are no real shortcuts for this style; you have to understand how to brew well and pay attention to every step in the process. If you try to cut corners, it will show. If you are unsure of any of the steps, review Greg Noonan's *New Brewing Lager Beer* — it provides an excellent foundation.

First, you have to start with very soft water (low mineral content) and fresh ingredients — preferably continental Pilsner malt, German or Czech lager yeast, and German or Czech noble hops (depending on whether you are brewing a Czech/Bohemian Pils or German Pilsner). Stale ingredients will show (malt will have a honey-like flavor, hops will seem dull and cheesy, and yeast will underperform). I don't like to use domestic "Pilsner" malts because they don't seem to have the right flavor profile of the best German and Czech examples. Spend some money and get good ingredients. I'm OK with using some US hops if they are markedly fresher than imported ones, as long as you are substituting hops with a similar flavor and aroma profile.

Second, you have to pay attention to stylistic details. German Pilsners are dry and crisp with a lighter body, so conducting a mash program for attenuation is important (step mashes are traditional). A good mash program will also help develop the necessary nutrients for the yeast. I sometimes do a short protein rest for clarity purposes around 131 °F (55 °C), with the main saccharification rest around 143 °F (62 °C), and a short alpha amylase rest at 158 °F (70 °C) to help build a little body.

Conduct a cool fermentation (around 50 °F/10 °C), otherwise you might have unwanted esters. Allow the fermentation to complete and fermentation byproducts to be reduced. Adding oxygen at the start of fermentation will help, and kraüsening can help the fermentation complete. I tend not to crash-cool my lagers since I do want to take advantage of the yeast continuing to clean up after fermentation is complete.

I don't like my lagers to be too sulfury, so select a low sulfur-producing strain, don't add excessive gypsum to the water, and run a traditional lagering program. I can tell the difference when someone rushes a lager, so take your time, lager at as close to freezing temperature as you can get, and rack once done. If you don't have the time or patience to brew a Pilsner correctly, then choose a different style of beer to brew instead.

I generally don't do a diacetyl rest because I don't choose yeast strains that produce significant diacetyl and I run healthy fermentations. But I always do check to see if it's present before reducing the temperature for lagering, just in case something unexpected happened.

Package your beer cleanly, not introducing oxygen. Keep the beer at cool temperatures for serving, and enjoy it while fresh. Keep the recipe simple, use classic ingredients, and resist the urge to add unusual ingredients. One of the best things about Pilsner is its simplicity. So embrace the "nowhere to hide" approach, and don't try to hide anything. Pilsners certainly are one of the hardest beer styles to brew, but they are also some of the best when brewed with care.

RELATED LINK:

· Looking for more on brewing Pilsners? Digital Members can find a story I wrote on award-winning Bohemian Pilsners here: https://byo.com/article/bohemian-pilsner/

Belgian Tripel

"Little to hide, challenging to brew to its appropriate final gravity." – Holger Michaelis

I'll tell you an embarrassing secret – I used to not like Belgian tripels. But enough people that I respected thought they were wonderful that I figured I must not understand the style well enough. So I did what any self-respecting beer geek would do; I took a trip to Belgium with the specific goal of learning about tripels.

Yes, I really was missing the point by tasting many American-made examples of the time. They often seemed more like pale barleywines with odd yeast than anything Belgian. Americans were focusing too much on the alcohol level and not enough on the mouthfeel. So the beers I was tasting were often heavy and sweet, in addition to being boozy and having an unusual yeast character.

Sometimes American brewers would understand that tripels should be highly attenuated. That's true, but if your starting gravity is too high then a highly attenuated tripel will still have a high finishing gravity and seem sweet or heavy. This is also a major problem with saisons, by the way. The trick is to start low and finish lower. If you have a finishing gravity below 1.010, do the math and figure out where you need to start to reach 8.5 or 9% alcohol. Hint: It's nowhere near where you'd start a barleywine.

A typical Belgian tripel recipe is dead simple: Belgian Pilsner malt and white sugar (I use around 20% in my recipes). A saccharification temperature on the lower end of the range or a step mash helps develop a fermentable wort – don't rely solely on the sugar for fermentability.

Many Belgian tripels seem sweet because of the high final gravity, but some also seem sweet because the IBUs are too low. One thing I learned in Belgium is that paler beers tend to be more hoppy and bitter than equivalent darker beers because there is less interest from the malt so the hops are providing the character (along with the yeast). As with saisons, many homebrewers make tripels with not enough IBUs. Add too many and it seems like you're making a Belgian IPA, but too little is also a problem that leads to a beer with a perceived sweetness.

The yeast provides a great deal of the character and there are differing opinions on which yeast to use. I found many small breweries in Belgium getting their yeast from the larger Trappist breweries. The two yeast strains that I saw most often used in Tripels was the Westmalle yeast (also used at Westveletern) and the Orval yeast. The Westmalle yeast is available commercially as Wyeast 3787 (Trappist High Gravity) and the Orval yeast as White Labs WLP510 (Bastogne). Either of these yeast strains will make a fine homebrewed tripel.

Belgian yeast strains can be used in different temperature ranges. While Westmalle and Westvleteren use the same yeast, they ferment at different temperatures (Westvleteren ferments higher). I recommend experimenting to find the ranges that taste the best to you; there is no one right answer. However, know that the 3787 yeast does not like to be chilled. It performs best when the temperature rises during fermentation. It is quite sticky and a blow-off tube is frequently needed. If it stalls, rouse it and warm it up a little.

With these active Belgian strains, the fermentation temperature inside the fermenter can be quite a bit higher than the ambient temperature. Some Belgian brewers ferment in shallow fermenters, which helps control the fermentation temperature, so be careful about fermenting too warm. Some strains (like the one from Chimay) will give unpleasant flavors if fermented hot (banana and nail polish remover is what I frequently taste). The dreaded headache-inducing fusels are also produced at warmer temperatures. Stay on top of your fermentation temperature inside the fermenter.

I like to warm condition my Belgian beers on the yeast to give them time to fully attenuate and to reduce some of the fermentation byproducts. This can be taken to the extreme, of course, but a couple weeks won't hurt and often helps keep the beer from being too rough. Once packaged, continue to condition the beers as you would for any beer of that alcohol level. Bottle-conditioning tripels is traditional to get the high carbonation level with the creamy, tiny bubbles and rocky, persistent head.

Above all else, brewers must remember that tripels are not barleywines.

Photo by Charles A. Parker/Images Plus

Irish Red

"Getting the color right." – Joel Rakoski

Photo by Charles A. Parker/Images Plus

Irish red ale in Ireland is similar to English pale ale in England, but in North America the beer is often a bit bigger, maltier, and darker in color. I am assuming you are talking about the American version of Irish red ale with this response, so it is the style that I will focus on with my response.

The color in Irish red ale comes from a combination of medium color crystal malt (40–60 °L) and a small dose of highly kilned grain, such as roasted barley. As with any recipe, the color and the flavor need to be matched because not all grains of a certain color give the same flavors. The medium crystal malt gives a caramel flavor while the roasted barley mostly contributes a drying note in the finish rather than an overt roast flavor.

Other recipe ingredients don't generally add much color. The base is often pale ale malt, there might be some oats or Carapils® present since the beer has a bit more body than an English pale ale, but the color generally comes primarily from crystal malts and roasted barley.

Most malts range in the color scale from yellow to brown, passing through amber and copper on the way. None of these are truly red, so don't set your expectations to be able to accomplish this through crystal malts alone. A light copper color is about as close as you can get. But remember that the darker crystal malts bring along stronger flavors than the medium color ones, and this often isn't what you want in this style.

Try an experiment sometime — take a little roasted barley and put it in a small grain bag. Heat up a pot of water to mashing temperature. Now dip the bag in the water and watch what happens. You don't see black right away, you start to see ruby red. If you leave it in long enough then you'll get black colors — but in small amounts and shorter exposure, you will get red. So if I want a red beer, I will often do just this. Steep a small amount of grain in my strike water until I get the color I want, then remove the grain and brew the beer.

You can also use this trick at the end of the boil to adjust the color. Taste it first, because you don't want to taste the roasted barley much. If it already has enough flavor, try using a debittered black malt like Carafa® III Special to make the adjustment. It's easy to go overboard, so I often do this by eye in the way I describe.

Because the reasoning from Joel for Irish red ale as one of the most difficult beer styles to brew was focused simply on color that is what I have focused on here. And, really, the rest of the style is a rather straight-forward brew-day. But, if you want more tips on brewing Irish red ales, you can find the "Tips from the Pros" in this issue (pages 18–19) on the subject of brewing Irish reds (which includes their own tips for getting the color just right).

RELATED LINKS:

- For a more complete rundown of Irish red ale and brewing techniques, check out Jamil Zainasheff's "Style Profile" column at https://byo.com/article/irish-red-ale-style-profile/

- Crystal malts are an important part of brewing an Irish red ale. Digital Members can find tips on brewing with crystal malts here: https://byo.com/article/crystal-malts-techniques/

- The largest contributor to the beautiful redish/amber color of an Irish red ale is with the use of just a little highly kilned grain, such as roasted barley. Digital Members can read more about roasted barley here: https://byo.com/article/dark-roasted-barley/

New England IPA

"Oxidation is hard to avoid with all the hops involved."
– Luiz Felipe Franco Garcia

I think the hardest part of making New England IPA is scraping up all the money needed to buy huge quantities of expensive hops. But I digress . . .

The question really comes down to how to use large amounts of hops without oxidizing them. I break this down into supply chain, hot-side use, cold-side use, packaging, and storage phases.

In the supply chain phase, the process starts with getting fresh hops. Not just well-stored hops, but hops from the current season. Then look at how the hops were packaged and stored. I prefer getting hops in oxygen-barrier bags that are nitrogen-filled. Finally, these hops should be stored in a freezer. Not just by you after you buy them, but from the point in which they were first packaged. I personally store my hops in a freezer set close to 0 °F (-18 °C). I only open them when I first am going to use them, and immediately reseal them and store the remainder in the freezer.

If your hops are old or oxidized when you buy them, they aren't going to be miraculously transformed into something wonderful. They stay oxidized and you can taste the difference. Look at the hops for signs of age. Fresh hops should be bright green with yellow lupulin glands. Stale hops will be dull green and brown, and have orange lupulin glands. Rub the hops between your fingers; reject any that have a cheesy aroma. They should smell fresh.

When making New England IPA, there may be a few hops used first wort, but most of them are going to be used post-boil. Again, do not break out the hops until you are going to put them into the wort. Add hops to the whirlpool (for homebrewers, this is usually the kettle once the heat has been turned off). Stir gently (don't whip) so that you aren't introducing oxygen on the hot-side. Once enough time has elapsed, chill and transfer the wort in a way that separates the whirlpool hops gently.

You can add pure oxygen to aid fermentation but only right before you pitch the yeast. The yeast should be active and ready to go. Even if you have sufficient yeast, you should still make a starter so that you are pitching actively fermenting yeast so there is as short a lag time as possible.

Some recipes call for hops to be added during fermentation, aiming to biotransform hop oils into new aromatic compounds. Again, get the hops from cold storage and use them immediately. When opening the fermenter, add the hops as quickly as possible and reseal it. Any oxygen incidentally introduced during this process is not a problem as the yeast will either metabolize it, or it will be pushed out by the carbon dioxide generated by fermentation.

Once fermentation is complete, you will begin transferring the beer and dry hopping. Many recipes call for doing this three times. So remember to always get the hops from cold storage right before usage every time.

Practice transferring wort without introducing excess oxygen. This means to transfer under cover of carbon dioxide, not just running a hose or racking cane into one container and filling another open container. Fill an empty keg with carbon dioxide. The easiest way to do this is to fill the keg with water and then push it out using CO_2. Once emptied and full of gas, the beer can be added to the keg. You can use gravity to do this as long as the fermenter is above the keg, and the keg is vented as it is filled.

Add dry hops in a mesh bag and put in the water-filled keg before pushing the water out. Then push the beer from the first keg into the now-empty second keg that contains the hops. Dry hops are usually used for two or three days, then discarded. If you want to cold-crash the beer before the last transfer, go ahead.

New England IPA is not the most stable of beers, so keep it stored cold and drink it right away. It won't get better over time no matter what you do, so keep it in a keg and enjoy it fresh. If given the choice, I would not package it into bottles as there is too much risk of adding oxygen then. You can take steps to minimize this, but you won't totally eliminate it. Only do the minimum number of transfers as necessary.

Photo by Charles A. Parker/Images Plus

English Bitter

"Easy brew day, simple ingredients, difficult to master." – Robert Merrall

Photo by Charles A. Parker/Images Plus

I'm not sure I agree that it's difficult to master; I guess it depends on what your goals are. Bitters in the UK can be quite different, so you aren't going to brew a single recipe that makes you think of all of them. You have to choose a target and visualize your goal. And you have to make sure you're actually making a bitter like in the UK, not a heavily oxidized or over-strength one that might be imported into the US.

I had this problem for a long time, until I actually went to the UK and tried them there. I was wondering why bitters in the US were caramelly and those in the UK tended to be fruity and hoppy. It was oxidation, plain and simple. Way back then, I trusted judging guides that said oxidation was sensed as cardboard and paper. Well, yes, but there are other ways of sensing it, and it turns out that amber beers often oxidize into a sweet, caramelly state with duller hops and lower bitterness. Some great beers are imported but the import formulation is different than the domestic formulation (cask versions can be different than bottled, as well). Try a fresh cask bitter if possible.

So, back to ideas for brewing bitters. Yes, there are simple ingredients and an easy brew day. But you have to source good-quality, fresh ingredients nonetheless. English pale ale base malts can have a wide range of flavors; not every malt is Maris Otter (nor should it be). Experiment with different varieties and maltsters to find ones that you like. Personally, I'm a fan of the maltsters Crisp and Thomas Fawcett, and I absolutely love Golden Promise malt.

There are a wide range of crystal malts as well, and they also have different flavors from maltster to maltster, especially the darker versions. So again, try different products and find the ones you like. Or at least understand their flavor profiles. If you aren't getting consistent results, make sure you aren't changing maltsters along the way.

The British aren't afraid of using brewing sugars and adjuncts, many of which have interesting flavors and/or mouthfeel effects, so don't be pompous about keeping your beer all-malt. Some of my favorite recipes use some corn or sugar (but rarely simple white sugar).

Traditional English hops are wonderful, but many UK brewers are using some US hops in their brews. Always go with fresh hops. Definitely learn what good Goldings smell and taste like; they are a great go-to hop for bitters.

Traditionally, English brewers use a simple infusion mash, often as part of a parti-gyle brew day (so it can be complicated after all). However, for a simple bitter, I wouldn't bother with that; single-step infusion is fine.

Pay attention to the gravity, alcohol, and bitterness levels for bitters. They are much lower than for most American beers, and that is part of their appeal. When in doubt, try to make a best bitter. You want to taste the hops, malt, and yeast, and the bitterness shouldn't make you pucker up. Remember that you are making a session beer – it should be easy-drinking.

Finally, try different yeasts to see what you like. They often emphasize different characteristics in beer. Some can be fruity, malty, minerally, sulfury-dry, or have other characteristics. One of my favorite all-around yeasts is Wyeast 1335 (British II), which is quite balanced but still has a good English character. I also like Wyeast 1968 (or White Labs WLP002) for its fruitiness and it is absolutely a great cask yeast since if flocculates so well. But many different British yeasts work for this style. Since bitter is low gravity, it's often easy to make a double batch and split the fermentation between two different strains as an experiment.

And please do try a cask-conditioned bitter. I like to serve them young and dry hop them in the cask. It's a great beer for a party since you don't have to worry about it going off over time because it will be long gone by then.

Sweeter Beers

"Getting the right balance." – Mark Armstrong

This is an interesting answer to our "most difficult style" question since it doesn't relate to a particular style. I tend not to brew many sweet styles, but I think there are some interesting things to say about this topic.

When people want to talk about sweet beers, I try to understand if they really mean *sweet* or if they mean *malty*. I enjoy malty styles like doppelbock, wee heavy, and English barleywine, but I don't like them to be excessively sweet. Malty means the flavor of malt, while sweet usually means the basic flavor of sugar. Some beer styles like London brown ale are back-sweetened with sugar, and that flavor is pretty obvious.

Balance plays a role in the perception of sweetness and maltiness, of course. Some styles that seem sweet on your palate just are lacking balancing bitterness (or sourness, or tannin). The final gravity of the beer measures how much unfermented sugar (or residual extract) remains in the beer, and ultimately how much bitterness it can take to balance the sweetness.

So if I'm trying to make a malt-forward beer that has the impression of sweetness, I try to reduce the IBUs to change the balance. If I go too far in the sweet direction, it's easier to add something to balance the beer (blending with a more bitter beer, age the beer on wood, encourage more attenuation using kraüsening, etc.) than it is to remove sweetness.

I sometimes make beers with intentionally less bitterness than a style demands. For example, when I make a braggot, I often blend a malty beer and a sweet mead. Too much bitterness in the beer tends to clash with the sweetness of the honey, so I like to be gentle with the IBUs. Or if I know that a beer will be barrel-aged I reduce the bitterness to account for the tannins that the wood will add.

These examples cover the cases of recipe design where sweetness is a big consideration. But sometimes there are cases where you need to adjust the balance of a specialty beer. My favorite approach to this problem is blending and using your palate to fine-tune the final product.

I was once asked to make a chocolate imperial stout for a retirement party. They didn't really give me enough time to brew an imperial stout, but fortunately I had a half keg of one I could use. I also had an experimental beer that had a large portion of chocolate malt in it, maybe 25%. I blended some of that in to increase the chocolate flavor, but the beer the person envisioned clearly had added chocolate in it. So I had to look at ways to bring those flavors in.

I used a combination of cocoa nibs, Dutch-process cocoa powder, and chocolate extract first. I soaked the nibs in vodka, blended and skimmed the powder, and added the extract. Still not enough chocolate flavor was present, so I tried blending in some Godiva chocolate liqueur. This combination had a good chocolate flavor but still was missing something – sweetness. So I kept adding lactose until the chocolate had enough balance. I know this has more of a feel of making a cocktail than brewing a beer, but it was a one-off project to fill a time-sensitive request. The person loved it, by the way, and we also made some great stout floats with it and some vanilla ice cream.

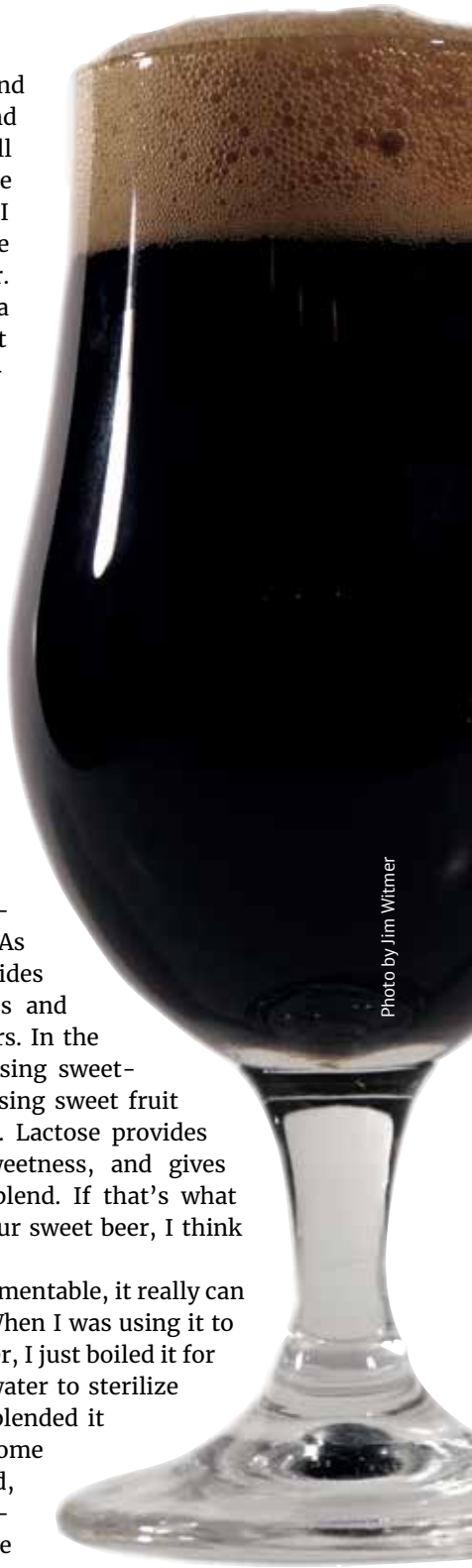


Photo by Jim Witmer

People that experiment with milkshake IPAs know that lactose provides the balancing sweetness and helps fill out fruit flavors. In the past, I had tried increasing sweetness in fruit beers by using sweet fruit meads to some success. Lactose provides a different type of sweetness, and gives creamy flavors to the blend. If that's what you're looking for in your sweet beer, I think it works very well.

Since lactose is unfermentable, it really can be added at any point. When I was using it to sweeten a fermented beer, I just boiled it for ten minutes in a little water to sterilize it, then let it cool and blended it into the beer. There is some trial and error involved, and expect to do repeated tastings to get the balance right. BYO

Experiment with Yeast

Performing yeast trials

by Karen Fortmann

In the beginning, fermentation was a mystery. We now know that the conversion of fermentable carbohydrates into ethanol and carbon dioxide is accomplished by *Saccharomyces cerevisiae* (or *Saccharomyces pastorianus* if we're talking lagers). We also know that there is more to fermentation then just alcohol and CO_2 — other yeast metabolism byproducts such as esters, carbonyl compounds, acids, higher alcohols, and sulfur compounds can all contribute to the final flavor, aroma, and mouthfeel of beer. Similar to changing wort composition or dry hop regimes, changing your yeast strain or varying fermentation parameters is one of the quickest and easiest ways to alter your beer.

The genetic makeup (genotype) of the yeast strain used can dictate the types and quantities

Photo by Charles A. Parker/Images Plus

of these organoleptic compounds (phenotype) — therefore changing the yeast strain can greatly affect the sensory attributes of your beer. However, changing the yeast strain isn't the only way to affect a beer's final sensory. Changing fermentation parameters can also be instrumental in honing in on the final flavor and aroma of your beer. This is because the environment that your yeast ferments in will affect its metabolism, growth, and overall health. This is not to discredit the role that wort composition or hopping regimes have on beer flavor and aroma; they play huge roles as well.

Nevertheless, experimenting with yeast strains and the parameters in which it ferments is a great way for brewers to optimize fermentation flavors. What's the easiest way to see this in action? Perform yeast trials of your own, of course!

Photo courtesy of White Labs

A yeast strain experiment performed at White Labs, all using the same wort but with different wild yeast strains.

Yeast trials can be conducted relatively easily without the need of specialized equipment. All you'll need is your wort and a couple of vessels to ferment in. Depending on your brewing setup, you can perform ferments in anything from 5-gallon (19-L) carboys to 1-quart (1-L) Erlenmeyer flasks. I'd recommend keeping the type of vessel consistent within an experiment and, of course, sanitation is paramount. In order to determine the impact that the yeast strain is having on your ferment you'll need to ensure that the only variable changing is the strain of yeast being used. This means keeping other factors like temperature, pitch-rate, dissolved oxygen (DO) levels, etc., the same.

EXPERIMENT WITH YEAST STRAINS

You might ask yourself when designing a new recipe, "How do I know what yeast to try"? Think about what kind of attributes you want your beer to have and then research the yeast strains that fit those characteristics. When you have your list of possible strains then it is time to conduct an experiment.

Are you looking to make a hazy IPA? Don't choose a super flocculent strain. Are you looking for a funky saison? Choose a high phenol-producing strain. You could also be looking for something completely out of the blue. Try brewing your award-winning pale ale in a split batch, one fermented with the recipe's usual strain and one with a strain that has a little funk like WLP644 (Saccharomyces Bruxellensis Trois). The world is your oyster when it comes to choosing strains to experiment with.

Another interesting experiment you could try is to perform dry yeast versus liquid yeast trials. You'd be amazed at the differences that you can detect in terms of changes in metabolites. Even things like clarity or head retention, which you might not immediately attribute to a yeast strain, can be noticeably different due to the yeast's interaction with wort proteins and hop compounds.

As far as wort goes, you can perform these experiments in any sort of medium like an IPA, a stout, or a blonde. Typically, when in the lab (I'm a Senior Research Scientist at White Labs), I tend to make a very simple all-malt wort with a specific gravity of 1.061 (15 °P) hopped to 25 IBUs with Iso-hop. Sounds appealing, right? Of coruse, you don't need to work with anything this bland in order to gain an understanding of the yeast's character; you want to be able to drink your experiment after all. However, the more neutral in flavor the beer is, the easier it will be to evaluate the differences in your experiment. So, at home, you may consider brewing a light lager, golden ale, or other style that has a low hopping rate and few specialty grains.

If the different yeast strains you're using in your experiment vary in their optimal fermentation temperature (they should be in the same ballpark if you are choosing between multiple strains for a particular beer style), it is usually a safe bet to ferment at 68 °F (20 °C) for ales or 54 °F (12 °C) for lagers. Consistency is key when it comes to this type of experimentation, so whatever you choose to do, do it the same every time.

In order to see an experiment us-

Table 1: Headspace gas chromatography results of final beer with different yeast strains. Values listed are in mg/L (ppm).

	Flavor Threshold	WLP001 California	WLP004 Irish	WLP023 Burton	WLP051 Cal V	WLP300 Hefeweizen	WLP570 Belgian Golden
Acetaldehyde	10	14	16.3	9.8	10.1	8.6	62.4
Total Diacetyl	0.05–0.1	0.078	0.088	0.049	0.062	0.061	0.051
Ethyl Acetate	30–50	17.46	25.53	31.96	33.13	38.17	44.78
Isoamyl Acetate	1–2	0.51	0.61	0.63	0.97	12.78	7.85
1-Propanol	600–800	37.23	24.1	27.35	20.42	29.88	79.54
Isoamyl Alcohol	70	90.18	186.27	93.06	145.03	197.99	184.35

ing different strains on a single wort in action, we performed mini ferments at White Labs on a benchtop scale and ran the beer through gas chromatography to quantify some of the aromatic compounds present. While some compounds don't change much between strains, some compounds like Isoamyl Acetate, an ester that is typically described as banana, have huge variances between strains (Table 1, above). This experiment was performed in the lab wort I mentioned earlier, however similar trends should be seen with a more complex medium. Remember, this was the exact same wort split into multiple vessels; all fermentation parameters were controlled.

This experiment was performed in order to illustrate how these metabolites can vary between strains. You'll notice that the values for the compounds listed are all different across strains; no two strains produced the exact same amount of a given metabolite. This data is cool (in my humble opinion) because it validates what we already know from a sensory aspect. For instance, esters, which are fruity in aroma, are higher in both the Belgian golden strain and the hefeweizen strain — two beer styles in which esters are a common descriptor.

EXPERIMENT WITH FERMENTATION PARAMETERS

Another way to conduct yeast trials at home would be to vary fermentation parameters. These are things like dissolved oxygen levels, head pressure, temperature, pitch-rate, starting pH, mineral levels, agitation, etc. For the sake of brevity, we will focus on two of

Photo courtesy of White Labs

At White Labs, beer samples fermented with different yeast strains are run through a gas chromatograph to quantify some of the aromatic compounds created from the various strains.

Table 2: Headspace gas chromatography results of final beer fermented at different temperatures. Values listed are in mg/L (ppm) except for alcohol.

	Flavor Threshold	75 °F (24 °C)	66 °F (19 °C)
Ethanol	1.4% (abv)	5.04%	4.74%
1-Propanol	600 ppm	22.76	23.78
Ethyl Acetate	30 ppm	33.45	22.51
Isoamyl Alcohol	70 ppm	114.92	108.43
Total Diacetyl	0.1 ppm	0.0823	0.0746
Acetaldehyde	10 ppm	152.19	7.98

these variables: Fermentation temperature and pitch-rate. Similar to our yeast strain setup discussed before, you'll only want to change one variable at a time in order to really see the influence that this variable has on the final sensory of your beer.

Pitch-rate can be altered and played with very readily at home. Adjusting pitch rate will lead to different amounts of growth in fermentation. This change in growth will affect the type and amount of metabolites produced. Pitching rates will vary depending on the type of beer you're producing and the yeast strain that you're using, but generally speaking 0.75–1.5 million cells per milliliter per degree Plato is recommended.

In our yeast lab we use a cell counting setup that allows us to determine the exact number of cells being added to each fermenter. But, how can you do this at home?

If you're pitching directly from the manufacturer's yeast packaging (without a yeast starter) try adding two packets of yeast if you typically add one. Most manufacturers will list the concentration of the yeast on the package, so if you don't have a microscope, don't fret, just use the information given to you by the manufacturer. The general rule of thumb is that the higher the pitch rate the more fusel alcohol production and the lower the ester content.[1] Remember, the viability of your liquid yeast will decrease with age. The amount of death is yeast strain- and manufacturer-specific, but an overarching estimate for liquid yeast would be that about 5–10% of the yeast will die each month.

Varying fermentation temperature can be done at home if you have

Photo courtesy of White Labs

For this pitch-rate experiment, I used three different dry yeast strains and two different pitch-rates. The negative control is on the far left.

fermentation control or with a little ingenuity. Set up your ferments as before, this time only vary the temperature at which you're fermenting. You'll want to make sure that the temperatures are not out of the realm of normal fermentation temperatures. Most strains will come with a recommended fermentation temperature range. Try fermenting at the top and bottom of that range. For most ale strains I'd stay between 61–77 °F (16–25 °C) and most lager strains between 48–59 °F (9–15 °C). Generally speaking, a higher temperature will increase the metabolic compounds formed.[1] The effect that temperature has will be yeast strain-specific as well. Certain yeast strains have the capacity to handle higher fermentation temperatures better that others and the same is true for lower temperatures.

I performed a trial at White Labs using WLP001 (California Ale) in the aforementioned lab wort at 66 and 75 °F (19 and 24 °C). Interestingly, you don't see much difference between metabolites except for acetaldehyde (green apple), which was significantly raised with higher temperatures (Table 2). Acetaldehyde is considered a major off-flavor in beer, therefore in this instance I would conclude that this strain performs better at lower fermentation temperatures.

Photo courtesy of White Labs

For this temperature experiment the same wort was fermented with the same strain. The two middle carboys were at a higher temperature than two on the outside.

HOW TO EVALUATE YOUR EXPERIMENTS

While I know that many of you have homebrew setups that would make even the most experienced brewer jealous, there is a good chance that most of you don't have a gas chromatograph at your disposal. So how do you evaluate the effect that your yeast trials have had on your final product? An easy and quantifiable metric that you can measure is the speed of fermentation. This involves taking daily pH and gravity readings to track the progress of your fermentation. It's possible that you might not notice a huge sensory difference between two strains, but one strain might reach final gravity a full two days before another and we all know time is money.

If you are interested in the quantifiable sensory attributes of your beer, you could send your experiment to an outside lab (like White Labs, however labs that can perform these tests are scattered across most regions). These services cost a range of money depending on what exactly you are after, but as they're experts in the field and have the right equipment, you get results you can trust. Or you might be lucky and have a friend who works at a university or biotech company that might be able to run your samples for you in exchange for beer, (these are some of the best friends to have).

Another easy and enjoyable way to evaluate your results is to perform sensory on your final product. This can be done in more sophisticated ways than asking yourself "is this good or bad?" (though that is a valid question to ask). Sensory evaluation should encompass four aspects of your beer – flavor, aroma, mouthfeel and appearance. When trying to determine whether your experiment in yeast strain or fermentation parameters causes a noticeable change in sensory, try setting up a sensory test like a duo trio or a triangle test and then recruit some samplers. Details of how to set up these tests can be found online. Both methods are easy to set up and will help you evaluate whether there is a difference between your yeast trials. Another method you could use to evaluate your trials is to ask your panel (friends, homebrew club members, beer judges, etc.) to rank your beers using a 5-point hedonic scale.

When it comes to performing yeast trails, the biggest thing to remember is to only change one variable at a time so that you get a true understanding of how that variable affects the final outcome of your beer, mead, or cider. If your system allows for it, try your experiments at a small scale before ramping up to larger ferments. This will help keep you from making a bunch of bad beer. Overall, experimenting at home can be very enjoyable, especially when you get to drink your experiments.

RESOURCES

[1] Van Laere, S.D.M., Saerens, S.M.G., Verstrepen, K.J. et al. Appl Microbiol Biotechnol (2008) 78: 783. https://doi.org/10.1007/s00253-008-1366-9

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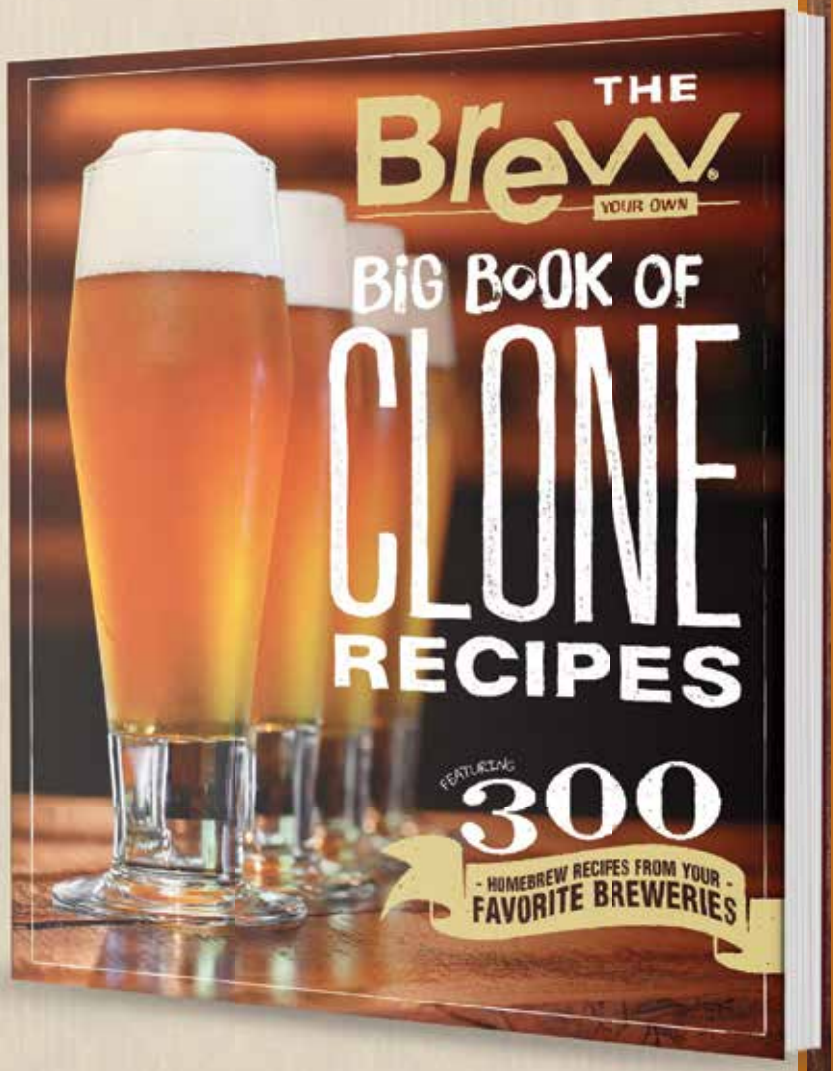

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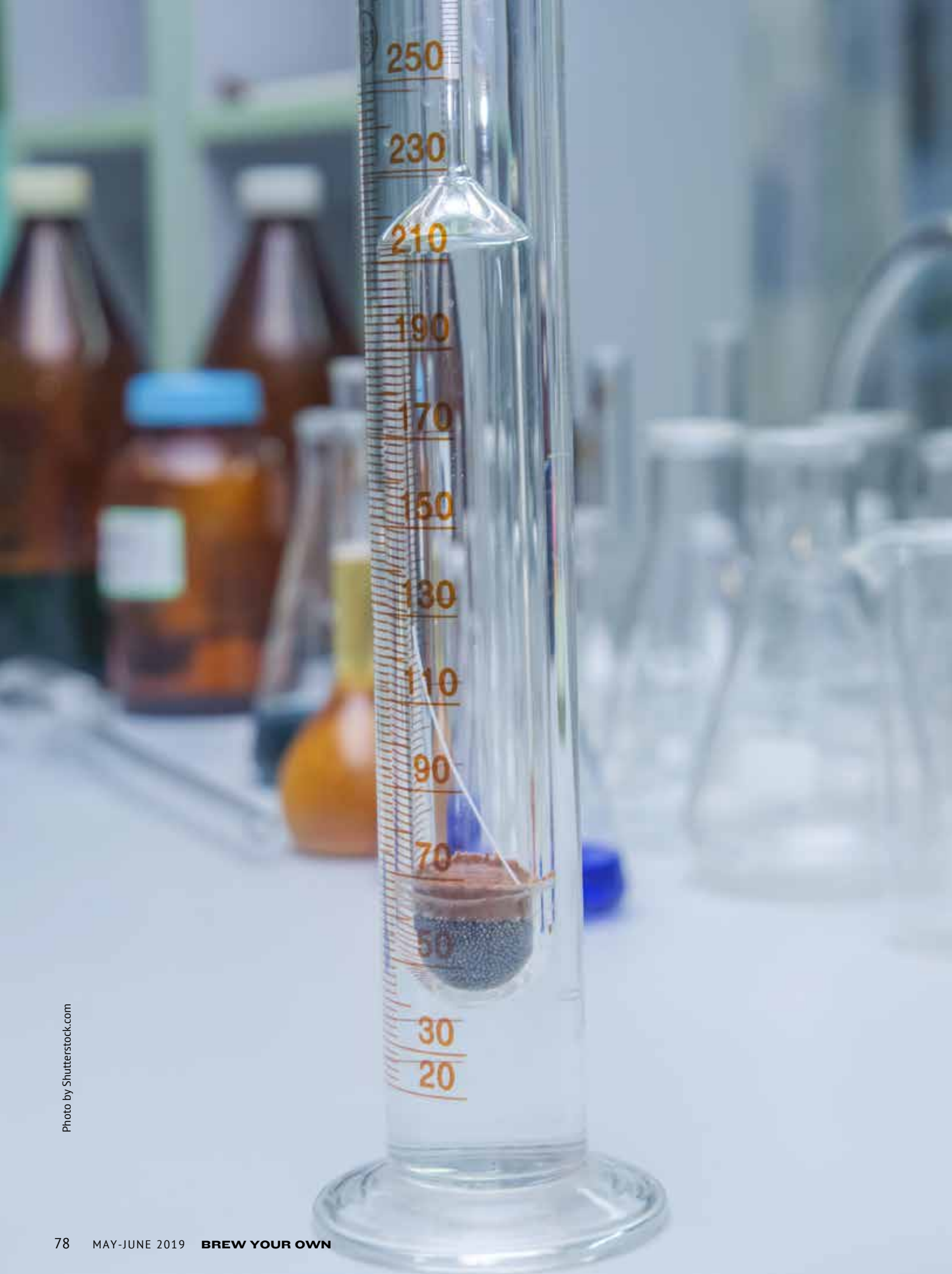

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Setting Up a Homebrew Laboratory

Tests you can perform at home

by Amy Todd

Everyone has their own reasons for homebrewing. Some do it for the creativity, others to be able to drink something they can't find in a store. Some enjoy making things themselves, or the challenge of brewing clone beers, or to see how well their beer does in a competition. Homebrewing is a skill you can keep improving on and learning about. Of course, the most common reason to homebrew is because it's a lot of fun and you end up with a bunch of beer to drink.

One of the things I love about homebrewing is that you can make beer as simple or as complex as you want. You can upgrade your system over time and add new tools to make things easier, more efficient, and tastier. Many people start out brewing with the basics and upgrade as they get more involved in the hobby. This is true of the brewing system, as well as the homebrewer's laboratory. Elaborate kettles and lab equipment may not be necessary to make beer, but they can help bring your beers to the next level. It is not hard to make beer. It is hard, however, to make *good* beer. And even harder still to make good beer on a consistent basis. Whether you're just starting out, or are an old pro, I'll take you through the basic equipment required to set up your own homebrew lab and start dialing in your recipes.

Don't let the word "lab" scare you away from this article. You may even be doing some of these things already! Brewing is one big science experiment and the more you do it, the easier it becomes and the more you understand. You start with just four ingredients but the variety of what you can produce is mind boggling.

Just as everyone has their own reason for homebrewing, there are many different reasons a homebrewer may decide to add some testing equipment to their process. There's the desire to learn even more about brewing. The challenge of hitting all your calculated values. Maybe you have a specific problem you've been experiencing and are trying to find a fix. You may notice some off flavors you want to work on identifying and eliminating. Some of these tests provide peace of mind and take a little of the unknown out of the process. The more you know about your beer and brewing system, the more you can improve. And who doesn't want to make better beer?

THE BASICS

Sanitation

One of the first things you learn when homebrewing is that you need to keep everything clean, so I'm not going to go into detail here. All homebrew supply stores sell various types of brewing sanitizer. Bottles of 70% ethanol, which can be purchased at a drug store and then fitted with a spray nozzle, are also handy to have around. I like spraying down carboy caps anytime I take a sample, even if it doesn't touch anything. While I am not going to get into the precautions and procedures of sanitation here, just know that it is of the utmost importance in the homebrew laboratory.

Brewing Notebook

This is where you'll keep track of your recipes and what you did on brew day; what you planned, and what actually happened. If you were aiming for a mash temperature of 156 °F (69 °C) but you ended up at 150 °F (66 °C), write that down. For your next mash you might want to aim a little higher. Any data you collect along the way should go in here. What was your mash temperature, when did it start, end, when did you add your hops, what was the alpha acid percentage of the hops, what was your starting gravity, etc. These notes should go beyond brew day as well. Any time you take a sample during fermentation, note the date and results. Every time I bottle I forget how much sugar I need so I flip back to my last batch of the same style in my notebook and there it is. If I want to make an adjustment based on style, I can alter my recipe based on previous results. You want to fill in sensory information on all of your batches too. More on sensory in a bit.

Thermometer

You probably already have a thermometer, but do you know if it's accurate? One brew day I had three different thermometers all read different temperatures. You can check the accuracy by taking the temperature of a cup of ice water, which should be 32 °F (0 °C). You can also check it against another thermometer (that works) or when water starts to boil, at 212 °F (100 °C)(at sea level). Different types of thermometers can also be really handy for different steps in the brewing process. I use an infrared one on the outside of my kettle as a quick check of how quickly it's heating up. It's also handy when I'm chilling my wort — no need to sanitize another piece of equipment! It's not super accurate but works great for what I am using it for.

To get a good temperature reading on my mash tun I use a meat thermometer with a probe designed to withstand the heat of an oven. Usually these are waterproof and you can stick the probe way down in the middle of your mash to get a more accurate temperature reading. Some of them even come with two probes and you can make sure you have consistent temperatures throughout your mash.

Hydrometer

This is something most of you are already familiar with as well. A hydrometer can tell us a lot of great information. It can tell you when your beer is done fermenting, and with a few calculations, the efficiency of your brew system and the alcohol content of your beer. Keep in mind

Photo by Shutterstock.com

A refractometer can be used to take gravity readings prior to fermentation with just a drop or two of wort.

Photo by Amy Todd

Yeast cell counts can be conducted using a microscope with a 40X objective lens and a methylene blue dye to identify the dead yeast cells.

hydrometers are very user- and temperature-dependent. These also need to be calibrated. Check out the videos made by the Brewers Association and American Society of Brewing Chemist on how to use and calibrate a hydrometer: *https://www.asbcnet.org/lab/webinars/Pages/BeerMethodsSeries.aspx.*

Wine Thief

If you're going to start taking more measurements of your beer then you'll need a way to get samples. The best way to do this is with a wine thief. With one of these, tipping and pouring from your carboy is no longer necessary and the risk of oxidation is decreased. Simply stick your sanitized wine thief into your carboy and pull out your sample. Since these are so long, they can be hard to sanitize (same goes for a racking cane when it's time to transfer your beer) so take extra care when sanitizing. If you go with a glass wine thief then storage containers meant to fit under the bed work pretty well to keep them safe when not in use, and can also house things like tubing and other brewing accessories.

BEYOND THE BASICS

pH Meter

There's plenty of information on adjusting pH for brewing online so I'm not going to go into much detail here about how to make adjustments, but I do want to talk a little about pH meter use.

pH meters range in price from $20 to $800. For a homebrewer I would look in the $50–$200 range. More expensive ones are often easier to use, more accurate, and easier to calibrate. pH meters need to be calibrated frequently and pH buffer solution, used for calibration, does not last for a very long time after it's been opened. Once opened, buffer solutions typically have a 3–6 month shelf life. You'll want to calibrate your meter every time you use it, so if you don't brew very often you might be better off with single-use packets. Keep in mind temperature will affect pH readings. Some meters have an automatic temperature correction function built in but this can only go so far. You will want to chill to room temperature before testing. Hot samples will also shorten the life of your probe, as well as leaving the probe sitting in a sample for an extended period of time. Never let your pH meter dry out and don't store it in water when not in use, use a storage solution recommended by the supplier.

Refractometer

These are also used to measure starting gravity and with the help of some calculations, final gravity. They only need a drop or two of sample vs. 100 mL or so when using a hydrometer. The biggest downside is that they're not accurate once there's alcohol in your finished beer, although there are calculations available for converting refractometer final gravity readings.

Magnetic Stirrer Hot Plate

I like equipment with multiple uses and these are really handy to have in your lab. They can be used to grow the number of yeast cells in a yeast starter, for conducting forced fermentation tests, and for stirring pH samples for more accurate measurements. If you want to get into micro and plating samples of beer, which this article doesn't cover, you'll also need one for making media. The combination heat and stir capabilities are going to be more useful, but also more expensive. The stirring function is the more important one, so if you're on a tight budget, just stick with a stir plate. You can find stir plates at most homebrew suppliers or refer to this article (*https://byo.com/project/build-stir-plate/*) on how to make a stir plate using an old computer fan.

Microscope

This is another versatile piece of equipment. Not just for brewing either, it's just fun to have a microscope around to look at whatever you want! With the help of a hemocytometer you can start counting the yeast cells in a representative sample of your yeast slurry and calculate how much yeast you need to add to each batch of beer. A methylene blue dye will identify dead cells, allowing you to calcu-

late the viability of your yeast. A microscope will be most useful to those who are collecting and reusing yeast or propping up wild yeast. Pitching the correct number of yeast cells is going to lead to healthier, more reliable fermentations with fewer off flavors.

If you're just looking at yeast, a microscope with a 40X objective lens (400X magnification when you add in the 10X eyepiece) is all you need. If you eventually want to be able to look at bacteria you'll need to look for one with a 100X oil immersion lens. Basic microscopes are available for around $300 but ones at this price point may only last a few years.

Outside Testing

Equipment required to perform some tests such as IBUs, color, and accurate alcohol measurements are not worth the price of the equipment on the homebrew scale. For those who want to know how their calculated values match up to measured values, there are several labs that offer testing for homebrewers. It can be an educational and beneficial learning experience to find out how the actual ABV and IBUs compare to your calculated values.

TESTS

The following two tests are fairly simple to do without much equipment. They are a great start to a more advanced homebrew lab and can provide some great information on troubleshooting or may highlight ways you can improve your brewing experience.

Forced Fermentation

This is an easy test that will quickly (2–3 days) tell you what gravity your beer should finish at. This is great for troubleshooting and can help determine if you have a yeast problem or other brewing issue. For those who make small batches or are concerned with cutting into their final volume too much, this one might not be for you.

How to do it:

Add 50–100 mL of yeast to a 1- or 2-L Erlenmeyer flask with a magnetic stir bar inside. Add about 600 mL of wort and cover with tinfoil. If you have a combination hot plate/stir plate, start spinning your pitched yeast with a little bit of heat. Try to keep it below 70 °F (21 °C). You want enough heat to get the fermentation moving along but you don't want to get to a point where you are stressing or killing the yeast. The stirring is more important than heat as it introduces oxygen and keeps the yeast in suspension. Essentially, you're making a mini batch of beer. With the continuous agitation, heat, and plenty of yeast, this mini fermentation should finish in 2–3 days. This will tell you what you should expect your main batch of beer to ferment out at. The forced fermentation is intentionally overpitched to show you what the wort is capable of fermenting to given plenty of yeast

If your main batch of beer and your forced ferment finish at the same expected final gravity, great. If both the forced ferment and your main batch finish higher or lower than expected, the difference is most likely due to the brewing process. If you are an all-grain brewer, I would first look at mash temperature then the crush of your grain. You may not have had an even mash temperature, or maybe you didn't get an accurate temperature reading.

If your forced ferment sample finishes lower than your main batch, you either have a stuck fermentation, or you didn't pitch enough yeast.

Forced ferment tests can be helpful if you're not quite sure if your beer is done or not. This test isn't necessary on a regular basis but could be used when troubleshooting fermentation issues or experimenting with different recipe and process variations.

Sterile Wort Test

This is a quick and easy check on the sterility of your brewing process and heat exchanger. Collect a sample of

Photo by Amy Todd

A forced ferment test will show the potential final gravity of a full fermentation within 2–3 days using a heated stir plate.

Photo by Amy Todd

A sterile wort test will determine if wort is free of yeast, bacteria, or other spoilage organisms.

chilled wort into a sterile container, before any yeast has been added. Working as quickly as possible, open the sterilized sample container with one hand (this takes a little practice) and fill using a sanitized wine thief with the other (as pictured above). Close the centrifuge tube and put it in a cup or some type of holder in case it leaks. Put the sample somewhere warm for a few days and then check for signs of fermentation. Signs of fermentation would be a hiss of carbonation when you open the tube, a turbid sample, or an off aroma.

Assuming you did everything correctly, and didn't introduce any bacteria while chilling your wort or filling your carboy, your sample should be sterile and not show any signs of growth after a few days and smell like warm wort. This is a good check if you use a counterflow or plate chiller and aren't quite sure you're cleaning it well enough.

Depending on your setup, it might be best to take the sample as you're filling your carboy, or maybe even after the carboy has been filled but before the yeast has been added. I like to buy sterilized 50 mL centrifuge tubes as they're easy to work with and have some give if your sample does start to ferment. This experiment is also a good introduction to micro as it gets you to work on sterile sample collection techniques.

SENSORY

Sensory evaluation is a huge part of quality control for professional brewers and the same techniques can be used in your homebrew lab. Your beer could hit all your target numbers perfectly but be undrinkable due to an off-flavor. Once you are able to identify off flavors, you can make the necessary brewing improvements to avoid those flaws in future beers.

The Beer Judge Certification Program (BJCP) is an excellent resource if you want to learn more about evaluating beer and identifying where in the brewing process off-flavors come from. The BJCP is a non-profit organization that ranks and certifies beer judges for homebrew competitions. Part of being a beer judge is assessing beers on technical merit and providing feedback on ways to improve next time. The BJCP has a ton of information on off flavors, including a "Beer Fault List" that covers various brewing faults, what they taste like, and most importantly to the homebrewer, how they are caused. Check with your local homebrew club to see if there are any study groups you can join. Some other useful resources are *Tasting Beer: An Insider's Guide to the World's Greatest Drink*, by Randy Mosher and *Brewing Better Beer: Master Lessons for Advanced Homebrewers* by Gordon Strong. You can even set up your own sensory lab to get a better understanding of how different ingredients affect your beer, which you can learn more about in this article: *https://byo.com/article/ingredient-sensory-methods/*

Have a standard set of evaluation questions to ask yourself when you taste your beers. Get into sensory mode and be intentional about it. How would you rate the hop aroma or malt sweetness? Is the body full or thin? How does it compare to what you expected? If you notice any off flavors, go back to your notes from brew day. Was there anything that may have triggered this flavor profile?

Looking at Your Data

None of this matters if you don't actually do anything with your data. It can be as simple as making a note of your water strike temperature and mash temperature and then adjusting for the next batch of beer if need be. Or you can start tracking daily gravity readings and chart out your fermentation curve in a Microsoft Excel spreadsheet.

Just remember, none of this is really *necessary* to make beer, but it can help you learn even more about this joyous hobby, and help you make *better* beer. You can make recipe adjustments based on data you've collected. You can be confident in what is taking place inside your fermenter. It can help you design recipes as you'll have a better understanding of what changes result in various outcomes. And, if you're like me, it can be a lot of fun.

Where to Buy Equipment and Supplies

Most homebrew suppliers offer a range of lab equipment and gear.Ebay is another great place to get inexpensive lab equipment such as a hot plate and stirrer, a used microscope, or pH meter. Cynmar is a good place to get consumable lab supplies because they have affordable prices and often sell supplies in packs of 10–25. This is great if you're only working on the homebrew scale and don't need 500–1,000 centrifuge tubes. Once you get to that stage, you can switch over to Weber Scientific of Fisher Scientific. Websites like Amazon are another option to get sterile supplies in smaller quantities.

Starting a homebrew lab doesn't have to be difficult or expensive. Just like when you first started homebrewing, there are always ways to improve and challenge yourself. Whatever your reason for starting a homebrew lab and expanding on the tests and measurements you take, you'll discover more and more possibilities with every batch of beer. With homebrewing there is always something new to try, and something new to learn.


BYO NANO CON
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BIG IDEAS FOR
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Sales & Marketing • Brewing Operations
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Save $200 when you register by August 5 — space is limited for this conference so don't wait to lock in your spot and also save!
Join Nano Breweries (and Nanos in planning) in the Portland, Oregon area for two days packed with over 30 seminars, workshops, and events geared just for you — the small-scale commercial brewery working on systems under 5 barrels.
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HIGHLIGHTS

Vancouver, Washington • November 1 & 2, 2019

BYO NANO CON

The Nano segment of craft brewing is growing fast with the majority of new breweries opening up falling into this small-scale, hyper-local segment working on brewing systems 5 barrels or under. But often this Nano niche can't relate to current educational events for the pro brewing industry because their scale of brewing and distribution models are so different from larger brewery companies.

Now's there's a conference just for you: The small-scale craft brewery. Learn the business, marketing, and brewing strategies targeted for your sized needs. From strategies to maximizing taproom sales to more accurately forecasting future ingredient purchases you'll learn over two days from experts and fellow Nano colleagues about actionable ways to improve – or launch – your brewery with ideas targeted just for your small-scale size and business direction.

30 BIG SEMINARS

Expert speakers will cover topics on brewing operations, sales and marketing, business operations, start-up and lots more all geared to Nano Breweries!

ROUNDTABLE DISCUSSIONS

Peer-to-peer learning bringing full audience discussions on a variety of subjects so you can learn what is working – and what isn't – from others working in the Nano Craft Beer segment.

TWO LUNCHES WITH KEYNOTE ADDRESSES

Learn during lunch with panel discussions on current Nano trends as well as expert tips for success on both the business and brewing side.

NANO-FOCUSED VENDORS

Check out the latest in equipment, supplies, and ingredients from leading companies focused on your Nano market and your specific scale and needs.

OPENING & CLOSING PACIFIC NORTHWEST BEER RECEPTIONS

Wrap up your full day of learning with sampling some of the Portland, Oregon region's finest craft beers served by the breweries on the trade show floor.

OPTIONAL 2-DAY PRE-CONFERENCE START-UP BOOT CAMP

Spend two full days leading into NanoCon learning from Steve Parkes, Lead Instructor and Owner of the American Brewers Guild, about the keys to starting up a new craft brewery both on the business side as well as the brewery side. This popular class has regularly sold out at past events.

OPTIONAL 1-DAY PRE-CONFERENCE BOOT CAMPS

Spend an immersive full-day workshop just before NanoCon starts exploring several key topics: Dr. Chris White on Yeast Management for Nanos, Audra Gaiziunas on Brewery Financials, and Ashton Lewis on Hands-On Nano Brewing Science.

OPTIONAL PRE- AND POST-CONFERENCE PORTLAND-AREA BREWERY TOURS

Here's your chance to easily check out the Portland area's famed craft beer scene. We'll offer different tours on both the day before and the day after NanoCon. One trip will head across the river to explore breweries in Portland while the second tour will stay on the Washington side to visit local craft breweries.

NANO LEARNING TRACKS

BYO NANO CON

BREWERY OPERATIONS

- Reliable Yeast Propagation Techniques
- 10 Mistakes Pro Brewers Make Impacting Beer Quality
- Brewing with Unmalted Adjuncts: From Flaked Oats to Coffee and Beyond
- Dry Yeast Techniques for Nanos
- New (and Classic) Pro Hopping Techniques
- Taproom Draft System Operations & Troubleshooting
- Do's and Don'ts of Mobile Canning & Bottling
- Nano Peer-to-Peer Table Topics

SALES & MARKETING

- Latest Email Strategies to Boost Your Business
- Brewery Branding Through Taproom Events
- Creating a Customer-Centric Nano Business
- Social Media Best Practices for Breweries
- Great Event Ideas to Pack your Taproom
- Leveraging Local Tourism to Boost your Brewery Business
- Training your Taproom Staff
- Nano Peer-to-Peer Table Topics

BUSINESS OPERATIONS

- Planning for Brewery Expansion
- Brewery-Specific Cash Flow Strategies
- 10 Insurance Mistakes Made By Small Breweries
- Your Biggest Legal Risks as a Brewery
- Roadmap to Better Brewery Financial Projections
- You're Never Too Small for Human Resources
- Understanding Taproom-Specific Accounting
- Nano Peer-to-Peer Table Topics

START-UPS

- Keys to a Strong Nano Brewery Business Plan
- 10 Legal Steps to Take Before You Open Your Doors
- Nano Case Study: One Brewery's Journey from Idea to Reality
- Brewery Insurance 101: Protection from Conception to Operation
- 1 Barrel, 5 Barrel, or More? Determining System Size
- Branding Strategies for Start-Up Nanos
- Keys to a Successful Brewery Website
- Nano Peer-to-Peer Table Topics

PRE-CONFERENCE NANO BOOT CAMPS

- Starting Up a Commercial Brewery (2-day class, Oct. 30 & 31)
- Hands-On Nano Brewing Science (1-day class, Oct. 30)
- Yeast Handling for Nano Brewers (1-day class, Oct. 31)
- Brewery Financials (1-day class, Oct. 31)

PRE- AND POST-CONFERENCE CRAFT BREWERY TOURS

- Portland, Oregon Breweries
- Washington State Breweries

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SEMINARS & EVENTS

BYO NANO CON

DAY 1 • FRIDAY, NOVEMBER 1, 2019 | 9:30 – 10:30AM

RELIABLE YEAST PROPAGATION TECHNIQUES
BREWERY OPERATIONS

Knowing how to properly and reliably step up the amount of yeast you need to pitch is a key skill for any professional brewer. And getting your fermentation off to a strong start with the right amount of healthy yeast is key to great beer. Take the guesswork out of this critical step by learning the correct techniques to propagate yeast in your brewery from one of the top experts in brewing yeast, Dr. Chris White, Founder and President of White Labs.

DR. CHRIS WHITE - PRESIDENT, WHITE LABS, INC.

BREWERY-SPECIFIC CASH FLOW STRATEGIES
BUSINESS OPERATIONS

Having a healthy cash flow is vitally important to any small brewing business (and helps owners sleep better at night!) As a business there are steps you can take to improve your cash flow to meet your spending needs. And as a brewery business there are industry-specific ways you can maximize cash flow with strategies that use the unique aspects of running a brewery to your advantage. Learn these specialized techniques to boost the amount of cash you have on hand with brewery financial expert Audra Gaiziunas. Who knows, you might even sleep better as a result too!

AUDRA GAIZIUNAS - OWNER, BREWED FOR HER LEDGER, LLC

BRANDING STRATEGIES FOR START-UP NANOS
START-UPS

Branding is essentially telling a story about your brewery. But with a start-up brewery you have an empty page of paper. Where do you start? How do you prioritize what you need to do with branding before you even pour a drop of beer? And how do you identify and then translate that story into a marketable package? Brewery branding consultant Ryan Wheaton is luckily here to help you make sure your first steps with figuring out your new brewery's branding strategies are the right ones and will offer a roadmap for future branding success.

RYAN WHEATON - FOUNDER, CRAFT BREW CREATIVE

LATEST EMAIL STRATEGIES TO BUILD YOUR NANO
SALES & MARKETING

Strategic email use can be a cost-effective way to boost beer sales, brand awareness, customer loyalty, special event attendance, and overall business in the taproom. But the key word is strategic – how much do you send, when do you send, and how do you even best build an email list? In this session you'll learn the latest email strategies other breweries are using to effectively build their sales and business from Alex Standiford, who consults and manages email programs for several small craft breweries.

ALEX STANDIFORD - DIRECTOR, FILLYOURTAPROOM.COM

10:30 – 11:00AM

COFFEE BREAK & EXHIBITS

NANO EXHIBITS

Grab a coffee and check out the latest in Nano-sized equipment, gear, ingredients, and supplies from dozens of craft brewing's top vendors.

11:00AM – 12:00PM

PLANNING YOUR BREWERY EXPANSION

BUSINESS OPERATIONS

Congrats! Your Nano Brewery is doing well. You've got customers buying your beer, your taproom is humming along, and you are maxing out the amount of beer your system and fermenters can handle. So you are starting to think about expanding your brewery, but where do you start? How big are you going to go and what are the different key brewery and business aspects to consider? Learn how to plan your brewery expansion in a thoughtful and strategic way to avoid future headaches and surprises with Deborah Wood of Brewers Supply Group who has helped numerous craft breweries in Canada grow and expand their beer volumes and revenues.

DEBORAH WOOD - BSG CANADA

SOCIAL MEDIA BEST PRACTICES FOR BREWERIES

SALES & MARKETING

Anyone can use social media, but how to use it strategically as a brewery business is another story. From Facebook to Instagram to Twitter there are plenty of opportunities to build your Nano business and create a loyal community of potential customers.

BREWERY INSURANCE 101: PROTECTION FROM CONCEPTION TO OPERATION

START-UPS

Starting up a brewery can feel like a big risk, but that doesn't mean you can't take steps to manage and protect your new business from unnecessary exposure. And the brewing industry comes with a whole set of specific insurance demands you need to know about before you ever even mash in your first batch of beer. Robin Campbell of CedarBrew Insurance will walk you through the commercial brewery insurance landscape so you better understand what coverage you need to consider both in planning and in year one of operation.

ROBIN CAMPBELL - RISK MANAGER, CEDARBREW INSURANCE

10 MISTAKES PRO BREWERS MAKE IMPACTING QUALITY

BREWERY OPERATIONS

Steve Parkes trains new commercial brewers for a living and over his decades of experience as one of the leaders in brewing education in North America he's seen it all. Now find out what are his top ten mistakes he sees fellow pro brewers regularly make that impacts beer quality. You'll walk away with an actionable list of ideas you can put to use in your brewery to make better beer. Get ready to learn how to avoid mistakes you may have never realized you were making – all in the name of better beer!

STEVE PARKES
BREWMASTER & OWNER, DROP-IN BREWING COMPANY
OWNER & LEAD INSTRUCTOR, AMERICAN BREWERS GUILD

LUNCH & NANO TRENDS ROUNDTABLE

GROUP SESSION
NANO EXHIBITS

Listen and learn after you enjoy lunch as a range of craft beer industry veterans discuss trends specific to the Nano segment from both the business as well as beer side. Nano exhibitors will also be available over lunch to visit.

12:00 – 1:45PM

EVENT IDEAS TO PACK YOUR TAPROOM ROUNDTABLE

SALES & MARKETING

Find out from your fellow Nano Breweries what's working in terms of hosting special events at your tasting room and what hasn't. From themed parties to special releases to different competitions, Nano Breweries have gotten very creative coming up with new ways to bring old and new customers in their doors. We'll have a panel as well as open up discussions for the entire room so everyone can learn new ideas from each other.

2:00 – 3:00PM

KEYS TO A STRONG NANO BREWERY BUSINESS PLAN

START-UPS

There are plenty of templates out there for creating a business plan. But the brewing business has its own specific needs and specialized considerations to keep in mind when you want to convert your dreams into a potential brewery launch. Luckily we have Audra Gaiziunas who helps craft breweries-in-planning write better business plans that will help your new brewery move off the drawing board and more successfully into business.

AUDRA GAIZIUNAS - OWNER, BREWED FOR HER LEDGER, LLC

YOUR BIGGEST LEGAL RISKS AS A BREWERY

BUSINESS OPERATIONS

Are you opening up your brewery business to legal risks without even realizing it? Join craft brewery lawyer Matthew McLaughlin to go over the biggest potential areas of exposure you face running a brewery. The brewing business is unique and one filled with specialized legal concerns as a result of alcohol production and intellectual property. Be prepared to be surprised about possible legal problems that could harm your business and get in the way of your mission of making great beer at your Nano Brewery.

MATTHEW MCLAUGHLIN - FOUNDER, MCLAUGHLIN, PC

BREWING WITH UNMALTED ADJUNCTS: FROM FLAKED OATS TO COFFEE & BEYOND

BREWERY OPERATIONS

Barley malt. Hops. Water. Yeast . . . and gummy bears, coffee, flaked oats, and so much more. Brewing commercial beers with ingredients outside the traditional big four is more popular than ever before and a big driver to customer interest and sales in your taproom. But how do you best tackle these unmalted adjuncts in your brewery since most equipment set-ups are designed for more traditional brewing ingredients? Pro brewer Ashton Lewis is here to help you get creative with your brewing recipes while getting the most out of them and making the best beers you can. He'll walk you through techniques and best practices to use unmalted adjuncts in your Nano Brewery.

ASHTON LEWIS
BREWMASTER & CO-OWNER, SPRINGFIELD BREWING COMPANY
SALES REPRESENTATIVE, BSG CRAFT BREWING
TECHNICAL EDITOR, BREW YOUR OWN

3:00 – 3:45PM

PACIFIC NORTHWEST NANO BEER BREAK & EXHIBITS

NANO EXHIBITS

Sample some local Nano craft beer from the Portland-Vancouver area as you check out the latest in Nano-sized equipment, gear, ingredients, and supplies from dozens of craft brewing's top vendors.

4:00 – 5:00PM

ROADMAP TO BETTER BREWERY FINANCIAL PROJECTIONS

BUSINESS OPERATIONS

Let's face it, if your business projections and forecasted budgets are not as accurate as they should be they won't do you or your brewery much good. Building your financial projections on a firm foundation will help you better anticipate the future money needs of your company and help you run it more strategically. The brewery business is highly specialized with unique accounting needs for this industry. CPA Maria Pearman focuses on the craft brewing segment and she will help you understand how to create more accurate projections for your Nano Brewery and give you a clear roadmap of what you should know and include in your forecasts.

MARIA PEARMAN - **PRESIDENT, RADIX ACCOUNTING**

NANO CASE STUDY: ONE BREWERY'S JOURNEY FROM IDEA TO REALITY

START-UPS

During the early start-up and planning phase of your journey to opening up a Nano Brewery, it is valuable to hear from somebody else who just walked that same path ahead of you. Mike Wenzel took his idea of opening a small-scale commercial brewery in upstate New York and turned it into a reality. Find out about the lessons he learned along the way, from what he got right and wrong in the planning stages to the current realities of the business side of making and selling his beer commercially. You'll be better prepared for your own journey to launching a brewery after you hear and learn from this Nano brewer who wants to share his very relevant experiences with you.

MIKE WENZEL - **CO-OWNER & BREWER, HELDERBERG MOUNTAIN BREWING CO.**

MOBILE PACKAGING DO'S & DON'TS

BREWERY OPERATIONS

With space and cash flow at a premium for many in the Nano niche of craft beer, the option of mobile canning and bottling lines opens up new sales channel possibilities without the required investment and upkeep with on-site equipment. Learn more about how to make the most of using a mobile packaging company so you can better take advantage of the flexibility these can provide you as a brewer and as a business.

OWEN LINGLEY - **OWNER, CRAFT CANNING & BOTTLING**

BREWERY BRANDING THROUGH TAPROOM EVENTS

SALES & MARKETING

Events in your taproom are a great way to bring old and new customers into your business to buy more of your beer. But events can also do much more than a one-time sales boost on a given day. Events can be a valuable tool in building and reaffirming your brewery's branding with customers (and even potential customers who don't attend the event but hear about it elsewhere.) Learn about the ways you can use your taproom events to not only drive sales, but also drive branding for your brewery as your story gets more defined in the public's eye. Ryan Wheaton, a brewery branding consultant, will walk you through how to incorporate branding into your taproom events that will help you long-term.

RYAN WHEATON - **FOUNDER, CRAFT BREW CREATIVE**

PACIFIC NORTHWEST CRAFT BEER OPENING RECEPTION
NANO EXHIBITS

5:00 – 6:30PM

We've invited some of our favorite Portland-Vancouver area craft breweries to join us to pour samples of their beer for you as a fun way to wrap up your first full day of NanoCon. You'll have the chance to talk with attendees, brewers, and visit with our exhibitors before you head out on the town to check out the incredible local brewery and taproom scene in the Vancouver-Portland area for the evening.

DAY 2 • SATURDAY, NOVEMBER 2, 2019 | 9:30 – 10:30AM

10 LEGAL STEPS TO TAKE BEFORE OPENING YOUR BREWERY
START-UPS

One of the biggest blind spots and areas of concern for new breweries starting up is getting a grasp on all the legal paperwork required for both a small business and especially a small business producing and selling alcohol. Federal, state, and local permits and licenses need to be completed as well as a host of other legal considerations as you get ready to open your doors. We're lucky to have Matthew McLaughlin, an attorney with years of experience helping start-up craft breweries, lead this seminar so you can better understand some of the most important checklist items on the legal side of your business well before you ever pour your first pint.

MATTHEW MCLAUGHLIN - FOUNDER, MCLAUGHLIN, PC

DRY YEAST TECHNIQUES FOR NANOS
BREWERY OPERATIONS

One option many Nano Breweries are looking at increasingly in their ingredient selection is dry yeast. Dry yeast has come a long way since the days of old, not-so-viable dusty packets found under the lid of a malt extract can during your earliest homebrewing days. More strains are being released and the quality has improved dramatically. Nano Brewers have taken notice while also attracted to the ease of storage and shelflife in their small breweries. But since dry yeast has been out of the mindset of many commercial brewers for the last few decades, what are the best practices to using yeast in a dry format? How do you make sure dry yeast results in the kind of fermentations you want with the end qualities in the beer you serve? José Pizarro from Fermentis will help bring you up to speed on the new world of dry yeast and how best to use it in your brewery.

JOSÉ PIZARRO - NORTH AMERICAN REPRESENTATIVE, FERMENTIS

LEVERAGING LOCAL TOURISM TO BRING IN MORE CUSTOMERS
SALES & MARKETING

You are doing your best to get the word out in a variety of ways about your craft brewery. But why not piggyback your efforts along with your town or region's own tourism marketing efforts? Craft beer remains a hot draw for visitors wanting to check out local spots of interest. And local visitors' bureaus know this fact and most likely would love to feature your business in their promotions. Learn how teaming up with everyone from city beer tourism operators to your local tourism office can bring more customers in your door to buy your beer and how you can take advantage of this team dynamic to raise awareness for your brewery.

MICHELLE MCKENZIE - VISIT VANCOUVER USA

UNDERSTANDING TAPROOM-SPECIFIC ACCOUNTING
BUSINESS OPERATIONS

The accounting behind making your beer and selling your beer in your taproom needs to have different rules applied if you want to run your business more strategically. Learn what the key accounting and financial guidelines should be for your taproom so you can understand your numbers more accurately to be in a better position to forecast your future and make key decisions. Learn what you need to know about the numbers-side of your important taproom-side of your business from CPA Maria Pearman, who specializes in working with craft breweries.

MARIA PEARMAN - PRESIDENT, RADIX ACCOUNTING

10:30 – 11:00AM

NANO EXHIBITS & COFFEE BREAK

NANO EXHIBITS

Refuel with a cup of coffee and check out the latest in Nano-sized equipment, gear, ingredients, and supplies from dozens of craft brewing's top vendors.

11:00AM – 12:00PM

NANO TABLE TALKS

GROUP SESSION

Peer to peer learning from your fellow Nano industry people at its best. We'll have dozens of tables each assigned a different topic of interest to Nano Breweries spanning brewing, sales, business, and start-ups. For 30 minutes you will trade advice and tips with the other people at your table on that specific topic. Then you'll switch tables to another subject of interest to you. So you'll have the chance to gain knowledge on two different specific subjects you want to explore (and maybe make some new friends and contacts along the way!)

12:15 – 1:45PM

LUNCH & NANO IDEA-O-RAMA ROUNDTABLE

GROUP SESSION
NANO EXHIBITS

Get ready to listen in as specialized craft beer experts each share their top favorite five ideas in a rapid-fire discussion after you wrap up lunch. Nano exhibits will also be open for you to explore during the lunch session.

2:00 – 3:00PM

NEW (& CLASSIC) PRO HOPPING TECHNIQUES

BREWERY OPERATIONS

The last few years have seen a change in how professional brewers look at hopping schedules and techniques with a shift towards late hopping. But there are still hopping techniques that have stood the test of time that also need to be considered as you pull together your next recipe. Pro brewer Ashton Lewis will cover both the new wave of hopping techniques as well as hit the classic hopping techniques you need to know as well. He'll cover both the hows and whys of the techniques so you can better understand when you make your hopping decisions.

ASHTON LEWIS
BREWMASTER & CO-OWNER, SPRINGFIELD BREWING COMPANY
SALES REPRESENTATIVE, BSG CRAFT BREWING
TECHNICAL EDITOR, BREW YOUR OWN

YOU'RE NEVER TOO SMALL FOR HUMAN RESOURCES

BUSINESS OPERATIONS

Yes, you are a small business. Maybe you are even the only employee or have one or two others to help you out with the brewing and selling your beer. But that doesn't mean you shouldn't follow some basic guidelines when it comes to human resources. Having procedures in place will help you navigate any potential trouble spots that can pop up and cause you much more than just headaches. Understand what you should minimally have in place for your business from a human resources standpoint to protect yourself and your business. It might not be as fun as brewing beer, but in many ways it is just as important.

CREATING A CUSTOMER-CENTRIC NANO BUSINESS
SALES & MARKETING

2:00 – 3:00PM

The old saying is "The customer is always first." But what exactly does that mean and how do you implement a customer-centric business? And what are the actual benefits of being customer-centric as you hand a pint of beer to a patron across the bar in your taproom? Get the answers to these questions and how being customer-centric can positively impact your bottom line with Audra Gaiziunas who works with craft breweries on the financial side of their businesses. She is all about hard numbers so you'll leave knowing more about the financial upsides of being customer focused.

AUDRA GAIZIUNAS - OWNER, BREWED FOR HER LEDGER, LLC

1-BARREL, 5-BARREL, OR MORE? DETERMINING SYSTEM SIZE
START-UPS

How big or small a brewing system do you want to have in place at your planned brewery? That's a pretty big question to answer and there are lots of factors to consider. How much beer do you want to produce? How much beer do you think you can sell? How often do you want to be brewing each week? Are there space limitations for your brewhouse? Walk through these questions and many more with John Blichmann who helps craft breweries figure all this out as a producer of small-scale brewing systems. During his years of selling small-scale systems John has heard all the questions and is the perfect person to help you on the path of deciding how big or small a system you should have in place on day one.

JOHN BLICHMANN - PRESIDENT, BLICHMANN ENGINEERING

PACIFIC NORTHWEST NANO BEER BREAK & EXHIBITS
NANO EXHIBITS

3:00 – 3:45PM

We've invited a new group of local Nano Breweries from around Portland and Vancouver to pour samples and visit with as you check out the latest in Nano-sized equipment, gear, ingredients, and supplies from dozens of craft brewing's top vendors.

TRAINING YOUR TAPROOM STAFF
SALES & MARKETING

4:00 – 5:00PM

Your taproom staff is the frontline of interacting with your end customers. They can easily help or hurt beer sales based on how well they interact with visitors. And ultimately they are a reflection of your brewery and will influence the enjoyment of your beer being served. Learn the best practices for training your taproom staff and how to make them more knowledgeable about your brewery's beers they are being asked to sell to customers. A server or bartender more knowledgeable about your beer will translate to a better customer experience, which then translates to more sales. Learn how to make sure your staff maximizes the opportunity to turn a first-time visitor into a longtime customer with the right training about your beer.

TAPROOM DRAFT SYSTEM OPERATIONS & MAINTENANCE
BREWERY OPERATIONS

You work hard to produce great beer in the brewery. Shouldn't you work just as hard to make sure that beer makes it from keg to glass in great shape? Cleaning draft lines and making sure your draft system is operating properly should be a priority when running a taproom. Learn the right cleaning techniques, how often to clean, and what other regular maintenance you should be doing so your draft system does the beer you brewed justice. Nick Klein, who works in the Portland, Oregon area working with draft systems, will teach you what you need to know so you can better take care of your draft beer back home at your brewery.

NICK KLEIN - ACCOUNT MANAGER, NORTHWEST DRAFT TECHNICIANS

4:00 – 5:00PM

KEYS TO A SUCCESSFUL BREWERY WEBSITE

START-UPS

Your website will be your billboard to the outside world for your new brewery. But what website elements need to be included as you design this new brewery website? Website budgets can quickly spiral upward if you aren't strategic about pages you need versus those that won't matter as much. You'll learn these website planning strategies from Alex Standiford who builds websites for breweries and has first-hand knowledge of what works and what doesn't for craft breweries. And ultimately what will drive more business to you and dollars to the bottom line.

ALEX STANDIFORD - DIRECTOR, FILLYOURTAPROOM.COM

10 BREWERY INSURANCE MISTAKES TO AVOID

BUSINESS OPERATIONS

Are you underinsured or even not insured and exposed to risk without realizing it? Craft brewing is a specialized industrial business with plenty of potential problems in addition to all that wonderful beer. Having the right insurance coverage in place, including policies specific for brewing beer, will reduce your exposure to unwanted risk. Robin Campbell will walk you through her top ten list of insurance mistakes you can avoid as a brewing business. You'll learn from other brewery's mistakes and leave with a better understanding of where you stand right now and what insurance moves you might want to consider.

ROBIN CAMPBELL - RISK MANAGER, CEDARBREW INSURANCE

5:00 – 6:30PM

PACIFIC NORTHWEST CRAFT BEER CLOSING RECEPTION

NANO EXHIBITS

We've invited some more of our favorite craft breweries from Vancouver and Portland to join us to pour samples of their beer for you as a fun way to wrap up NanoCon. You'll have this final chance to talk with attendees, speakers, local brewers, and visit with our exhibitors before you head out to check out the Portland-Vancouver area's breweries and craft beer taprooms for Saturday night.

As an attendee, you'll have the opportunity to check out the latest Nano-sized brewing equipment, products, supplies & services from leading craft brewery vendors Friday & Saturday in the Heritage Ballroom.

Thanks to our BYO NANO CON Sponsors!

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The 2019 NanoCon is being held at the Vancouver Hilton just across the river from Portland, Oregon. The Portland-Vancouver area is an international leader in the craft beer world with 80+ local breweries to discover. You not only have the chance to learn strategies to be more successful at your own brewery all day at the conference, but we've set up the schedule so you can also explore on your own this incredible local craft beer scene at night.

Vancouver Hilton
301 W. 6th Street
Vancouver, Washington 98660

Telephone Reservations: 360-993-4500

Mention group name "BCI" to receive a special discounted rate.

Web Reservations:

byo.com/nanocon

Group Discounted Room Rate:

$169 per night for a room with either one king bed or two queen beds.

Hotel Information: We have reserved a limited number of rooms at a special discounted rate for attendees. Contact the hotel directly for your room reservations. When making your reservations make sure to say you are attending the "NanoCon" to receive the special discounted group rate for your room. Rooms are available on a first-come, first-served basis. The special discounted rate will be available until the conference group block of rooms is sold out (which it did last year), so reserve your room right after registering for the conference.

**Please make sure you have already successfully registered for the conference before making your hotel room reservations or any other travel plans.*

COME EARLY OR STAY LATE: PRE- AND POST-NANOCON ACTIVITIES

WEDNESDAY, OCTOBER 30 & THURSDAY, OCTOBER 31

STARTING UP YOUR OWN COMMERCIAL BREWERY BOOT CAMP

10 a.m.–5 p.m. both days
With Steve Parkes ($450 for NanoCon attendees, $525 for non-attendees)

Over Wednesday & Thursday you'll walk through the steps, planning decisions, and keys you need to know on both the brewing and management side to successfully open a commercial craft brewery with the Lead Instructor and Owner of the American Brewers Guild Steve Parkes, who had trained hundreds of professional brewers. Learn from Steve's decades of expertise and wide range of experience to help you better achieve your goals. Over two full days you'll be guided through all the various elements you'll have to know for the next big step toward starting a craft brewery. This two-day workshop is the perfect lead-in to the main NanoCon event if you already have a brewery in planning or are just starting to consider the possibility of opening one up yourself.

WEDNESDAY, OCTOBER 30

HANDS-ON NANO BREWERY SCIENCE

10 a.m.–5 p.m.
With Ashton Lewis ($225 for NanoCon attendees, $275 for non-attendees)

Get hands-on with pH meters, slants and loops, stir plates, centrifuges, and other brewing science gear with professional brewer and *BYO* Technical Editor Ashton Lewis. Ashton will walk you through what your Nano Brewery should have in terms of scientific testing equipment and how to best use this gear to improve quality control over your beer. You'll have the chance to understand how to not only use and care for the equipment properly, but also how to use the results to boost the consistency and quality of your brewery's beer. This workshop will focus only on those pieces of equipment suitable – and affordable – for a small-scale Nano craft brewery.

THURSDAY, OCTOBER 31

BREWERY FINANCIALS

10 a.m.–5 p.m.
With Audra Gaiziunas ($225 for NanoCon attendees, $275 for non-attendees)

You'll start the day by gaining an understanding of the importance of finance and accounting in craft beer and learn the top financial mistakes craft breweries make (and how to avoid them). You'll then be introduced to the basics of the brewery balance sheet, income statement, and cash flow statements to understand how they all tie together for your brewery business. You'll also learn basic ratio analysis to better communicate with bankers and investors. Brewery cost accounting will be covered including beer recipe costing and overhead allocation. Plus during this full-day workshop budgeting, inventory management, and standard operating procedures you should have in place will be discussed. You'll leave this workshop armed with the tools and confidence to better understand and manage your Nano Brewery's financial needs.

THURSDAY, OCTOBER 31

BEST YEAST HANDLING PRACTICES FOR THE NANO BREWERY

10 a.m.–5 p.m.
With Dr. Chris White ($225 for NanoCon attendees, $275 for non-attendees)

Join Dr. Chris White of White Labs as he discusses how to master different yeast-related techniques for your Nano Brewery. This full-day workshop will cover culture selection and explore preparing yeast for pitching, what to expect when re-pitching, working with multiple cultures, and how to troubleshoot fermentation issues related to poor yeast-handling practices. Plus you'll learn from Dr. White on the collection and storage of yeast, utilizing yeast for multiple generations, determining proper pitch rates, yeast nutrition, creating ideal fermentation conditions, and fermentation troubleshooting when problems do occur.

THURSDAY, OCTOBER 31 AND SUNDAY, NOVEMBER 3

WASHINGTON CRAFT BREWERY TOURS ($150)

Thursday, October 31
5 p.m.–9 p.m.
Sunday, November 3
11 a.m.–3 p.m.

This four-hour tour includes round-trip transportation from our NanoCon hotel, the Vancouver Hilton, while tasting and visiting four different breweries in the greater Vancouver area. Beer and a meal is included as you explore a variety of different craft breweries on the Washington side of the river.

PORTLAND, OREGON CRAFT BREWERY TOURS ($150)

Thursday, October 31
11 a.m.–3 p.m.
5 p.m.–9 p.m.
Sunday, November 3
11 a.m.–3 p.m.

This four-hour tour includes round-trip transportation from our NanoCon hotel, the Vancouver Hilton, while tasting and visiting four different breweries in Portland. Beer and a meal is included as you explore a variety of different craft breweries here in the city referred to as Beervana.

SCHEDULE AT-A-GLANCE

Pre-Conference NanoCon Boot Camps • Wednesday, October 30, 2019

10:00 AM – 5:00 PM	Starting Up a Commercial Craft Brewery Boot Camp (Day 1)
10:00 AM – 5:00 PM	Hands-On Nano Brewing Science Boot Camp

Pre-Conference NanoCon Boot Camps & Brewery Tours • Thursday, October 31, 2019

10:00 AM – 5:00 PM	Starting Up a Commercial Craft Brewery Boot Camp (Continued, Day 2)
10:00 AM – 5:00 PM	Brewery Financials Boot Camp
10:00 AM – 5:00 PM	Yeast Handling for Nano Brewers Boot Camp
11:00 AM – 3:00 PM	Portland Craft Brewery Tour (early session)
5:00 – 9:00 PM	Washington Craft Brewery Tour
5:00 – 9:00 PM	Portland Craft Brewery Tour (late session)

NanoCon Day #1 • Friday, November 1, 2019

8:00 – 9 AM	REGISTRATION			
9:00 – 9:15 AM	WELCOME & INTRODUCTION			
9:30 – 10:30 AM	Branding Strategies for Start-Up Nanos	Reliable Yeast Propagation Techniques	Brewery-Specific Cash Flow Strategies	Latest Email Strategies to Boost Business
10:30 – 11:00 AM	COFFEE BREAK & NANO EXHIBITS			
11:00 – 12:00 PM	10 Mistakes Pro Brewers Make Impacting Quality	Planning Your Brewery Expansion	Social Media Best Practices for Breweries	Brewery Insurance 101: Protection from Conception to Operation
12:15 – 1:45 PM	LUNCH & NANO TRENDS ROUNDTABLE			
2:00 – 3:00 PM	Events Ideas to Pack Your Taproom Roundtable	Your Biggest Legal Risks as a Brewery	Keys to a Strong Nano Brewery Business Plan	Brewing with Unmalted Adjuncts: From Flaked Oats to Coffee and Beyond
3:00 – 3:45 PM	PACIFIC NORTHWEST NANO BEER BREAK & NANO EXHIBITS			
4:00 – 5:00 PM	Roadmap to Better Brewery Financial Projections	Nano Case Study: One Brewery's Journey from Idea to Reality	Mobile Packaging Do's & Don'ts	Brewery Branding through Taproom Events
5:00 – 6:30 PM	PACIFIC NORTHWEST CRAFT BEER OPENING RECEPTION			

NanoCon Day #2 • Saturday, November 2, 2019

9:30 – 10:30 AM	10 Legal Steps to Take Before Opening your Brewery	Dry Yeast Techniques for Nanos	Leveraging Local Tourism to Bring In More Customers	Understanding Taproom-Specific Accounting
10:30 – 11:00 AM	COFFEE BREAK & NANO EXHIBITS			
11:00 AM – 12:00 PM	NANO TABLE TALKS			
12:15 – 1:45 PM	LUNCH & NANO IDEA-O-RAMA ROUNDTABLE			
2:00 – 3:00 PM	New (and Classic) Pro Hopping Techniques	You're Never Too Small for Human Resources	Creating a Customer-Centric Nano Business	1 Barrel, 5 Barrel, or More? Determining System Size
3:00 – 3:45 PM	PACIFIC NORTHWEST NANO BEER BREAK & NANO EXHIBITS			
4:00 – 5:00 PM	Training Your Taproom Staff	Taproom Draft System Operations & Maintenance	Keys to a Successful Brewery Website	10 Brewery Insurance Mistakes to Avoid
5:00 – 6:30 PM	PACIFIC NORTHWEST CRAFT BEER CLOSING RECEPTION			

Post-Conference NanoCon Brewery Tours • Sunday, November 3, 2019

11:00 AM – 3:00 PM	Portland Craft Brewery Tour
11:00 AM – 3:00 PM	Washington Craft Brewery Tour

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☐ 1-Day Hands-On Nano Brewery Science Boot Camp Only (Oct. 30)	$275
☐ 1-Day Brewery Financials for NanoCon Attendees (Oct. 31)	$225
☐ 1-Day Brewery Financials Boot Camp Only (Oct. 31)	$275
☐ 1-Day Yeast Management for Nano Brewers for NanoCon Attendees (Oct. 31)	$225
☐ 1-Day Yeast Management for Nano Brewers Boot Camp Only (Oct. 31)	$275

PRE- & POST-NANOCON CRAFT BREWERY TOURS

* Open to attendees and their guests

☐ Thursday, October 31, 11:00 AM – 3:00 PM Portland-area Breweries	$150
☐ Thursday, October 31, 5:00 – 9:00 PM Portland-area Breweries	$150
☐ Thursday, October 31, 5:00 – 9:00 PM Washington Breweries	$150
☐ Sunday, November 3, 11:00 AM - 3:00 PM Portland-area Breweries	$150
☐ Sunday, November 3, 11:00 AM – 3:00 PM Washington Breweries	$150

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- » Two Lunches with Roundtable Programs
- » Nano Exhibits Admission
- » NanoCon Welcome Bag
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BY DREW BEECHUM & DENNY CONN

A BITTER CHALLENGE

Simple thoughts about hopping

Pretty much every homebrewer knows that the alpha acid content (AA) is the main factor in bittering beer — but that's not all there is to it.

The debate lingers on . . . what effect does a brewer's choice of bittering hop variety make on the final beer? Let's find out!

A few things before we get started as the new authors of this column — in case we're strangers. One of us is a mad scientist amuck in the world and the other is a scientist mad at a world gone amuck. We'll let you decide which of us is which. But here's where we come together — in a world made pressure crazy by all the demands put on us by work, family, friends, etc., the last thing we need to be worrying about is our beer making. This is a hobby and if we wanted to be stressed out while spending precious time on a frivolous activity, we'd take up golf!

If you're reading this, you're a rare bird . . . a pelican dedicated to the idea of making your fish stew instead of settling for the catch of the day. You've probably spent time reading books, watching YouTube videos, listening to podcasts (Find *Experimental Brewing* on Apple Podcasts, Google Play, Stitcher, Spotify or your favorite podcast source. What? . . . a little harmless self promotion never hurt anyone!). Your head is swimming in approaches, techniques, calculations, and science.

Well, we hope to rescue you from some of that. Science is great, and we couldn't live or brew without it, but one of Denny's favorite sayings (from the late Tom Magliozzi of *Car Talk*), is "Reality often astonishes theory." In other words, start with science, but don't trust it. See how it works out for you! What we intend to do with this column is give you ways to make the best beer possible, with the least effort possible, while having the most fun possible. After all, we're homebrewers and if you're not having fun homebrewing, you're doing it wrong. And always remember, malted barley WANTS to become beer. All you have to do is give it a bit of help, then get out of the way.

Now you're either excited or scared. Either way is OK with us, because it means you're gonna stick around to see what happens next! Just remember, we're going to be lighter on the "Do it this way" and heavier on "Try it yourself and see what you think." After all, it's your beer. You get to decide.

A BITTER EXPERIENCE?

The first subject we want to tackle is hopping. Hops are one of the favorite topics of homebrewers. They make a huge impact on your beer. And let's face it, most homebrewers think of hops as the sexy part of brewing. American craft brewing doesn't explode the way it has without them. After all, we don't see people lining up for the latest 4-pack of "malt-forward" beer. (Ok, outside of pastry stouts, which is its own oddity.)

One question we get repeatedly is "does the variety of hop used for bittering make a difference?" Some people, like Drew, seem to think not and tend to use a few hop varieties for pretty much all their bittering. Magnum, or some other "neutral" variety, is very popular among that group. Others, like Denny, think that you get different bittering qualities from different hops. For instance, bittering an American IPA with Magnum will give you a different type of bittering than bittering it with Chinook. So what's going on and who's right? Or does it simply come down to personal preferences in the bittering qualities found in beer?

The other thing that's hotly debated in homebrewing circles is how much, if any, of the bittering hop's flavor characteristics come through in the

finished beer? Traditionally it was thought that it was none, so you could use any hop for bittering. More recent thinking questions that line of thinking. Pretty much every homebrewer knows that the alpha acid content (AA) is the main factor in bittering in beer — but that's not all there is to it. You've got isomerized alpha acids, which directly contribute to bittering in the way most of us think of, which are created during the wort boil. But there are also "plain" alpha acids, which contribute to measured bitterness values, although no perceptible bittering. Then there are humulinones, oxidized alpha acids, which are slightly bitter but don't contribute to IBU measurements in any clear, straightforward linear fashion. No, seriously, the whole thing is odd.

Higher alpha, lower cohumulone hops were once thought to make for a smoother quality of bitterness, but more recent research has shown that cohumulone is simply more efficiently utilized than humulone. Because of that efficiency, you get the same amount of bitterness from a smaller amount of high cohumulone hop. This leads to the perception of smoother bitterness in high cohumulone hops. In other words, by using fewer pellets you reduce the other bittering compounds as well as the amount of astringency contributed by the hops. Makes your head spin, huh?

> **In other words, the tannins in the hops actually can make a flavor contribution and fit with your recipe goals.**

Remember earlier when we said Drew likes using neutral high alpha acid hops because, in part, you need smaller doses? Here's why. One of the big impacts of the vegetal matter in the hops is a massive tannin contribution. In the wine and cider world, tannins are used to provide structure and bitterness. (For instance, in cider making "bitter" apples are high in tannins.) In addition, that vegetal matter has an effect on the flavor the hops contribute. This tannic contribution to bitterness became abundantly clear when we brewed with two new products from Yakima Chief Hops — Cryo Hops® and American Noble Hops™ pellets. Cryos are made with a proprietary process (think liquid nitrogen, hops, freezing, and shattering — *SCIENCE!*). They sift the hop powder and separate the lupulin glands from the leaf matter. The pellets with concentrated lupulin and hop oils becomes the Cryo Hops®. The remaining vegetation, which still contains flavorful compounds but with low bittering potential, becomes American Noble Hops™ pellets. Special note: These are not noble hops in the classic European sense. They are American varieties, like Loral® or Citra®, which after processing mimic some of the characteristics of continental noble hops — low bitterness, and a low but "laid back" aroma (that's the best way we can describe it). The American Noble Hops™ pellets smell like American hops — citrusy, piney, fruity as opposed to the European spicy tones.

We knew what to expect when we first tried the Cryo Hops® — we've mainlined so much hop oil and lupulin that we could feel in our brewing bones that we'd be getting a turbo boosted hop experience. The American Noble Hops™ — with their more attenuated alpha acid (2–3% AA versus 20–27% AA in Cryo Hops®) and hop oils — were a complete unknown. It turns out that tannin component provides a constant base note, a foundation to the higher tones and more aggressive flavors we're used to.

QUESTION BREWING MORES

Let's revisit that common refrain we've been taught as of recent years — "you should avoid bittering with low alpha hops, because all the extra vegetation affects the taste." Many describe it as a muddying effect. But sometimes that kind of flavor is exactly what you're after. Denny's oft re-iterated American Mild recipe depends on that tannic flavor from the debittered hop in it to contrast the malt flavor with its subtle bitterness while allowing a soft, not-overpowering character from Citra®, Simcoe®, and Mosaic®. It really makes the beer a whole experience. In other words, the tannins in the hops actually can make a flavor contribution and fit with your recipe goals. And that's kind of the key to anything in recipe design . . . don't just put it in there . . . KNOW what you're going to get from it before you use it. We'll dig deeper into that in a future column, but for now here's a pragmatic method to develop an opinion of your own.

Now that we've digressed, let's link this back to where we started — does your choice of bittering hop impact the flavor of the beer even at the same IBU level? What we propose is a way to "get to know your hops." It's an easy way to find out how you perceive different bittering hops. Remember, the only experimental results that apply to you are the ones you find yourself. (If you want more proof of this, go listen to *Experimental Brewing* Episode 32 "The IBU is a Lie" and find out why some of these formulas we use in brewing are far more individualized than you'd think.)

For this experiment, we're only going to use bittering hops. At first glance, you'd think this is going to be a boring beer, but give this a shot. You'll be surprised. Push comes to shove, if it bores you — well, that's why we invented the technique of dry hopping! So, here's a quick look at the design of an experiment . . . (Beer geek warning — light-weight science ahead!)

PUT IT TO THE TEST

We start with our question. In this case it's "Do different bittering hops produce different qualities of bitterness?" Then we go on to a hypothesis. "Bittering with Magnum will produce a smoother, less sharp bitterness than bittering with Chinook even at the same IBU levels." Now how do we prove or disprove this? Here's how we'd tackle it.

Produce a batch of American pale ale wort. Nothing fancy . . . pale malt and maybe a touch of crystal malt in the 20-60 °L range. This doesn't matter a lot since all batches will use the same wort. Split the wort in half. Bitter one half

# 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%

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).

with Magnum and the other half with Chinook (you could try something like American Noble Hops™ here too). Make sure the amounts you use will create an equal IBU level. Boil both for the same amount of time and utilize the same cooling and fermentation process for each half. Remember, it's important to keep everything but the variable under test as close to each other as you possibly can. Ferment to completion, then package each batch the same way, whether bottled, kegged, canned, etc.

Once carbonation is complete, it's time to taste and figure out what the heck you've done. This is where we use the triangle test. Gather your tasters. You'll want at least a half dozen, more if you can get them. (Hey, this is a great homebrew club activity!) Your tasters' experience level doesn't matter as much as you'd think – so grab anyone with functioning noses and taste buds.

If you're going to be a taster, get someone else to pour the beer. Using opaque cups (of three different colors if possible for easy ID to the pourer), pour one of the beers into 2 cups and the other beer into the other cup. If you can't get three different colors of otherwise identical cups, mark a circle, square and triangle on the 3 cups. Why not A,B,C or 1,2,3? Turns out that when you present tasters with labels that have an implied order it has an impact on what they choose, thus it's better to go with something without a clear order. Humans and our senses are weird!

Make sure you don't give away the nature of the experiment to your tasters. When you give them the beers, ask them to answer the question "is one of these beers different?" You don't want to give them any clues.

Of course, you'll know one is different, so your own perceptions will be just a bit less valid than the blind tasters. From there, you just do what comes naturally — sniff, sip, taste, fret, and repeat until you decide which (if any) of the beers are different. Have each taster record (silently) their finding and what differences they've noted. After the tasters are done, count how many identified the correct beer. Divide the correct results by the number of tasters to see what percentage got it correct. If your percentage of correct identification is ~70% (for small sets of tasters, about 10–12), you have a pretty clear indication that your tasters noticed something! But if you struggle in the middle ground, we've included a handy-dandy chart. Notice how as the tasters go up, you need relatively fewer to show significance. Isn't math nifty?

And let us know what the results of your experiment are. Email us at edit@byo.com or results@experimentalbrew.com and tell us how your experiment went. We'll compile the results.

MAGNUM/CHINOOK BLONDE ALE

(5 gallons/19 L, all-grain)
OG = 1.047 FG = 1.010
IBU = 33 SRM = 4 ABV = 4.8%

INGREDIENTS

9.5 lbs. (4.3 kg) pale malt
4.1 AAU Magnum hops (60 min. — Boil A)
(0.35 oz./10 g at 11.6% alpha acids)
4.1 AAU Chinook hops (60 min. — Boil B)
(0.32 oz./9 g at 13% alpha acids)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or SafAle US-05 yeast

STEP BY STEP

Single infusion rest for 60 minutes at 152 °F (67 °C).

NOTE: whichever you use, be sure to adjust the amount to account for the actual AA of the hops.

BY COLIN KAMINSKI

THE DRAFT COMBINE

Deep clean your draft system

Draft beer offers an experience that is difficult to recreate in a bottle or can. The rich head and bright aromatics are unparalleled compared with most bottle pours. This affordable and wonderful pour comes at a high maintenance cost though. And nothing ruins a great beer faster than a dirty draft system.

THE PERFECT BALANCE

In order to deliver a perfect pour, a draft system has to walk a delicate balance. The CO_2 pressure on the keg must match the carbonation level in the beer and the temperature of the keg. Let me say this one more time: Temperature, pressure, and carbonation level must match! Once these parameters are defined then the back-pressure created by the resistance of the beer flowing through the line must allow the beer to flow at the faucet's designed flow-rate. The resistance is usually changed by adjusting the length of a leader of 3⁄16-inch line placed just before the faucet. Most faucets work well when set to pour a pint in 6 seconds although it is common to see a range of 4 to 8 seconds in professionally-designed systems. If the back-pressure is set higher than this the beer will not pour with a head or, in the extreme case, the faucet will trickle foam. If the back-pressure is set lower than this then the beer will flow too quickly, making it difficult to pour and, in the worst cases, pour foam.

It is also very important for all of the parts in a draft system to be designed so the beer transitions smoothly from one part to the next. Abrupt changes can cause turbulence in the beer flow and will release the carbonation prematurely (breakout) causing the beer to pour foamy. If the draft system is designed with clear line these bubbles can be seen by visually inspecting the line while the beer is flowing, making identifying the offending fitting easy. The appearance of beer flowing should not show breakout in the lines at all. If you see bubbles form in the line when it is not moving then the temperature, pressure and carbonation level do not match. More pressure is the quick solution but getting your handy CO_2 chart out is the best way to see what is going wrong.

KNOW YOUR SYSTEM

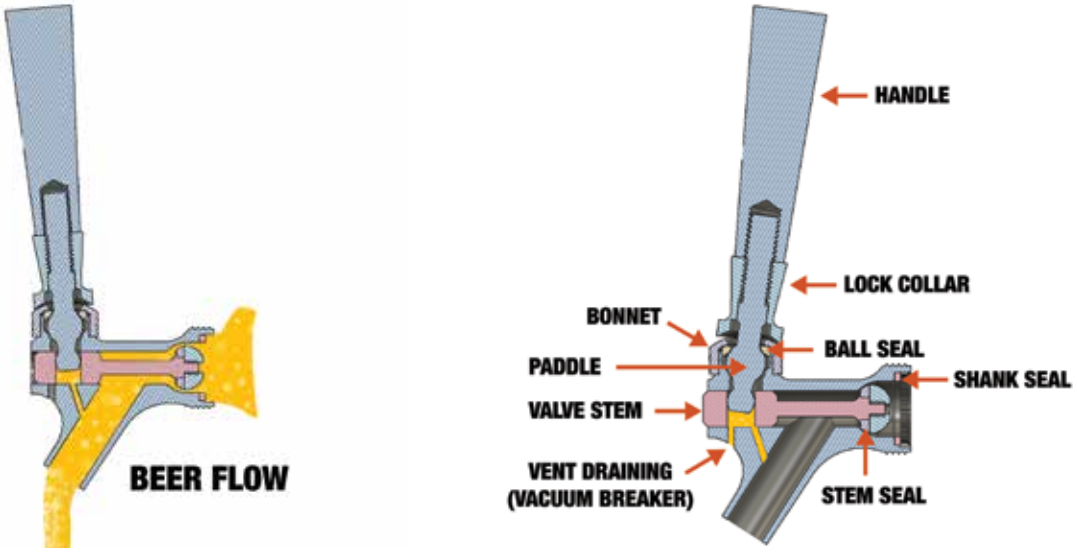
While chrome-plated brass was the industry standard for many decades, modern draft parts are available in stainless steel. Chrome-plated draft parts lose their plating quickly, exposing the brass to the low pH of beer; this can contribute to metallic flavors in beer. The action of beer on brass is to dissolve it and erode the fittings. Hardware store brass fittings should not be used in draft systems. Brass in a water supply relies on the municipality properly adjusting the water chemistry so a small protective layer of calcium carbonate will be deposited on the brass protecting it from erosion. The protective action of properly adjusted water is not duplicated in beer, causing the fittings to erode and depositing the metals into the glass of beer.

If you study a schematic of a standard draft faucet there are a couple of things that are very important to its function. When we pull on the handle the lever of the handle pulls the valve stem backwards and lifts the rear seal off of the body allowing beer to fill the cavity. The handle has a small paddle on the end that fits a rectangular slot in the valve stem. The back of the faucet and the valve stem are carefully designed to create a laminar flow that does not break the CO_2 from the beer. It is very important that the faucet is fully open or fully closed. In between

Most faucets work well when set to pour a pint in 6 seconds although it is common to see a range of 4 to 8 seconds in professionally-designed systems.

Photos courtesy of Colin Kaminski

Commercial cleaning systems allow multiple taps to be cleaned simultaneously. Homebrewers with a draft system should maintain a regular cleaning schedule to assure clean lines and faucets.



Traditional beer faucet design with an open tap on the left and a closed tap on the right displaying the moving parts on a beer faucet. The pressure in the beer line pushes the stem seal, helping keep the faucet closed. The small vents will break the vacuum, allowing the spout to properly drain.

settings, even briefly, will cause the beer to foam.

The faucet is designed with two mechanical stability points, fully open and fully closed. The flow and the weight of the handle will hold the faucet closed. When open, the weight of the handle holds the faucet completely open. Faucets should never be used in the in-between positions. In-between positions result in excessive foaming. An exception to this rule: A faucet can be cracked slightly at the beginning of a pour to start a little foam in the glass to correct for an under-carbonated beer.

After the handle is closed it is extremely important for all of the beer to drain from the faucet. There are two small vents that break the vacuum and allow the beer to drain from the paddle's slot in the valve stem. If these vents get clogged the beer will not drain causing a perfect place to culture spoilage organisms.

KEEP IT CLEAN

When yeast ferments wort to beer it can create 2 ATP for each molecule of glucose (glucose ---> 2 ethanol + 2 CO_2 + 2 ATP). This is important because ATP is the currency of energy inside of cells. If an organism has available oxygen it can create 28 molecules of ATP (glucose + 6 O_2 ---> 6 H_2O + 6 CO_2 + 28 ATP)! This is a much better value for organisms. Since the ethanol contains such a rich source of energy many organisms are also able to extract that energy once there is available oxygen. We call them spoilage organisms.

The main spoilage organisms that can tolerate hops and flourish inside of draft faucets are *Lactobacillus, Pediococcus,* and *Acetobacter*. These organisms have distinctive flavors and can easily be identified by experienced tasters. Based on taste and smell (not lab culturing) I have found that the *Lactobacillus* presents as a black thin slime (picture 1 on pg. 106) and the *Pediococcus* presents as a gray slimy thick rope (picture 2 on pg. 106). It is also likely that *Brettanomyces* is a common beer line infection. It is very unlikely that any contamination is a single organism and lab culturing would show positive for all three and likely more organisms.

While I have been unable to identify the exact bacteria involved; most people exposed to a very dirty draft line will encounter gastro-intestinal distress. People vary in their sensitivity to this effect but I have found it widely reported. Please don't do your beer the disservice of causing digestive issues in yourself or your friends.

When a contaminated faucet is opened the contamination actually will spread upstream to the draft line itself. This makes cleaning the line at the same time as disassembling and cleaning the faucet very important.

Large breweries spend a considerable amount of effort insuring that faucets get cleaned in the trade. Some states even require draft line cleaning as part of health code. Many breweries require that a publican allow the distributor to clean the line in states that allow that. At home or in a brewpub this very critical task is left to the brewer. This is a very easy task to put off but it is of the utmost importance if you care about the taste of your beer.

A typical draft line-cleaning regime would be to hook the keg coupler (including any accessories like Foam On Beer detectors) to a keg with hot line cleaner and run line till warm and clear cleaner is being dispensed. At this point the keg cleaner is disconnected and the faucet is disassembled and each part is scrubbed and inspected. It is very important to pay special attention to the rectangular slot, the area above the paddle and both of the vacuum breaking vents. These spots do not allow very much line cleaner to flow through them and are ideal places to harbor bacteria that will re-colonize the faucet. Once the faucet is clean, it is reassembled and a keg or hose of fresh water is coupled onto the draft line and the line is rinsed until it is pH-neutral. You will know when it is pH-neutral when it no longer feels soapy/slimy to the touch.

A cleaning like this will keep a beer line clean for about two weeks. If we do a better job of cleaning we can keep a beer line clean for 4 weeks. This advanced cleaning procedure involves pulsing cleaner through the beer line with the faucet removed for 15 minutes. Normally one line is used

Picture 1 on left and picture 2 on right. The black slime, indicative of Lactobacillus *growth seen in picture 1, and the ropey goop found in picture 2, indicating a* Pediococcus *infection.*

for the send and its flow is looped back through a second line as a return cleaning two lines simultaneously. The cost in equipment is considerable and it is time-consuming but for many brewers there is a net timesaving from the length of time a line stays clean justifying the costs. A third method of line cleaning has been promoted for a few decades now. I have not used the method but the sales people have big claims for it. It involves passing a sponge through the line from the coupler through the shank using cleaning fluid.

There are a few chemicals used for line cleaning. Most beer line cleaners are simply diluted caustic with some anti-foam agents added. My favorite line cleaners also have a pH indicator added. With a pH indicator added, the cleaner runs dark until the pH is in a good range for cleaning and then turns clear. Since calcium oxalate (beer stone) can also build up, line cleaning acids are also available. Beer stone deposits are very brand-specific so your need for this step can be from every 6 line cleanings to never. Beer stone after a caustic cleaning is a white rough surface that looks like pumice. Before the caustic step it can also be brown and rough. All cleaning chemicals work better warm and getting water as hot as 150 °F (66 °C) will speed the cleaning time. It is not recommended to exceed 150 °F (66 °C) as the beer tubing itself can fail. Rinse till the water no longer feels soapy. After the line is clean it is important to taste a small sample of beer. This is a good safety check to make sure the line has been properly rinsed. About once a year I hear of a customer being served a pint of line cleaner. This usually results in permanent damage to the customer's esophagus.

Once a line is clean, a good but rarely done quality assurance step is to plate the beer for spoilage organisms. A faucet should plate negative for at least 2 weeks if the line cleaning was done properly. Alternatively, you can add 1 oz. of beer from the faucet to 1 liter of 1.040 wort and cover it in a flask. It should stay clear for 7 days. If you are not experienced with using wort in this way you can also make a control flask of wort with nothing added to insure your methods are sanitary.

After a line cleaning session I always take the time to pull a perfect pint and relax. I note the rich head, smell the just released aromas, and feel proud that I did a task well that many brewers and publicans put off till it is too late. BYO

BY AMY TODD

VETTING YOUR BEER

Starting a quality control program

How many of you want to start a lab, but have no idea where to start? You begin to look into it, but there are so many different aspects of a lab you get overwhelmed and put the project on the back burner. Starting a quality control program may feel like a very daunting task, but it doesn't have to be. I'll walk you through the initial steps to get you started.

This article is not going to cover specific equipment needed, or how to run tests, but it will walk you through what you need to think about to start planning your quality control program. Every brewery is different and for some breweries this may include a designated lab, for others it might not. Regardless of experience or budget, everyone can, and should, implement a quality program in their brewery.

By the end of this article I want everyone to feel empowered to take the next steps in starting their own lab or quality program. It's perfectly okay to start small, in fact, that's one of the best ways to start. I'll even cover what to do with no budget.

Here's a little recap on why you should start a quality control program. First off, having a good quality program is going to help you ensure the consistency of your product, you'll be able to identify inefficiencies, improve your process control, and it's going to reduce wasted product and wasted time. It's also going to instill a sense of pride and ownership in you and your employees. The hardest part of starting a quality program is just starting in the first place.

PLANNING STAGE

Your very first task should be to plan out the logistics of your quality program. To help break it down into manageable chunks, I like to start by thinking about who, what, when, where, and why. These are all going to ultimately determine what your quality program will look like and where you're going to start. As you work through this you'll see that most of these are interconnected. Every brewery is different and everyone will start out at whatever point is best for their brewery.

Why — I like to start with why. Why do you want a quality program in the first place? Do you already have an issue you want to address? Maybe you're looking to avoid off-flavors, or maybe improve your brewhouse efficiency, or the consistency of your product. Maybe then you want to focus on packaging and micro as you enter new markets. Having a solid why is going to help you focus and find the best place to start for your brewery.

Who — Who is going to run the lab? Just you? Your brewer? Are you hiring someone just to do quality? Will that be full-time, part-time? If you only need a few hours a week, maybe it's best to outsource some testing to start. Don't forget to think about time commitments and associated labor costs.

What — This is a two-part section. What is your budget? And what is going to go in your lab? This is a really big one. Ultimately your budget will determine what's in your lab. You'll want an initial budget, a yearly budget for new equipment, as well as a monthly budget for consumable lab supplies and chemicals. This will help determine what's in your lab and what you're testing for.

Don't forget labor costs when you decide what you're testing for. Again, you might want to outsource some tests if you can't afford equipment or additional employees right now. $30–$40 added to the cost of a batch of beer might make a lot more sense

Regardless of experience or budget, everyone can, and should, implement a quality program in their brewery.

Photo courtesy of Amy Todd

than thousands of dollars in lab equipment at this time. Your why will help determine what's in your lab as well.

When — I say start your program right away! It's easier to slowly add tasks as you grow than to play catch up if you start growing too fast. Even something small, like starting with cell counts, is way better than nothing. You don't want to put this on the back burner and never get to it. Start planning for your future too. When are you going to start testing IBUs or dissolved oxygen (DO)? Just as you plan for your brewery's growth, plan out the lab's growth.

When are you going to have time to work in the lab? This will affect what tests you are able to do. If you don't have time personally, do you need to hire someone?

Where — Where is your lab going to be? When you're first starting out, a countertop with room for cell counting, pH and gravity readings, and some storage space is all you really need to get started. Make sure you keep future growth in mind. 10–15,000 barrels (bbls) and you'll want a separate space. Maybe a 10 x 12 ft. space. At 30,000 bbls you might want double that. Don't forget space for employees, computer stations, sinks, hoods, eye wash stations, and lots and lots of outlets. The bigger you get, the bigger the lab you'll need.

Once you answer these questions you can look into some specific tests and areas of focus for a quality program.

QUALITY CONTROL CATEGORIES

Next I like to break a quality control plan down into four basic categories — sensory, chemistry, micro, and packaging. I want to mention safety here too as you should always be thinking about safety in your brewery. Each of these categories are going to have their own safety concern, some of which will come with added expense.

You may want to start by focusing on only one of these categories, like sensory, then as you expand your quality program you can add another category. Some may decide to do a little of each.

Sensory — A sensory panel will help you identify off-flavors or troubleshoot problems in the brewhouse. Making sure your beers are true to brand and taste how they are supposed to taste is another key part of a sensory panel. A beer may hit all its desired specifications but still not taste how you want it to.

Chemistry — Tracking values such as gravity, pH, IBUs, color, FAN (free amino nitrogen), alcohol, haze, etc. can help us ensure everything is going according to plan. Tracking this data can also alert you when something isn't going according to plan. The quicker you notice something isn't right, or trending towards out of spec, the quicker you can look into the root cause and fix the problem before too many other batches are affected.

Micro — We like to think we're in control of the brewing process, but ultimately it's all those little yeast cells, (and bacteria in some cases, whether intentional or not) that are making the final beer. We want to do everything we can to make sure our yeast are happy and healthy. We also need to make sure there are no unwanted wild yeast or bacteria lurking around our brewery trying to take over.

Packaging — You spend all this time making the perfect beer and it can be instantly ruined if not packaged properly. Dissolved oxygen and CO_2 testing are critical measurements here. Checklists are a great way to assure date codes are legible and correct, labels are straight, and boxes are sealed.

MAJOR HURDLES

As you start planning out your quality program, you're most likely going to face some hurdles. You can easily overcome these with a little patience and planning.

Time — One of the biggest hurdles to overcome when setting up your quality program is time. Most of us are already trying to cram too many things into one day, and adding something new may sound impossible. Everyone is going to handle this differently but some suggestions are to start by taking 10–15 minutes each day to start planning out your quality program. If you work better by having a solid chunk of time, schedule two hours one week to work on it. Schedule it as a meeting, even if it's just you, and commit to it. Go through your who, what, why one category at a time. Once you start, you might find yourself making time to work on this. If you can't make time for quality, how are you going to ensure you keep making great tasting, high-quality beers?

Money — Money is another big hurdle for most breweries, especially small ones and start-ups. A quality program can save money indirectly, and some of the biggest savings are when you prevent bad beer from going out in the marketplace. It can be very hard to calculate these theoretical savings and it may feel like you're just spending money and not getting anything in return. How do you measure increased quality and consistency to sales? It can be hard to show the correlation. Think about how much will it cost you to dump a batch of beer? This is a cost you are potentially avoiding by implementing a quality control program. How much will bad reviews cost you?

Time is money and being able to react quickly, or having the peace of mind that everything is performing as intended, can save you a lot of hassle and headaches. Yes, actually making the beer is important, but if you're constantly rushing and aren't taking the time to be proactive about quality, you'll find yourself reacting to something later on that will take even more time to handle.

Failure to Plan — The best way to implement your quality control plan is to draft it out and actually plan it. Go slow and add things as you grow, do what works for you. Go back to your business plan, or if you haven't started a brewery yet, make sure you have a section on quality control and how and when you're going to grow your lab. What will your lab look like at 5,000, 15,000, 50,000 BBL? But even if you don't plan to grow capacity-wise, what would your lab look like in 1 year or 3 years as your brewery matures?

When you have a plan in place it's much easier to focus on it and work towards that goal. You may be tempted to invest in growth and more space or brewing equipment, but always keep quality in mind and you'll last longer than your competitors who grow too quickly but can't keep up with quality.

Check out the American Society of Brewing Chemists (ASBC) guide to starting lab. This is a great resource with information on what type of lab equipment you should have

at different stages of growth.

Fear — Some people are scared of what they might find. Ignorance is bliss, right? The thing is, you want to find issues, because then you have the opportunity to fix them and make better beer! Some people are also hesitant to start a lab or quality program because they don't have a science background. Yes, it's helpful, but it's not necessary. Anything can be learned and you don't need a science background to start a lab. Remember, there was once a day when you didn't know how to brew either.

Budget — What if you have no budget? Just because you don't have a budget for quality improvements now, doesn't mean you can't get started. You should still go through the process of thinking about why, who, what, when, and where to come up with a list of things you want to start implementing in your quality program. Without any expenses, you can make sure your hydrometers are calibrated. Check out the ASBC video on how to do this. Plot out your daily gravity readings during fermentation. Different batches of the same beer should follow a consistent curve. Any improvements you can make there? Plot out pH as well and make sure you're recording final pH values on all your beers.

Start a sensory program. Start by tasting your beers and ingredients. Come up with descriptions and expected intensity levels for hop aroma, malt sweetness, body, etc. Use Googleforms to keep track. Once you have a bigger budget to work with, purchase some off-flavor training kits.

Write out Standard Operating Procedures (SOP) to make sure all your brewing steps are being performed the same way every time. Make sure you're collecting useful and actionable information when you're brewing. Implement checklists so you don't forget anything.

While you're making all the free improvements, start saving! Come up with an exact budget of what you want to have in your lab. Utilize the acronym SMART for your goals: Specific, measurable, achievable, relevant, and time-based. You're much more likely to follow through with a goal of: "Save $500 in the next six months to spend on a microscope, hemocytometer, scale, glassware, and pipettes so I can perform cell counts and produce cleaner, more consistent beers" than if you had a vague goal of "save some money for a lab this year." If your budget is too small to afford any testing equipment right now but you have a long list of data points you want to collect, use a 3rd-party lab to supplement your own in-house quality program.

If you want repeat customers and continuous growth, you need a quality program in place. Be proactive about your quality, not reactive. With over 7,000 breweries in the US, craft-beer consumers can choose to be very picky. If the beers they purchase from your brewery are inconsistent, they can go elsewhere. Don't just tell your customers you care about quality, show them. Want to set up your own quality program? I've provided a planning & starting worksheet at www.byo.com/articles/quality-control-worksheet. BYO

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INDUSTRIAL-STYLE PEDESTAL TOWER

Building a tap tower with black pipe

BY JS BULL

My beer brewing started in 2002 with a Mr. Beer kit. While the Mr. Beer plastic bottles were handy, they weren't glamorous. So, I added some bottling equipment and bottled a few batches in glass bottles. Unfortunately, the collecting of bottles, multi-step cleaning, and two-week wait for bottles to carbonate were more than I wanted to deal with. I began researching home draft systems. I decided the convenience was worth the investment and bought a nice stainless mini fridge that would fit two corny kegs. I drilled a hole in the top and installed a two-tap tower.

Fast forward about 15 years to 2016. I had slowed my brewing to about twice a year, mostly based on my lack of ability to drink five gallons (19 L) of beer a month by myself. Then I read about the PicoBrew Zymatic®. Fully automated all-grain brewing of 2.5 gallons (9.5 L) at a time. I could get creative again without risking the time and money of brewing five gallons (19 L) of bad beer. This got me into kettle sours, mixed fermentation, oak-aged beers, *Brett*-only fermentation, and unique styles that I hadn't tried to brew previously. This sparked a renewed love of brewing and I quickly upgraded to a 20-gallon (76-L) Spike Brewing System. Before I knew it, I was brewing 15 gallons (57 L) every few weekends, splitting the batches into multiple experiments and variations. That old trusty dual tap kegerator just wasn't cutting it with my new brewing schedule, so I had to go back to bottling. Even with new technology like my Last Straw® Bottle Filler, I still disliked every minute of it. I started looking again at draft ideas and came across the keezer concept. A keezer is a kegerator built out of a chest freezer with an external thermostat to control the temperature.

A quick Google image search will return a massive variety of keezer styles. Those with collars, those with tile towers, those built into bars or walls, and many other varieties. After a bit of planning, I sketched out my concept: A keezer that would hold six 5-gallon (19-L) corny kegs and a 5-lb. (2.3-kg) CO_2 tank. The beer lines would go through the top, into both legs of a 3 in. (7.6 cm) black pipe pass-through tap tower that would support six taps. The only minor problem was that I had never done a single wood or metalworking project in my life. Despite this, my lovely wife gave me the thumbs-up. The following is a tutorial of my tower build and some advice to make it easy for you to replicate.

That old trusty dual tap kegerator just wasn't cutting it with my new brewing schedule, so I had to go back to bottling.

Tools and Materials

- 24 in. (61 cm) of 3-in. (7.6-cm) diameter schedule 40 black pipe (MNPT x MNPT)
- (2) 12 in. (30 cm) of 3-in. (7.6-cm) black pipe (MNPT x MNPT)
- (2) 3-in. (7.6-cm) black pipe elbows (FNPT x FNPT)
- (2) 3-in. (7.6-cm) black pipe flanges (FNPT)
- (8) ¾-in. x 3-in. hex bolts, nuts, and washers
- Custom-rolled sheet metal
- 6-ft. (1.8 m) of 1-in. diameter rubber pipe insulation
- (6) faucets and appropriate draft hardware and beer lines
- (4) mounting bolts (cover plate)
- (2) ¼-in. x ½-in. thumb screws
- Rope loop and short wood screws
- 5⁄16-in. turnbuckle with eye
- 5⁄16-in. zinc threaded rod, cut to size (mine is 24 in./61 cm long).
- Grinder to cut the black pipe
- Drill and tap kit
- 2½–3 in. (6.4–7.6 cm) hole saw
- 1-in. drill bit for the faucets
- Angle grinder
- Drill with ⅞-in. drill bit

Photos by JS Bull

STEP BY STEP

1. PREPARE THE PIPE AND COVER

The first step is to cut through the black pipe with a grinder so you can run beer line through it and down to the freezer. At first, I tried to cut the pipe with a plasma torch. That created too much collateral damage to the pipe. I cut 16½ in. x 1¾ in. (42 cm x 4.4 cm) to fit six taps. Be sure to center the hole on the pipe so the cover will align correctly.

For the cover, I found an old muffler that I was able to cut a section out of to act as the cover plate. Fortunately, it happened to fit the curvature of the pipe. Alternatively, you can take the black pipe to a local sheet metal shop and ask them to cut you a cover that is 18 in. x 2½ in. (46 cm x 6.4 cm) and roll it to fit the pipe. It doesn't have to fit the curvature perfectly. Note that you can use shiny sheet metal as is or rough it up with a sander to give it a more rustic look.

2. DRILLING AND TAPPING

I carefully measured and used a drill press to drill a 1-in. (25-mm) hole for each of the six taps in the cover. You will want about 2¾-in. (7-cm) spacing center-to-center for the taps. For an 18-in. (46-cm) long cover and six taps, the first hole's center point to drill is 2⅛ in. (5.4 cm) in from each end of the cover plate.

To mount the cover to the black pipe, you'll need to drill four mounting holes in the cover, and drill and tap the black pipe. Start with the cover and drill holes in each corner about ¼ in. (6 mm) in from both edges. Once that's complete, center it on the black pipe. Use a Sharpie to mark where you need to drill, then drill and tap the black pipe.

Grab the elbows and drill into each of their collars that are facing horizontally. Tap those holes for the thumb screws. The thumb screws will secure the center pipe to be sure it doesn't rotate when you operate the tap handles.

3. ASSEMBLE AND MOUNT THE TOWER

Assuming the previous steps went well, this one is easy. You won't be able to assemble the black pipe once the flanges are screwed into the freezer, so start at one flange and put the pieces together until you get to the other flange. Try to screw each piece tightly so there are no spacing issues later.

It's now time to cut the tap tower holes in the top of your keezer. Assuming you've spent some time doing something nice with the freezer (like the keezer top I built), this is really the most nerve-racking part of the project. It was one of those measure ten times, cut once activities. I centered the holes ⅔ of the way back on the keezer top and that worked out.

Sit the tower on the top of the keezer, align the flanges and mark where the bolt holes need to be. Remove the tower and drill ⅞-in. (22-mm) holes for each ¾-in. (19-mm) bolt. Now, use those holes to find the center mark for the large beer line hole on each side. Cut a 2½-in. to 3-in. (6.4-cm to 7.6-cm) hole with a hole saw for each leg. Once everything is drilled, mount the tower using the ¾-in. (19-mm) bolts, washers, and nuts. Be sure to tighten them well.

4. INSTALL THE DRAFT EQUIPMENT

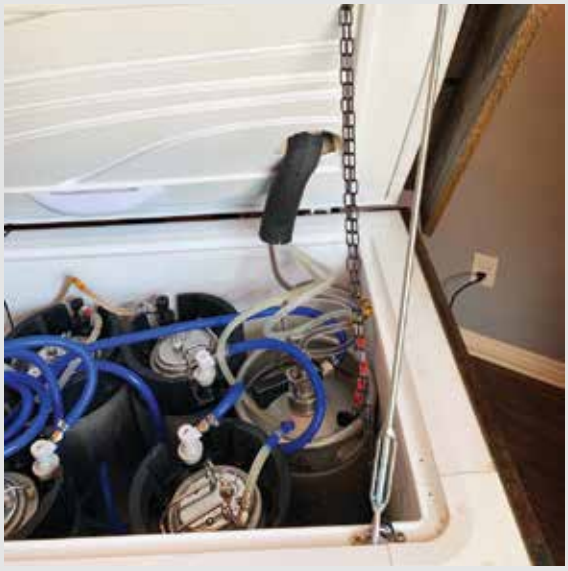
Now that the tower is mounted, run the pipe insulation up through one leg, across, and down the other. The pipe insulation's primary purpose is to keep the black pipe from sweating. However, as a side benefit, I've learned that it keeps me from needing to run glycol. With the pipe insulation, the first ounce of beer is close to room temperature, but by the time you pour a pint, you can't tell.

Next, work the beer lines through the pipe insulation. Take three lines one direction and three the other. Mount the shanks to the cover and connect them to the beer line. At this point, you can screw the cover onto the black pipe and you're nearing the finish line.

5. INSTALL A SAFETY CHAIN AND PROP ROD

The lid will be heavy, and no one wants to be decapitated while changing kegs, so let's keep that from happening. I had originally thought that the heavy tower would create a lot of leverage to pull the top back too far, so I installed a couple of chains on the inside of the freezer to keep it from breaking off the back. What I learned was that my suspicion was true, but not as early in the opening of the lid as I had thought. Therefore, I needed something to hold the lid up while I worked on the kegs inside. I tried several different contraptions, including hydraulics, but ended up building a simple 5⁄16-in. x 9-3⁄8 in. (8-mm x 24-cm) turnbuckle with a threaded rod that holds it up, like a prop rod for a car's hood.

The basic instructions are to remove the hook end from the turnbuckle and screw in the threaded rod. Put a rope loop through the turnbuckle's eye and screw the rope loop into the inside of the freezer somewhere that makes sense. I drilled a small hole in the inside of the freezer lid to secure the prop rod. This will hold the lid up, while the chains keep it from overextending backwards. Problem solved.



6. FINISHING TOUCHES

It's time to wrap this project up. Find or make some nice tap handles (Etsy is a good place to start), grab a drip tray, drop in your kegs and hook everything up. And don't forget: As with all good beer projects, this one should properly conclude with some consumption. BYO

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BY GREG SPACEK

ENRAPTURED IN THE RYE

A team effort to fill a rye whiskey barrel

What would you do if you were given a large whiskey barrel? Baltimore, Maryland homebrewer Jason Black was attending a beer release when a friend of his, Steve Marsh, came up to him. Steve is one of the owners of Checkerspot Brewing Company located in downtown Baltimore, and he had just picked up several empty 30-gallon (113-L) rye whiskey barrels from Catoctin Creek Distillery of Purcellville, Virginia. Steve had distributed most of the barrels to local breweries, but he still had one left. Knowing Jason as a resourceful and creative person, Steve decided to give the last barrel to Jason.

Jason discussed the barrel with Mike Sherman, the President of the Baltimore-based Cross Street Irregulars homebrew club. Mike suggested we pull together some homebrewers for a collaboration brew to fill the barrel. The seven brewers (Jason Black, Dave Carpenter of Mobtown Brewing Co., Julianne Haciski, Rick Noble, Brent Riha, Mike Sherman, and Greg Spacek) each made a batch of beer. The only rule: Make a brown ale with at least some rye in it. The result: 16 grains, 9 hops, and 4 different yeasts. We let the beer age for 6 weeks in the fresh rye whiskey barrel. When we tasted it, the seven recipes had become their own new, delicious beer! Next up we had to figure out the best way to drink it.

Steve Marsh and Jason Black would best be described as "cask people." Steve has worked for several breweries over the years, including running the cask program at Heavy Seas Beer. Jason is the President of the Chesapeake Bay Branch of the Society for the Preservation of Beers from the Wood (SPBW), the only U.S.-based branch of the oldest consumer-based group focused on cask-conditioned real ale. Steve suggested we put some of the beer on cask . . . so of course we did! We filled two pins (5.4 gallons/20.4 L each) with our beer. We added whole leaf Cascade hops to one pin, and left the other without any dry hop addition. Normally, cask ale carbonates using residual yeast, but since the beer was aged, we did add a little Lallemand CBC-1 yeast to the pins to assure carbonation.

For the release party, contributing brewers Brent and Julianne opened their home to over 50 people for an official SPBW event. Steve loaned a beer engine so we could enjoy one of the pins on hand pump, while the other was gravity fed. While we were nervous about the results of blending different recipes together (especially with four different yeasts), by keeping the styles relatively similar, the end result was still great! The cask treatment was also a nice way to bring out all of the flavors of our creation.

The beer poured a nice clear brown. Rye-whiskey aroma dominated with a slight roasty smell right behind. The beer had an unsurprisingly complex malt backbone that came through on the first sip, including a noticeable rye component from both the malt and the whiskey. Hops were appropriately understated, with a noble spiciness that paired well with the spice of the rye malt. Given the 30% crystal malt component, we were concerned that the beer would have too much body, but it turned out to be quite balanced. Most people preferred the base beer slightly more than the pin with the dry hops. Everyone enjoyed both, but some people said the added hops detracted a bit from the delicate and complex flavors of an otherwise malt-forward beer.

If you want to make a beer similar to the concoction we made — a blend of our blend — you can find it at www.byo.com/recipes/its-my-barrel-and-ill-rye-if-i-want-to. BYO

The cask treatment was also a nice way to bring out all of the flavors of our creation.

Photo courtesy of Greg Spacek

Sampling the rye goods. Clockwise from top left: Mike Sherman, Jason Black, Rick Noble, Dave Carpenter (Mobtown Brewing Co.), Steve Marsh, Rob Neff (Checkerspot Brewing Co.), Brent Riha, Julianne Haciski. Not pictured: Greg Spacek.

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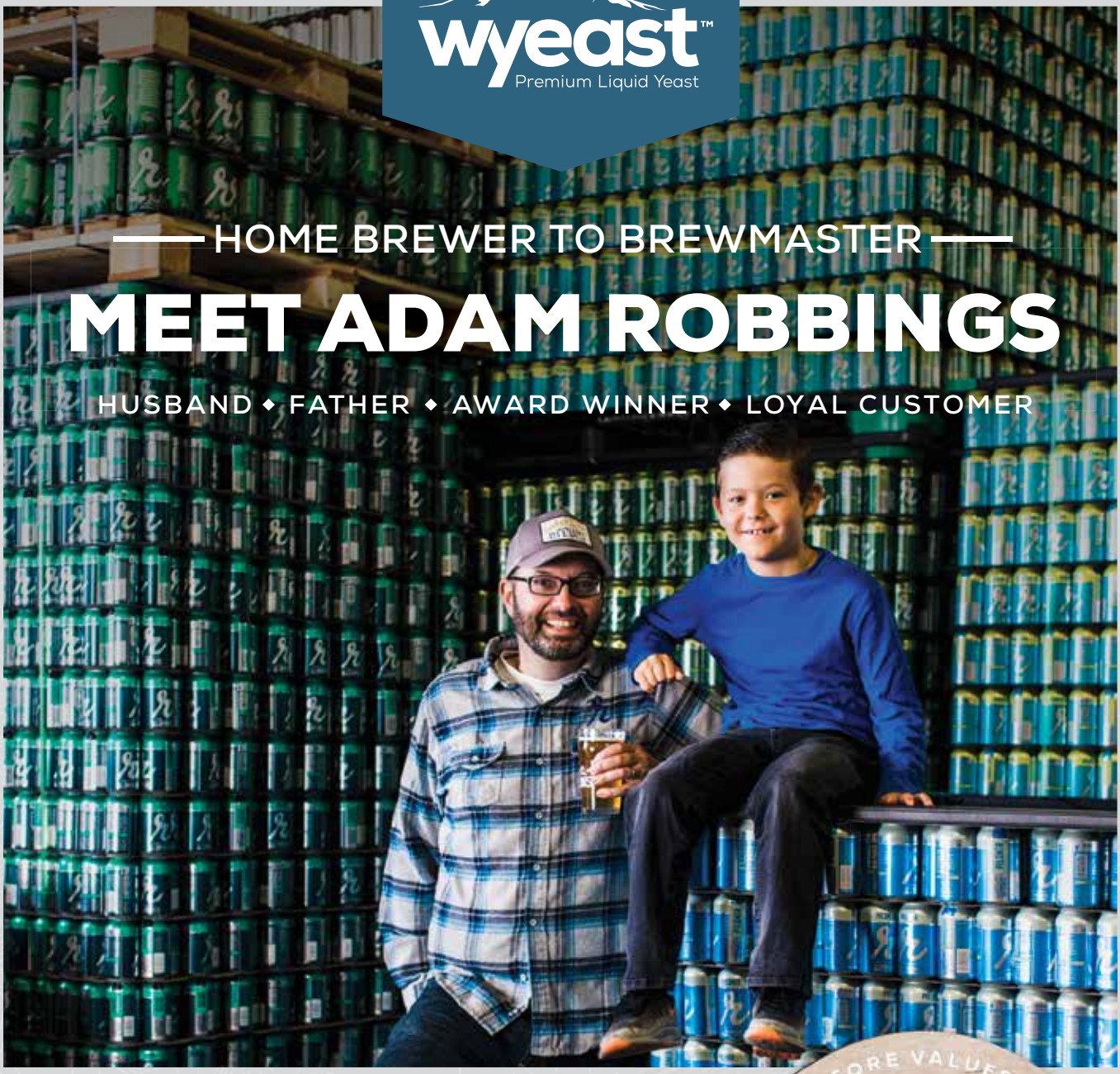

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HUSBAND ◆ FATHER ◆ AWARD WINNER ◆ LOYAL CUSTOMER

When Adam Robbings received a homebrew kit from his wife Grace, he never imagined that brewing would become his livelihood. Fueled by a growing family, fascinated with fermentation and driven by his Londoner roots, Adam crafted home brews from Wyeast Smack Packs that earned him regional and national awards. And after just three years of home brewing, Adam's passion for brewing "bloody good" beer turned into a family-run, award-winning brewery: Reuben's Brews.

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.

wyeastlab.com

PREMIUM LIQUID YEAST